

Appendix 5A
Public Notices

requests, and related administrative materials.

7. Department of Justice, Agency-wide (DAA-0060-2016-0004, 1 item, 1 temporary item). Records relating to evaluation and selection of prospective employees, interns, and volunteers.

8. Department of Justice, INTERPOL Washington United States National Central Bureau (DAA-0060-2015-0002, 8 items, 8 temporary items). Records relating to United States representation to INTERPOL including reports, meeting minutes, agreements, and administrative records.

9. Department of Justice, Office of Information Policy (DAA-0060-2016-0005, 10 items, 7 temporary items). Records relating to oversight of Federal agency compliance with the Freedom of Information Act (FOIA). Records include report drafts, background and resource material gathered in preparing final reports, records relating to the administration of the FOIA, compliance monitoring, and legal advice to agencies. Proposed for permanent retention are Government-wide FOIA Reports, the Department of Justice Guide to the FOIA, and records of the Chief FOIA Officers Council.

10. Department of Transportation, Federal Transit Administration (DAA-0408-2013-0004, 2 items, 2 temporary items). General financial records, including Government Accountability Office exception files, and accountable officer designee records.

11. Department of Transportation, National Highway Traffic Safety Administration (DAA-0416-2015-0001, 1 item, 1 temporary item). Electronic information system used to facilitate the criminal investigation of odometer fraud.

12. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (DAA-0571-2015-0001, 4 items, 4 temporary items). Web site records including internal and external Web sites, content management system, Web site logs and statistical compilations.

13. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (DAA-0571-2015-0010, 1 item, 1 temporary item). Records pertaining to plans for responding to pipeline spills.

14. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (DAA-0571-2015-0015, 1 item, 1 temporary item). Activity files to include quarterly and technical program activity reports.

15. National Archives and Records Administration, Government-wide (DAA-GRS-2014-0002, 21 items, 21 temporary items). General Records

Schedule for employee acquisition records including classification standards, position descriptions, classification appeals, job vacancy case files and application packages, interview records, records relating to political appointments, special hiring authority program records, pre-appointment files, and administrative records of agency agreements with the Office of Personnel Management to process examination and certification of potential employees.

16. National Archives and Records Administration, Government-wide (DAA-GRS-2015-0007, 23 items, 23 temporary items). General Records Schedule for employee relations records such as Alternative Dispute Resolution files; Reasonable Accommodation program records; Equal Employment Opportunity program and complaint files; anti-harassment program records; labor management relations records; administrative grievance, disciplinary and adverse action files; displaced employee program records; and telework/alternative worksite program files.

17. Peace Corps, Overseas Posts (DAA-0490-2016-0012, 6 items, 6 temporary items). Records include administrative records, copies of policies and procedures, handbooks, logs, and emergency planning materials.

18. Securities and Exchange Commission, Office of Human Resources (DAA-0266-2016-0013, 2 items, 2 temporary items). Records of agency employee applications for assistance in repaying outstanding qualifying Federal student loans.

19. Securities and Exchange Commission, Office of Human Resources (DAA-0266-2016-0014, 1 item, 1 temporary item). Records of employee temporary work assignments with Federal, State, local, and American Indian tribal governments; colleges and universities; and other eligible organizations.

Laurence Brewer,

Chief Records Officer for the U.S. Government.

[FR Doc. 2016-25224 Filed 10-18-16; 8:45 am]

BILLING CODE 7515-01-P

NATIONAL SCIENCE FOUNDATION

Notice of Intent To Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia and Notice of Public Scoping Meetings and Comment Period

AGENCY: National Science Foundation.

ACTION: Notice of intent to prepare an Environmental Impact Statement and Initiate Section 106 Consultation for proposed changes to Green Bank Observatory operations, Green Bank, West Virginia and notice of public scoping meetings and comment period.

SUMMARY: In compliance with the National Environmental Policy Act of 1969, as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at Green Bank Observatory, in Green Bank, West Virginia (Proposed Action). (See **SUPPLEMENTARY INFORMATION** for more details.) By this notice, NSF announces the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS. At this juncture, NSF welcomes public comments on the preliminary proposed alternatives and resource areas identified for analysis. NSF also intends to initiate consultation under section 106 of the National Historic Preservation Act to evaluate potential effects, if any, on historic properties as a result of the Proposed Action.

DATES: This Notice initiates the public scoping process for the EIS and the initiation of public involvement under section 106 per 36 CFR 800.2(d). Comments on the scope of the preliminary proposed alternatives and resource areas to be studied may be submitted verbally during the scoping meetings scheduled for November 9, 2016 (see details in **SUPPLEMENTARY INFORMATION**) or in writing until November 19, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

ADDRESSES: You may submit written comments by either of the following methods:

- *Email to: envcomp-AST-greenbank@nsf.gov*, with subject line "Green Bank Observatory."

• *Mail to:* Elizabeth Pentecost, RE: Green Bank Observatory, National Science Foundation, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230.

EIS INFORMATION: Information will be posted, throughout the EIS process, at www.nsf.gov/AST.

FOR FURTHER INFORMATION CONTACT: For further information regarding the EIS process or Section 106 consultation, contact: Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

SUPPLEMENTARY INFORMATION: Green Bank Observatory (GBO) is located in Pocahontas County, West Virginia adjacent to the Monongahela National Forest. NSF owns the GBO land, which consists of numerous parcels acquired by the U.S. Army Corps of Engineers in the 1950s, when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The Allegheny Trail passes through portions of the NRAO property along the Little Mountain ridgeline. GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ). GBO is located on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. Having telescopes within the NRQZ allows for detection of faint scientific signals that would otherwise be drowned-out by man-made signals. The GBO facilities include the Robert C. Byrd Green Bank Telescope, the largest fully steerable radio telescope in the world; the 43-meter Telescope; the Green Bank Solar Radio Burst Spectrometer; the 20-meter Geodetic Telescope; the 40-foot Telescope; the Interferometer Range; and previously operational telescopes.

The NSF Directorate for Mathematical and Physical Sciences, Division of Astronomical Sciences, through a series of academic community-based reviews, has identified the need to divest several facilities from its portfolio. This would allow NSF to retain the balance of capabilities needed to deliver the best performance on emerging and key science technology of the present decade and beyond. In 2012, NSF's Division of Astronomical Sciences' (AST's) portfolio review committee recommended divestment of the Green Bank Telescope (GBT) from the AST portfolio, stating the following: "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm; however, its capabilities are not as critical to *New World New Horizons*

[astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." In response to these recommendations, in 2016, NSF completed a feasibility study to inform and define options for the Observatory's future disposition that would involve significantly decreasing or eliminating NSF funding of Green Bank Observatory. Alternatives to be evaluated in the EIS will be refined through public input, with preliminary proposed alternatives that include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date)
- Deconstruction and site restoration

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identifying viable alternatives. At present, NSF has identified the following preliminary resource areas to analyze potential impacts: Air quality, biological resources, cultural resources, geological resources, solid waste generation, health and safety, socioeconomic, traffic, and groundwater resources. NSF will consult under section 106 of the National Historic Preservation Act and section 7 of the Endangered Species Act in coordination with this EIS process, as appropriate. Federal, state, and local agencies, along with other stakeholders that may be interested or affected by NSF's decision on this Proposed Action are invited to participate in the scoping process and, if eligible, may request to participate as a cooperating agency.

Scoping Meetings: NSF will host two public scoping meetings.

- *Afternoon meeting:* November 9, 2016, at 3:00 p.m. to 5:00 p.m., Green Bank Science Center, 155 Observatory Road, Green Bank, WV 24915, Telephone: (304) 456-2011.

- *Evening meeting:* November 9, 2016, at 6:00 p.m. to 8:00 p.m., Green Bank Science Center, 155 Observatory Road, Green Bank, WV 24915, Telephone: (304) 456-2011.

Oral comments provided at the scoping meetings will be transcribed by a court reporter. Please contact NSF at

least one week in advance of the meeting if you would like to request special accommodations (*i.e.*, sign language interpretation, etc.).

Dated: October 13, 2016.

Suzanne H. Plimpton,
Reports Clearance Officer, National Science Foundation.

[FR Doc. 2016-25213 Filed 10-18-16; 8:45 am]

BILLING CODE 7555-01-P

POSTAL REGULATORY COMMISSION

[Docket No. R2017-1; Order No. 3565]

Market Dominant Price Adjustment

AGENCY: Postal Regulatory Commission.

ACTION: Notice.

SUMMARY: The Commission is noticing a recently-filed Postal Service notice of inflation-based rate adjustments affecting market dominant domestic and international products and services, along with numerous proposed classification changes. The adjustments and other changes are scheduled to take effect January 22, 2017. This notice informs the public of the filing, invites public comment, and takes other administrative steps.

DATES: *Comments are due:* November 1, 2016.

ADDRESSES: Submit comments electronically via the Commission's Filing Online system at <http://www.prc.gov>. Those who cannot submit comments electronically should contact the person identified in the **FOR FURTHER INFORMATION CONTACT** section by telephone for advice on filing alternatives.

FOR FURTHER INFORMATION CONTACT: David A. Trissell, General Counsel, at 202-789-6820.

SUPPLEMENTARY INFORMATION:

Table of Contents

- I. Introduction and Overview
- II. Initial Administrative Actions
- III. Ordering Paragraphs

I. Introduction and Overview

On October 12, 2016, the Postal Service filed a notice of inflation-based rate adjustments affecting market dominant domestic and international products and services, along with numerous proposed classification changes.¹ The intended effective date is January 22, 2017. Notice at 1.

Contents of filing. The Postal Service's filing consists of the Notice which the

¹ United States Postal Service Notice of Market Dominant Price Adjustment, October 12, 2016 (Notice).

Department of Labor-OASAM, Office of the Chief Information Officer, Attn: Departmental Information Compliance Management Program, Room N1301, 200 Constitution Avenue NW., Washington, DC 20210; or by email: DOL_PRA_PUBLIC@dol.gov.

FOR FURTHER INFORMATION CONTACT: Michel Smyth by telephone at 202-693-4129 (this is not a toll-free number) or by email at DOL_PRA_PUBLIC@dol.gov. Authority: 44 U.S.C. 3507(a)(1)(D).

SUPPLEMENTARY INFORMATION: This ICR seeks PRA authority for the Ready to Work (RTW) Partnership Grants Evaluation 18-Month Follow-up Survey information collection. The DOL is conducting an evaluation of RTW Partnership Grants. The evaluation includes: (1) An implementation study that examines the operation of the programs and participation patterns of program enrollees in key program activities, and (2) an impact study that uses a random assignment research design to determine whether selected grantee programs increased participants' employment, earnings, and other outcomes. This submission seeks OMB approval for the impact evaluation 18-month follow-up survey of study participants. American Competitiveness and Workforce Improvement Act of 1998 section 414(c) authorizes this information collection. See 29 U.S.C. 2916a(7).

This proposed information collection is subject to the PRA. A Federal agency generally cannot conduct or sponsor a collection of information, and the public is generally not required to respond to an information collection, unless it is approved by the OMB under the PRA and displays a currently valid OMB Control Number. In addition, notwithstanding any other provisions of law, no person shall generally be subject to penalty for failing to comply with a collection of information if the collection of information does not display a valid Control Number. See 5 CFR 1320.5(a) and 1320.6. For additional information, see the related notice published in the **Federal Register** on April 25, 2016 (81 FR 24131).

Interested parties are encouraged to send comments to the OMB, Office of Information and Regulatory Affairs at the address shown in the **ADDRESSES** section within thirty (30) days of publication of this notice in the **Federal Register**. In order to help ensure appropriate consideration, comments should mention OMB ICR Reference Number 201605-1291-001. The OMB is particularly interested in comments that:

- Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;
- Evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;
- Enhance the quality, utility, and clarity of the information to be collected; and
- Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Agency: DOL-OASAM.

Title of Collection: Ready to Work Partnership Grants Evaluation 18-Month Follow-up Survey.

OMB ICR Reference Number: 201605-1291-001.

Affected Public: Individuals or Households.

Total Estimated Number of Respondents: 1,339.

Total Estimated Number of Responses: 1,339.

Total Estimated Annual Time Burden: 897 hours.

Total Estimated Annual Other Costs Burden: \$0.

Dated: October 26, 2016.

Michel Smyth,
Departmental Clearance Officer.

[FR Doc. 2016-26337 Filed 10-31-16; 8:45 am]

BILLING CODE 4510-HX-P

NATIONAL SCIENCE FOUNDATION

Extension of Comment Period on the Environmental Impact Statement for the Proposed Changes to Green Bank Observatory Operations

AGENCY: National Science Foundation.

ACTION: Notice.

SUMMARY: The National Science Foundation published a notice on October 19, 2016, at 81 FR 72124, seeking comments on identifying issues to be analyzed in the Environmental Impact Statement for the proposed changes to Green Bank Observatory operations. The original comment date was to end on November 19, 2016.

DATES: Comments on this notice will now be accepted through November 25, 2016.

ADDRESSES: Submit comments electronically to envcomp-AST-greenbank@nsf.gov or send by mail to National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230.

FOR FURTHER INFORMATION CONTACT: Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

SUPPLEMENTARY INFORMATION: Comments on the scope of the preliminary proposed alternatives and resource areas to be studied may be submitted in writing through November 25, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS. Information will be posted, throughout the EIS process, at www.nsf.gov/AST.

Dated: October 27, 2016.

Suzanne H. Plimpton,
Reports Clearance Officer, National Science Foundation.

[FR Doc. 2016-26343 Filed 10-31-16; 8:45 am]

BILLING CODE 7555-01-P

NATIONAL TRANSPORTATION SAFETY BOARD

Sunshine Act Meeting

Agenda

TIME AND DATE: 9:30 a.m., Tuesday, November 15, 2016

PLACE: NTSB Conference Center, 429 L'Enfant Plaza SW., Washington, DC 20594.

STATUS: The two items are open to the public.

MATTERS TO BE CONSIDERED:

8791 *ADMS Briefs on Two Midair Collisions*—July 7, 2015, accident involving a Cessna 150M and a Lockheed Martin F-16CM near Moncks Corner, South Carolina (ERA15MA259A/B); and August 16, 2015, accident involving a Cessna 172M and a North American Rockwell NA265-60SC Sabreliner near San Diego, California (WPR15MA243A/B); and Safety Alert—Preventing Midair Collisions: Don't Depend on Vision Alone

8737A *Highway Accident Report: Amphibious Passenger Vehicle DUCK 6 Lane Crossover Collision With Motorcoach on State Route 99, Aurora Bridge, Seattle, Washington, September 24, 2015* (HWY15MH011)

ENVIRONMENTAL IMPACT STATEMENT (EIS)



In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at Green Bank Observatory, in Green Bank, West Virginia. The Proposed Action is to reduce funding for the Green Bank Observatory. NSF also intends to initiate consultation under Section 106 of the National Historic Preservation Act (NHPA) to evaluate potential effects to any historic properties within the area of the Proposed Action.

By this notice, NSF is announcing the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS and the initiation of public involvement under Section 106. Comments on issues may be submitted verbally during scoping meetings scheduled for November 9, 2016 (see details below) or in writing until November 25, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

NSF WILL HOST TWO PUBLIC SCOPING MEETINGS:

November 9, 2016

Session 1 - 3:00 pm to 5:00 pm

Session 2 - 6:00 pm to 8:00 pm

Green Bank Science Center

155 Observatory Road
Green Bank, WV, 24915
Phone: (304) 456-2011

You may also submit written comments related to this Proposed Action by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov

Mail to: Elizabeth Pentecost RE: Green Bank Observatory
National Science Foundation
4201 Wilson Blvd., Suite 1045, Arlington, VA 22230

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST.

Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation).

AFFIDAVIT OF INSERTION

This is to certify that the insertion for Green Bank Observatory
(Advertiser Name)

Titled Environmental Impact Statement appeared in the
(Headline)

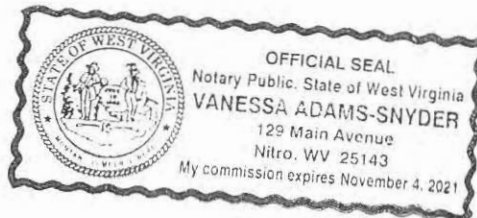
Charleston, WV Charleston Gazette-Mail on October 30, 2016
(City, Paper, Name) (Date)

Advertising Representative: Lisa Skeens

Sworn to and subscribed before me this 4th day of Nov, 2016

Notary Public: 

Seal: _____



State of West Virginia, County of Randolph, ss.

I, Heather Henline, General Manager of THE INTER-MOUNTAIN, a newspaper published at Elkins, in said county, do hereby certify that the annexed advertisement was published on the following dates:

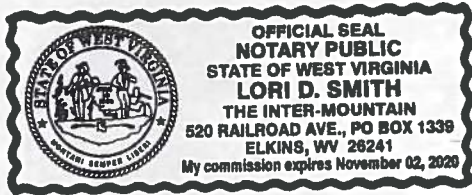
10/29 _____

20 16 _____ as required by law.

Given under my hand this 14 day of NOV 20, 16

Heather Henline

General Manager



Printer's Fee: \$ _____

Subscribed and sworn to before me this 14th day of November, 20, 16

Lori D. Smith

Notary Public

My Commission Expires the 2nd day of November, 20, 20

The Pocahontas Times
206 - 8th Street
Marlinton, WV 24954
(304) 799-4973

DATE	INVOICE #
10/27/2016	2016-77661

PAID
10/21/2016

BILL TO

Christina McDonough, PE -CH2M
5555 Tech Center Drive, Suite 212
Colorado Springs, CO 80919

P.O. NO.	TERMS	PROJECT
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QUANTITY	DESCRIPTION	RATE	AMOUNT
	PTI Display ADV., Oct 27 2016 - 3x5 column inch, Black & White, 1 Run - Environmental Impact Statement (EIS)	88.05	88.05

	Total	\$88.05
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AFFIDAVIT OF INSERTION

This is to certify that the insertion for NSF
(Advertiser Name)

Titled Environmental Impact Statement appeared in the
(Headline)

Marlinton - The Pocahontas Times on 10/27/16
(City, Paper Name) (Date of Insertion)

Total Inserts Distributed _____

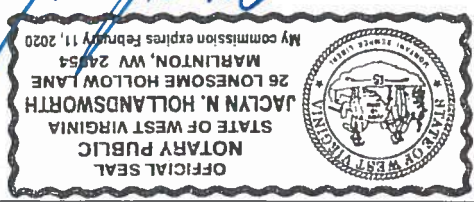
Cost of Insertion \$88.05

Advertising Manager Kimberly J. Jetter

Sworn to and subscribed before me this 27th day of October 20 16.

Notary Public [Signature]

Seal _____



AMR, from page 7

Norris is your host Friday afternoon from 2 to 3 p.m.

Jeneration Variations – Jenn brings great alternative folk to the AMR airwaves Saturday afternoon from 3 to 5 p.m.

Midnight Ride – Dan is the man Saturday from 8 to 11 p.m. – blues and a little jazz

AMR Hosts next week
Soul Survivor – Wayne is your host Thursday 1 to 3 p.m.

Alternate Transmission – tune in for an eclectic mix of alternative music with your host Josh – Thursday 6 to 8 p.m. from the WVMR studio.

TGIF Bluegrass – DJ Willie is your host Friday afternoon from 2 to 3 p.m.

For Those About To Rock – Joyce will be rockin' and rollin' Saturday 3 to 5 p.m.

Midnight Ride – Blues and interesting background on the artists – Keith provides both Saturday 8 to 11 p.m.

Interested in being a volunteer DJ for AMR? Call Heather or Dwayne at WVMR, 304-799-6004, Danny at WCHG 540-839-5400, or Scott at 540-468-1234.

Thanks for listening to Allegheny Mountain Radio. Your feedback is always welcome – you can contact me at heather@amrmail.org.

MARLINTON, WV 24954

Location: MARLINTON, POCAHONTAS COUNTY

Latitude: 38:12:19

Receiving Stream: Greenbrier River

Activity: To operate and maintain an existing consisting 0.2 million gallons per day wastewater treatment equivalent of approximately 2,000 persons in discharge treated wastewater via Outlet No. 001 to from its mouth, of the New River of the Kanawha I ducted for Outlet 001 and Tier 2 protection is prov 6. To accept nondomestic flow from Rite Aid Store Treatment Plant and Pocahontas Continuous Carri To operate and maintain disposal systems, best m controls for the direct discharge of sanitary waste Overflow (CSO) Outlet No. C002 to Knapp Creek, Greenbrier River. The CSO outlet is permitted to collection system is exceeded during wet-weather the wet weather discharge from CSO Outlet No. C CSO Long-term Control Plan.

Business conducted: Municipality

Implementation: Compliance with the Combined mit shall be attained in accordance with the provis March 31, 2009, and any amendments, thereto.

Compliance with the continuing terms and conc dance with the provisions of Administrative Conse On the basis of review of the application, the "V 11-8(a)," and the "West Virginia Legislative Rules application.

Any interested person may submit written comm lic hearing by addressing such to the Director of tl within 30 days of the date of the public notice. Su to:

Director, Division of Water a
ATTN: Lori Devereu:
601 57th
Charleston, WV

The public comment period begins October 27, Comments received within this period will be cc Correspondence should include the name, addres a concise statement of the nature of the issues re whenever a finding is made, on the basis of requer terest on issues relevant to the Draft Permit(s). In tion office to obtain further information.

The application, draft permit and any required f the Division of Water and Waste Management Pu Charleston, WV 25304-2345, between 8 a.m. and ments may be obtained from the Division at a nor p.m. Monday through Friday.

Veteran's Day is November 11

ENVIRONMENTAL IMPACT STATEMENT (EIS)



In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at Green Bank Observatory, in Green Bank, West Virginia. The Proposed Action is to reduce funding for the Green Bank Observatory. NSF also intends to initiate consultation under Section 106 of the National Historic Preservation Act (NHPA) to evaluate potential effects to any historic properties within the area of the Proposed Action.

By this notice, NSF is announcing the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS and the initiation of public involvement under Section 106. Comments on issues may be submitted verbally during scoping meetings scheduled for November 9, 2016 (see details below) or in writing until November 19, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

NSF WILL HOST TWO PUBLIC SCOPING MEETINGS:

November 9, 2016

Session 1 - 3:00 pm to 5:00 pm

Session 2 - 6:00 pm to 8:00 pm

Green Bank Science Center
 155 Observatory Road
 Green Bank, WV, 24915
 Phone: (304) 456-2011

You may also submit written comments related to this Proposed Action by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov

Mail to: Elizabeth Pentecost RE: Green Bank Observatory
 National Science Foundation
 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST.

Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation).

THE PLACE FOR THOSE WHO HUNT

ALL YOU NEED TO ATTRACT GAM

WE'LL GET YOU



HARVEST OF VALUES

TRENT'S GENERAL STORE EBT CARDS

IN THE LOOP - ARBOVALE, WV 24915
 Phone: 304-456-9906

STORE HOURS:
 Mon. - Sat. 7 a.m. to 7 p.m.
 Sundays - CLOSED

PRICES EFFECTIVE November 1st - 4th, 2016

\$700 \$140



GREEN BANK
OBSERVATORY



NATIONAL SCIENCE FOUNDATION PUBLIC SCOPING MEETINGS

In compliance with the National Environmental Policy Act, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed operational changes due to funding constraints at Green Bank Observatory, in Green Bank, West Virginia. NSF is conducting scoping meetings to obtain feedback from the community. A range of alternatives is being considered for evaluation in the EIS. These alternatives will be refined through continued public input, with preliminary alternatives that include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities
- Deconstruction and site restoration

Comments on issues may be submitted verbally during scoping meetings scheduled for November 9, 2016, or in writing through November 25, 2016. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

PUBLIC SCOPING MEETINGS:

November 9, 2016
Session 1 - 3:00 pm to 5:00 pm
Session 2 – 6:00 pm to 8:00 pm
Green Bank Science Center
155 Observatory Road
Green Bank, WV, 24915
304-456-2011

TO SUBMIT WRITTEN COMMENTS:

Email: envcomp-AST-greenbank@nsf.gov
OR Mail: Elizabeth Pentecost
RE: Green Bank Observatory
National Science Foundation
4201 Wilson Blvd., Suite 1045
Arlington, VA 22230

Information will be posted, throughout the EIS process, at www.nsf.gov/AST

Pollution Prevention and Control Act (“Colorado Act”), Colorado’s federally approved State Implementation Plan (“Colorado SIP”), and Colorado Air Quality Control Commission Regulation Number 7 (“Regulation No. 7”) at tank batteries (referred to in the consent decree as “Tank Systems”) owned and operated by PDC Energy, Inc. (“PDC”) in a portion of the Denver-Julesburg Basin in Colorado (known as the “8-hour Ozone Control Area”) designated as non-attainment with the National Ambient Air Quality Standards for ground-level ozone. The violations relate to alleged failures to adequately design, operate, and maintain vapor control systems at the Tank Systems, resulting in emissions of volatile organic compounds (“VOC”) and other pollutants to the atmosphere.

The proposed consent decree covers PDC’s Tank Systems in the 8-hour Ozone Control Area equipped with vapor control systems pursuant to Regulation No. 7 to achieve required system-wide emission reductions (more than 600 Tank Systems). The proposed decree requires PDC to perform injunctive relief, including conducting engineering evaluations of the vapor control systems at each of the Tank Systems and completing any necessary corrective actions to ensure that the vapor control systems are adequately designed and sized. PDC must also complete two environmental mitigation projects at a cost of \$1.7 million and pay a \$2.5 million civil penalty, \$1 million of which is anticipated to be used to perform one or more State-Only Supplemental Environmental Projects. Entering into and fully complying with the proposed consent decree will release PDC from past civil liability at the Tank Systems and associated vapor control systems for violations of the Colorado SIP and Regulation No. 7 relating to VOC emissions from condensate storage tanks.

The publication of this notice opens a period for public comment on the consent decree. Comments should be addressed to the Assistant Attorney General, Environment and Natural Resources Division, and should refer to *United States, et al. v. PDC Energy, Inc.*, D.J. Ref. No. 90–5–2–1–11467. All comments must be submitted no later than thirty (30) days after the publication date of this notice. Comments may be submitted either by email or by mail:

<i>To submit comments:</i>	<i>Send them to:</i>
By email	<i>pubcomment-ees.enrd@usdoj.gov.</i>

<i>To submit comments:</i>	<i>Send them to:</i>
By mail	Assistant Attorney General, U.S. DOJ—ENRD, P.O. Box 7611, Washington, D.C. 20044–7611.

During the public comment period, the consent decree may be examined and downloaded at this Justice Department Web site: <https://www.justice.gov/enrd/consent-decrees>. We will provide a paper copy of the consent decree upon written request and payment of reproduction costs. Please mail your request and payment to: Consent Decree Library, U.S. DOJ—ENRD, P.O. Box 7611, Washington, DC 20044–7611.

Please enclose a check or money order for \$25.25 (25 cents per page reproduction cost) payable to the United States Treasury.

Jeffrey Sands,
Assistant Section Chief, Environmental Enforcement Section, Environment and Natural Resources Division.

[FR Doc. 2017–24250 Filed 11–7–17; 8:45 am]

BILLING CODE 4410–15–P

NATIONAL SCIENCE FOUNDATION

Notice of Availability and Notice of Public Meeting for the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory, Green Bank, West Virginia

AGENCY: National Science Foundation.
ACTION: Notice of availability and notice of public meeting.

SUMMARY: The National Science Foundation (NSF) has made available for public review and comment the Draft Environmental Impact Statement (DEIS) for Green Bank Observatory. This DEIS has been prepared for the National Science Foundation (NSF) to evaluate the potential environmental impacts resulting from proposed operational changes due to funding constraints for the Green Bank Observatory in Green Bank, West Virginia. The DEIS was prepared in compliance with the National Environmental Policy Act of 1969. Consultation under Section 106 of the National Historic Preservation Act (NHPA) is being conducted concurrent with the NEPA process.

DATES: NSF will accept comments on the DEIS for 60 days following publication of this Notice of Availability; an additional 15 days are being provided beyond the standard 45-day review period to allow for the

holidays). Comments may be submitted verbally during the public meeting scheduled for November 30, 2017 (see details in **SUPPLEMENTARY INFORMATION**) or in writing until January 8th, 2018. Substantive comments will be addressed in a Final Environmental Impact Statement (FEIS).

ADDRESSES: You may submit written comments by either of the following methods:

- *Email to: envcomp-AST-greenbank@nsf.gov*, with subject line “Green Bank Observatory”.

- *Mail to: Elizabeth Pentecost, RE: Green Bank Observatory, National Science Foundation, 2415 Eisenhower Avenue, Suite W9152, Alexandria, VA 22314.*

FOR FURTHER INFORMATION CONTACT: For further information regarding the EIS process or Section 106 consultation, contact: Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 2415 Eisenhower Avenue, Suite W9152, Alexandria, VA 22314; telephone: (703) 292–4907; email: *epenteco@nsf.gov*.

DEIS Information: The DEIS, as well as information about the public meeting, is posted at www.nsf.gov/AST. A copy of the DEIS will be available for review at the following libraries: Green Bank Public Library, 5683 Potomac Highlands Trail, Green Bank, WV 24944, Durbin Community Library, 4361 Staunton Parkersburg Turnpike, Durbin, WV 26264.

SUPPLEMENTARY INFORMATION: Green Bank Observatory (GBO) is located in Pocahontas County, West Virginia, adjacent to the Monongahela National Forest. NSF owns the GBO land, which consists of numerous parcels acquired by the U.S. Army Corps of Engineers in the 1950s, when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO facilities include the Robert C. Byrd Green Bank Telescope, the largest fully steerable radio telescope in the world; the 43-meter Telescope; the Green Bank Solar Radio Burst Spectrometer; the 20-meter Geodetic Telescope; the 40-foot Telescope; the Interferometer Range; and previously operational telescopes.

The NSF Directorate for Mathematical and Physical Sciences, Division of Astronomical Sciences (AST), through a series of academic community-based reviews, has identified the need to divest several facilities from its portfolio. This would allow NSF to retain the balance of capabilities needed to deliver the best performance on emerging and key science technology of the present decade and beyond. In 2012,

AST's portfolio review committee recommended divestment of the Green Bank Telescope (GBT) from the AST portfolio, stating the following: "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm; however, its capabilities are not as critical to *New World New Horizons* [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." In response to these recommendations, in 2016, NSF completed a feasibility study to inform and define options for the Observatory's future disposition that would involve significantly decreasing or eliminating NSF funding of Green Bank Observatory. NSF issued a Notice of Intent to prepare an EIS on October 19, 2016, held scoping meetings on November 9, 2016, and held a 30-day public comment period that closed on November 25, 2016.

Alternatives to be evaluated in the EIS, which may be refined through public input, include the following:

- Collaboration with interested parties for continued science- and education-focused operations with reduced NSF funding (Agency-preferred Alternative).
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Demolition and site restoration.
- No-Action Alternative: Continued NSF investment for science-focused operations.

No final decisions will be made regarding the proposed changes to operations at Green Bank Observatory prior to issuance of an FEIS, and, subsequently, a Record of Decision for the Proposed Action.

Public Meeting: A public meeting to address the DEIS and to solicit public input under Section 106 of the NHPA will take place in Green Bank with notification of the time and location published in the local newspapers, as follows:

- *Public meeting:* November 30, 2017, at 5:00 p.m. to 8:30 p.m.

Green Bank Science Center
155 Observatory Road
Green Bank, WV 24915
Telephone: (304) 456-2011

The meeting will be transcribed by a court reporter.

Dated: November 3, 2017.

Suzanne H. Plimpton,
Reports Clearance Officer, National Science Foundation.

[FR Doc. 2017-24322 Filed 11-7-17; 8:45 am]

BILLING CODE 7555-01-P

NUCLEAR REGULATORY COMMISSION

[NRC-2016-0201]

Nuclear Power Plant Instrumentation for Earthquakes

AGENCY: Nuclear Regulatory Commission.

ACTION: Regulatory guide, issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing Revision 3 of Regulatory Guide (RG) 1.12, "Nuclear Power Plant Instrumentation for Earthquakes." This revision to the guide addresses new reactor plant configurations and the state of practice of seismic instrumentation since Revision 2 of RG 1.12 in 1997. The revision describes the seismic instrumentation criteria, including instrumentation type, locations, characteristics, and maintenance, that the NRC staff considers acceptable for nuclear power plants.

DATES: Revision 3 to RG 1.12 is available on November 8, 2017.

ADDRESSES: Please refer to Docket ID NRC-2016-0201 when contacting the NRC about the availability of information regarding this document. You may obtain publicly-available information related to this document using any of the following methods:

- *Federal Rulemaking Web site:* Go to <http://www.regulations.gov> and search for Docket ID NRC-2016-0201. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; email: Carol.Gallagher@nrc.gov. For technical questions, contact the individuals listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.

- *NRC's Agencywide Documents Access and Management System (ADAMS):* You may obtain publicly-available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "ADAMS Public Documents" and then select "*Begin Web-based ADAMS Search.*" For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by email to pdr.resource@nrc.gov. The ADAMS accession number for each

document referenced (if it is available in ADAMS) is provided the first time that it is mentioned. The RG 1.12 is available in ADAMS under Accession No. ML17094A831.

- *NRC's PDR:* You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

Regulatory guides are not copyrighted, and NRC approval is not required to reproduce them.

FOR FURTHER INFORMATION CONTACT:

Sarah Tabatabai, Office of Nuclear Regulatory Research, telephone: 301-415-2982, email: Sarah.Tabatabai@nrc.gov; Vladimir Graizer, Office of New Reactors, telephone 301-415-0675, email: Vladimir.Graizer@nrc.gov, and Edward O'Donnell, Office of Nuclear Regulatory Research, telephone: 301-415-3317, email: Edward.ODonnell@nrc.gov. All are staff members of the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

SUPPLEMENTARY INFORMATION:

I. Discussion

The NRC is issuing a revision to an existing guide in the NRC's "Regulatory Guide" series. This series was developed to describe and make available to the public information regarding methods that are acceptable to the NRC staff for implementing specific parts of the agency's regulations, techniques that the NRC staff uses in evaluating specific issues or postulated events, and data that the NRC staff needs in its review of applications for permits and licenses.

Revision 3 of RG 1.12 was issued with a temporary identification of draft Regulatory Guide, DG-1332. The NRC revised the guide to incorporate advances in seismic instrumentation and operating experience since the issuance of Revision 2 of RG 1.12 in 1997. The revision describes the seismic instrumentation criteria, including instrumentation type, locations, characteristics, and maintenance, that the NRC staff considers acceptable for nuclear power plants.

II. Additional Information

The NRC published a notice of the availability of DG-1332 in the **Federal Register** on September 21, 2016 (81 FR 64954), for a 60-day public comment period. The public comment period closed on November 21, 2016. Public comments on DG-1332 and the staff responses to the public comments are available under ADAMS under Accession No. ML17095A314.



GREEN BANK
OBSERVATORY



NATIONAL SCIENCE FOUNDATION PUBLIC MEETING

In compliance with the National Environmental Policy Act, the National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) to evaluate potential environmental effects of proposed operational changes due to funding constraints at Green Bank Observatory, in Green Bank, West Virginia. NSF is conducting a public meeting to obtain feedback on the DEIS. The DEIS alternatives include the following:

- Collaboration with Interested Parties for Continued Science- and Education-focused Operations with Reduced NSF funding (Agency-preferred Alternative)
- Collaboration with Interested Parties for Operation as a Technology and Education Park
- Mothballing of Facilities
- Demolition and Site Restoration
- Continued NSF Investment for Science-focused Operations (No-Action Alternative)

The DEIS is posted at www.nsf.gov/AST (see "AST Facilities-Environmental Reviews") and copies are available for review at the following libraries in West Virginia:

Green Bank Public Library
5683 Potomac Highlands Trail
Green Bank, WV 24944

Durbin Community Library
4361 Staunton Parkersburg Turnpike
Durbin, WV 26264

Comments on the DEIS may be submitted verbally during the public meeting scheduled for November 30, 2017, or in writing through January 8, 2018.

PUBLIC MEETING:

November 30, 2017
5:00 pm to 8:30 pm
Green Bank Science Center
155 Observatory Road
Green Bank, WV, 24915
304-456-2011

TO SUBMIT WRITTEN COMMENTS:

Email: envcomp-AST-greenbank@nsf.gov
OR Mail: Elizabeth Pentecost
RE: Green Bank Observatory
National Science Foundation
2415 Eisenhower Avenue,
Suite W9152
Alexandria, VA 22314

Information will be posted, throughout the EIS process, at www.nsf.gov/AST

McDonough, Christina/COS

From: Pentecost, Elizabeth A. <epenteco@nsf.gov>
Sent: Wednesday, November 08, 2017 9:06 AM
To: Pentecost, Elizabeth A.
Subject: Notice of Availability and Notice of Public Meeting for the Draft Environmental Impact Statement for Green Bank Observatory [EXTERNAL]
Attachments: Federal Register Notice_11-8-17[2][3].pdf

Dear interested party:

Please see the attached Notice of Availability (NOA) and Notice of Public Meeting for the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory. The DEIS, which evaluates the potential environmental effects of proposed operational changes due to funding constraints for the Green Bank Observatory, is posted at www.nsf.gov/ast (see AST-Facilities-Environmental Reviews, Green Bank Observatory, or click [here](#)). As indicated in the NOA, comments on the DEIS may be submitted to the National Science Foundation during the 60 day-day public comment period (an additional 15 days are being provided beyond the standard 45-day review period to allow for the holidays), which extends through January 8, 2018, via this email envcomp-AST-greenbank@nsf.gov or via mail to Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite W9152, 2415 Eisenhower Avenue, Alexandria, VA 22314. Comments may also be provided during the public meeting scheduled for November 30 at the following location:

Public Meeting:

November 30, 2017, 5:00 p.m. To 8:30 p.m.
Green Bank Science Center
155 Observatory Road
Green Bank, WV 24915
Telephone: (304) 456-2011

Information will be posted throughout the process at: www.nsf.gov/AST.

If you wish to be removed from or added to this email distribution list, please reply to this email indicating as such.

National Science Foundation
Division of Astronomical Sciences
Room W9152
2415 Eisenhower Avenue
Alexandria, VA 22314
Tel: 703-292-4907
Fax: 703-292-9452

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)



In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) to evaluate potential environmental effects of proposed changes to operations due to funding constraints at Green Bank Observatory, in Green Bank, West Virginia. Concurrent with the NEPA process, NSF also has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA) to evaluate potential effects to any historic properties within the area of the Proposed Action.

By this notice, NSF is announcing the beginning of the public comment period to solicit public comments on the Draft EIS and continuation of public involvement under Section 106. Comments may be submitted verbally during the public meeting scheduled for November 30, 2017 (see details below) or in writing until January 8, 2018. To be eligible for inclusion in the Final EIS, all comments must be received prior to the close of the public comment period.

The DEIS is posted at www.nsf.gov/AST (see “AST Facilities - Environmental Reviews”) and copies are available for review at the following libraries in West Virginia:

Green Bank Public Library
5683 Potomac Highlands Trail
Green Bank, WV 24944

Durbin Community Library
4361 Staunton Parkersburg Turnpike
Durbin, WV 26264

NSF WILL HOST A PUBLIC MEETING:

November 30, 2017, 5:00 pm to 8:30 pm

Green Bank Science Center, 155 Observatory Road, Green Bank, WV, 24915

Phone: (304) 456-2011

For further information regarding the EIS process or Section 106 Consultation, or to submit comments on the DEIS, please contact:

Email to: envcomp-AST-greenbank@nsf.gov

Mail to: Elizabeth Pentecost RE: Green Bank Observatory
National Science Foundation
2415 Eisenhower Avenue, Suite W9152, Alexandria, VA 22314

Telephone: (703) 292-4907

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST. Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation). A Notice of Availability has been published and is available on the Federal Register.

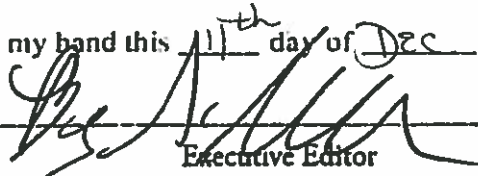
State of West Virginia, County of Randolph, ss.

I, Brad Johnson, Executive Editor of THE INTER-MOUNTAIN, a newspaper published at Elkins, in said county, do hereby certify that the annexed advertisement was published on the following dates:

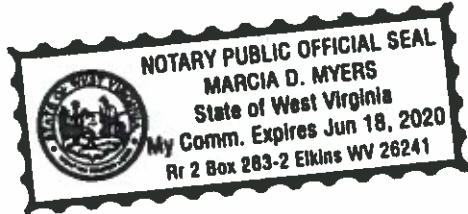
11/18 _____

2017 as required by law.

Given under my hand this 11th day of Dec, 2017



Executive Editor



Printer's Fee: \$ _____

Subscribed and sworn to before me this 11th day of Dec, 2017



Notary Public

My Commission Expires the 18th day of June, 2020

Bride and groom leave wedding guests hanging

Dear Annie: I recently attended a couple of weddings that left me baffled. The custom of most weddings in the Midwest is for the wedding couple and their wedding party to hire a limo, party bus or some other method of transportation to take the whole group around to various bars after the wedding ceremony and before the reception, usually held at another establishment. The guests are free to go to the reception site, and usually some type of refreshment is offered.

At one particular wedding, the couple did not even greet their guests at the back of the church after the ceremony. They secluded themselves in another room and left their parents to greet and thank the guests for coming, and



Dear Annie

Annie Lane

then they made their exit from the church with the usual fanfare and entered the party bus. It was more than two hours before they made an entrance at the reception. Meanwhile, the guests were left waiting for the couple to arrive before they were offered the reception meal. Some guests were elderly or had traveled a long distance and wanted to go home after the reception, so after two hours, they left without waiting for the couple.

Since another recent wedding, the bride has

been selling unwanted wedding/shower gifts on the Facebook Marketplace forum. Are we wrong to feel that our gifts were not appreciated? Perhaps this is easier than returning unwanted items to the store, or maybe the couple only really wanted money, but with far-reaching social media, I am sure some guests are seeing their gifts being sold within a month of the wedding and before the thank-you cards are even sent.

I realize that the happy couple would like to celebrate with their friends, but shouldn't consideration for their guests come first? At least make an appearance early at the reception so that the guests can enjoy that time, as well. And for goodness' sake, have the grace to appreciate the time

and effort guests have put into their gifts. — **Wedding Blues**

Dear Wedding Blues: Selling wedding gifts on social media is tacky, plain and simple. I'd never heard of that before, and I hope to never hear of it again. Newlyweds, if you don't want a gift, just return it.

As for the hourslong wait for the couple to make their entrance at the reception, I've noticed this trend. I believe it's because photographers can take more photos now than ever, and photo shoots are elaborate, with multiple locations and every possible combination of wedding party members. I encourage anyone planning a wedding to take guests' needs into account. If there is

going to be significant lag between the ceremony and the reception, make sure guests have somewhere to socialize and something to eat.

Dear Annie: This is in response to "Fume-Free," who is concerned about her mother-in-law's smoking around her new baby. My granddaughter is 13 years old. Fourteen years ago, when she was conceived, my son and daughter-in-law told my husband in no uncertain terms that the baby would not be entering our house if he continued to smoke. I told my husband that if that were the case, I would have to be living elsewhere. When my daughter-in-law was about seven months pregnant, he smoked his last pack of cigarettes.

Recently, he had a nine-hour operation in which his lung collapsed. The doctor told him that if he had still been a smoker, he would not have made it. He said the next day that he guessed Kayla had saved his life. So, "Fume-Free," be stern, and make it about not only the baby but also future health issues. — **Been There and Done That**

Dear Been There: I am so glad your husband is OK. It sounds as if Kayla was a blessing in more ways than one.

Send your questions for Annie Lane to dearannie@creators.com. To find out more about Annie Lane and read features by other Creators Syndicate columnists and cartoonists, visit the Creators Syndicate website at www.creators.com.

MEETING MEMOS

EDITOR'S NOTE: The Meeting Memos column is reserved for nonprofit, civic organizations.

SATURDAYS
ELKINS FARMERS MARKET: Elkins Farmers Market will be open every Saturday from 8 a.m. to noon behind the Railroad Depot. Items for sale will include a variety of vegetables of the season, eggs, cakes, breads, cookies, flowers, crafts and more.

NARCOTICS ANONYMOUS CANDLELIGHT SERENITY GROUP will meet at 8 p.m. Saturdays at Grace Episcopal Church on John Street in Elkins.

MONDAYS
ALCOHOLICS ANONYMOUS meets from 7 to 8 p.m. Mondays, at Grace Episcopal Church.

ARTHRITIS FOUNDATION EXERCISE CLASSES will be at 9:30 a.m. Mondays, Wednesdays and Fridays at Barbour County Senior Center. For more information, call Wanda at the center at 304-457-4545.

BUCKHANNON QUILTERS AT HEART QUILT GUILD meets at 7 p.m. the second Monday of each month at the Episcopal Church at the corner of Kanawha and Lincoln streets. Quilters of all levels are invited. For more information, call Barbara Lane, president, at 304-472-2649 or Christine Helmick, secretary, at 304-472-0909.

FIDDLER'S SUPPORT GROUP JAM hosted by the Randolph County Community Arts Center will be from 7 to 9 p.m. the first and third Mondays of each month. Those attending are asked to enter by the back door. This jam is for musicians to learn how to play in a jam and learn old-time tunes. All instruments are welcome including guitar, banjo, dulcimer, mandolin and fiddle. For more information, call David Proudfoot at 304-823-1460.

LITERACY VOLUNTEERS OF RANDOLPH COUNTY BOARD meets at 6:30 the first Monday of each month — with the exception of July. For more information, call the Literacy Volunteers office at 304 636-4515. The office is located at the YMCA in Elkins.

PROJECT LIFE CHANGE: The Davis & Elkins College Sport Science Department will host its fifth year of Project Life Change from 6 to 7 p.m. every Monday to Nov. 13 in Eshelman Science Center Room 400 on the D&E campus. The free program will cover nutrition, activity and overall wellness education with the aim of helping participants create a better, healthier lifestyle. For more information or to register, email plc@deuw.edu or call sport science instructor Dr. Jennifer Riggeman at 304-637-1383.

SILENT GROVE CEOS will meet the first Monday of each month.

SURVIVORS OF HOMICIDE

VICTIMS SUPPORT GROUP will meet at 7 p.m. the first Monday of each month at Chapel Hill United Methodist Church in Buckhannon.

TOPS WV 0235, ELKINS, will meet Mondays in the fellowship hall of Otterbein United Methodist Church, 1100 S. Davis Ave. at the corner of 11th Street and Davis Avenue. Weigh-in will be at 5 p.m., and the meeting will be from 6 to 6:45 p.m. For more information, call Cindy at 304-642-6824.

TOPS WV 0567, MARLINTON, meets Mondays in the Marlinton Elementary School computer lab. Weigh-in is from 5-5:30 p.m., and the meeting starts at 5:45 p.m. For more information, call Joann Estep, leader, at 304-799-4542.

TOPS WV 0565, PHILIPPI, meets Mondays at the Union Community Building in Philippi. Weigh-in starts at 5 p.m., and the meeting starts at 5:30 p.m. For more information, call Brenda Bennett at 304-457-1128 or 304-621-7603.

TOPS WV 0541, PARSONS, meets Mondays at the Parsons Church of God in Parsons. Weigh-in is 4:30-5:45 p.m., and the meeting starts at 6 p.m. For more information, call Barbie at 304-478-3744 or Linda at 304-478-2912.

TYGARTS VALLEY ATHLETIC BOOSTERS' CLUB meets at 7 p.m. the second Monday of each month in the Tygarts Valley Middle/High School cafeteria.

VETERANS OF FOREIGN WARS AUXILIARY to Roaring Creek Post 5583 will meet at 7 p.m. the second Monday of each month at the Post Home in Coalton.

VETERANS OF FOREIGN WARS Roaring Creek Post 5583 will meet at 7:30 p.m. the second Monday of each month at the Post Home in Coalton.

TUESDAYS
ALCOHOLICS ANONYMOUS will meet from 8 to 9 p.m. Tuesdays at Grace Episcopal Church.

ALZHEIMER'S SUPPORT GROUP will meet at 5 p.m. the last Tuesday of each month at Colonial Place, 301 Wilson Lane in Elkins. For more information, call Michelle Talkington at 304-636-8600.

BASIC COMPUTER SKILLS AND MICROSOFT OFFICE CLASSES will be offered from noon to 3 p.m. Tuesdays at Elkins Workforce WV office.

BEVERLY HISTORIC LANDMARKS COMMISSION meets at 6:30 p.m. the second Tuesday of the month at the Beverly Heritage Center, 4 Court St. in Beverly.

ELKINS MAIN STREET DESIGN COMMITTEE meets at noon the first Tuesday of each month at the Darden House, 421 Davis Ave.

ELKINS MAIN STREET PROMOTIONS COMMITTEE will meet at 8:30 a.m. on the first and third Tuesdays of each

month at Kissel Stop Cafe, 23 Third St.

GFWC WOMAN'S CLUB OF ELKINS will meet the third Tuesday of each month at Halliehurst on the campus of Davis & Elkins College in Elkins. The meeting will begin at 6:30 p.m.

MOPS (MOTHERS OF PRESCHOOLERS) meets from 9 a.m. to noon Tuesday, when school is in session, at First United Methodist Church. For more information, email elkinsmops@yahoo.com.

MOUNTAIN ARTS DISTRICT will meet at 4 p.m. the first and third Tuesdays of the month at the Randolph County Wood Technology Center to discuss concerns and opportunities about the arts, support for artists/venues and public art. All are welcome. The facilities are accessible. For more information, contact MAD at mtnarts-district@gmail.com.

RANDOLPH COUNTY HOUSING AUTHORITY BOARD OF COMMISSIONERS will meet at noon the third Tuesday of each month in the conference room at 1404 N. Randolph Ave. in Elkins. For more information, call 304-636-6495.

ROCK CAVE COMMUNITY EDUCATIONAL OUTREACH SERVICE meets at 7 p.m. the first Tuesday of each month, in Banks District Civic Center. For more information, call 304-924-6375 or 304-924-5021.

VETERANS OF FOREIGN WARS Tygart Valley Post 3647 Elkins will meet at 7 p.m. the second and fourth Tuesday of each month at the post home.

WEDNESDAYS
AL-ANON will meet at 7 p.m. Wednesdays at Davis Memorial Presbyterian Church in Elkins.

ENGLISH AS A SECOND LANGUAGE TUTORING by Literacy Volunteers of Upshur County will be from 5:30-7:30 p.m. every Wednesday at the literacy office located at 34 Franklin St. in Buckhannon, directly behind Holy Rosary Catholic Church. ESL tutoring is free and confidential. To sign up or for further information, call 304-472-2343.

MOOSE LODGE 2712 will meet at 3 p.m. the first and third Wednesdays of each month at Elkins Inn and Suites.

MOUNTAIN STATE GROTTTO meets at 7:30 p.m. the second Wednesday of the month at Gino's in Elkins.

NARCOTICS ANONYMOUS CANDLELIGHT SERENITY GROUP will meet at 7 p.m. Wednesdays at Grace Episcopal Church on John Street in Elkins.

RESUME AND ONLINE-JOB APPLICATION ASSISTANCE will be available from noon to 3 p.m. Wednesdays at Elkins Workforce WV office.

TOPS WV 0406, FRANKLIN meets Wednesdays at the Summit Bank in Franklin. Weigh-in starts at 5 p.m. and the meeting starts at 5:45 p.m.

For more information, call Mary Jane at 304-358-2537 or Anita at 304-335-4811.

WEDNESDAY NIGHT PICKIN', sponsored by the Augusta Heritage Center of Davis & Elkins College, meets every Wednesday through mid-May in Myles Center for the Arts on the college campus. Country music jams start at 5 p.m., and old-time music jam sessions start at 6:30 p.m. and go until about 9 p.m. The event is free, and open to all instruments and singers, all levels. Listeners are welcome.

THURSDAYS
AMERICAN LEGION POST 29 meets at 6:30 p.m. the second Thursday of each month in the upstairs hall of the Post Home.

AMERICAN LEGION LADIES AUXILIARY UNIT 29 will meet at 6:30 p.m. the second Thursday of each month downstairs in the back room of the post home.

CELEBRATE RECOVERY, a Christ-centered 12-step program for anyone with hurts, habits and hangups, will be begin at 6 p.m. Thursdays at Elkins Family Worship Center, 1402 Taylor Ave., Elkins. For more information, call 304-636-6200 or 304-636-2141 or visit the EFWC Facebook page.

CHESS CLUB meets to play chess from 6-8 p.m. Thursdays at Elkins-Randolph County Public Library. All chess nuts

are welcome.

ELKINS HIGH SCHOOL ALUMNI ASSOCIATION will meet at 7 p.m. the third Thursday of each month at the Steer Steakhouse. The purpose of the association is to assist the sports, band, academics and other programs.

ELKINS MAIN STREET ECONOMIC VITALITY COMMITTEE will meet at noon the third Thursday of each month at Henry G's Cafe, 110 Third St.

ELKINS MAIN STREET ORGANIZATION COMMITTEE will meet at 3 p.m. the third Thursday of each month at the Darden House, 421 Davis Ave.

NATIONAL ACTIVE AND RETIRED FEDERAL EMPLOYEES ASSOCIATION will meet at 1 p.m. the fourth Thursday of each month in the conference room at Elkins Senior Center. For more information, call 304-335-2036 or 304-637-0152.

NATIONAL ASSOCIATION OF RETIRED AND VETERAN RAILWAY EMPLOYEES INC. will meet at 9 a.m. the last Thursday of each month at Hardee's in Elkins. All railroaders are asked to attend and learn more about what services are available.

POTOMAC HIGHLANDS AMATEUR RADIO CLUB meets at 7 p.m. the third Thursday of each month at the Hardy County RRT building in Moorefield. Anyone interested in the radio hobby is welcome. For

more information, go to www.pharc.org.

THE RED HAT HAPPY HATTERS luncheon will be the second Thursday of each month. Plans will be made to meet at different local restaurants each month.

TOPS WV 0599, ELKINS, meets Thursdays at Elkins High School, Door 26. Weigh-in is from 4:30-5:30 p.m. with the meeting immediately following. For more information, call Michelle at 304-642-4402.

TYGART VALLEY LADIES ORIENTAL SHRINE CLUB will meet the fourth Thursday of each month. For more information, call 304-614-5991.

VIETNAM VETERANS OF AMERICA meet at 7 p.m. the first Thursday of each month upstairs at the American Legion in Elkins. For more information or to join VVA, call Jake Roberts at 304-630-2288 or 304-614-4326.

WRITERS CLUB will meet from 5-6:30 p.m. the second Thursday of each month at the Elkins-Randolph County Public Library. For more information, email Cornelia at elkinswriters@yahoo.com.

FRIDAYS
TOPS WV 0590, MILL CREEK meets Fridays at Tygart Valley Community Library in Mill Creek. Weigh-in starts at 10 a.m., and the meeting starts at 10:45 a.m. For more information, call Anita at 304-335-4811.

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DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) to evaluate potential environmental effects of proposed changes to operations due to funding constraints at Green Bank Observatory, in Green Bank, West Virginia. Concurrent with the NEPA process, NSF also has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA) to evaluate potential effects to any historic properties within the area of the Proposed Action.

By this notice, NSF is announcing the beginning of the public comment period to solicit public comments on the Draft EIS and continuation of public involvement under Section 106. Comments may be submitted verbally during the public meeting scheduled for November 30, 2017 (see details below) or in writing until January 8, 2018. To be eligible for inclusion in the Final EIS, all comments must be received prior to the close of the public comment period.

The DEIS is posted at www.nsf.gov/AST (see "AST Facilities - Environmental Reviews") and copies are available for review at the following libraries in West Virginia:

<p>Green Bank Public Library 5683 Potomac Highlands Trail Green Bank, WV 24944</p>	<p>Durbin Community Library 4361 Staunton Parkersburg Turnpike Durbin, WV 26264</p>
---	--

NSF WILL HOST A PUBLIC MEETING:
 November 30, 2017, 5:00 pm to 8:30 pm
 Green Bank Science Center, 155 Observatory Road, Green Bank, WV, 24915
 Phone: (304) 456-2011

For further information regarding the EIS process or Section 106 Consultation, or to submit comments on the DEIS, please contact:

Email to: envcomp-AST-greenbank@nsf.gov
Mail to: Elizabeth Pentecost RE: Green Bank Observatory
 National Science Foundation
 2415 Eisenhower Avenue, Suite W9152, Alexandria, VA 22314
Telephone: (703) 292-4907

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST. Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation). A Notice of Availability has been published and is available on the Federal Register.

THE POCAHONTAS TIMES
206 Eighth Street, Marlinton, WV 24954
304-799-4973

CERTIFICATE OF PUBLICATION

State of West Virginia
County of Pocahontas

I, Jaynell Graham, Editor of The Pocahontas Times, a weekly newspaper of general circulation published at Marlinton, West Virginia in the County of Pocahontas, State of West Virginia, do certify that publication of advertisements (case # or description) NSF Public Meeting Notice attached hereto was made in 1 issue(s) of the newspaper, dated November 16, 2017

Given under my hand this 16th day of November, 20 17

Jaynell Graham
Editor

\$ 86.25
Publication Fee

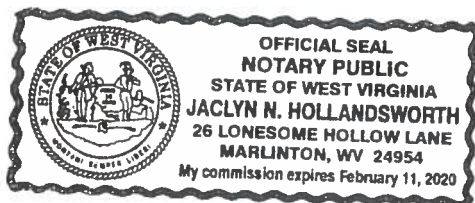
Subscribed and Sworn to before me

This 16th day of November, 20 17

My Commission expires February 11, 2020

Signature Jaclyn N. Hollandsworth

Notary Public



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10/19/tfnc

contributions and paid time off.
11/9/10c

S/7/tfnp

NOTICES

FOR SALE - Heat your entire home for free. Certified Outdoor Wood Furnace. **Central Boiler** Classic Edge. Buy now and save up to \$650. Call today. Gooding Outdoor Furnace 304-642-7753 or 304-704-9711. 11/2/3c

POSITIONS AVAILABLE - RLTCNA and Bedmaker positions open. Full and part-time positions on 3 p.m. to 11 p.m. shifts. Contact the Pocahontas Center, 5 Everett Tibbs Road, Marlinton, WV. 304-799-7375. EEO/AA-M/F/VET/DISABLED. 10/12/tfnc

NOTICE - No hunting on the property of Agnes and Ed Friel on Seebert Lane. 11/16/2c

NOTICE - Absolutely no hunting or trespassing on the property known as the Joseph D. Fertig Farm in Dunmore, West Virginia. 11/16/3p

WANTED

WANTED - Single bottom plow for three-point hitch. 304-799-7237. 11/9/3p

LPN OR RN POSITIONS AVAILABLE - 8 or 12 hour shifts. 3 p.m. to 11 p.m. or 7 p.m. to 7 a.m. Full or part-time. Contact the Pocahontas Center, 5 Everett Tibbs Road, Marlinton. 304-799-7375. EEO/AA-M/F/VET/DISABLED. 8/3/tfnc

NOTICE - No hunting or trespassing on the land owned by Steven Q. Moore and Emery Grimes, Hill Country, Pocahontas County, without written permission. 11/9/4p

FOR RENT

FOR RENT - Renick area. Three bedroom doublewide. \$700/month with \$650 security deposit. No HUD. 304-497-3383. 11/9/2p

FOR RENT - One large bedroom apartment and one three-bedroom

NOTICE - Looking for a Correctional Officer job? Testing will be offered at the Denmar Correctional Center, Hillsboro, WV, on a daily basis. Interested parties should contact Human Resources at the facility

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DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)



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5683 Potomac Highlands Trail
Green Bank, WV 24944

Durbin Community Library
4361 Staunton Parkersburg Turnpike
Durbin, WV 26264

NSF will host a Public Meeting

November 30, 2017, 5 to 8:30 p.m.

Green Bank Science Center, 155 Observatory Road, Green Bank, WV 24944

Phone: 304-456-2011

For further information regarding the EIS process or Section 106 Consultation, or to submit comments on the DEIS, please contact:

Email to: envcomp_AST_greenbank@nsf.gov
Mail to: Elizabeth Pentecost RE: Green Bank Observatory
National Science Foundation
2415 Eisenhower Avenue, Suite W9152, Alexandria, VA 22314
Telephone: (703) 292-4907

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST. Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation). A Notice of Availability has been published and is available on the Federal Register. 11/16/1c

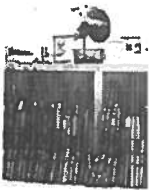


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(Advertiser Name)

Titled Environmental Impact Statement appeared in the
(Headline)

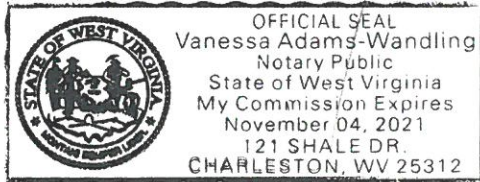
Charleston, WV Gazette-Mail on _____
(City, Paper, Name) (Date)

Advertising Representative: Lisa Stevens

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Seal: _____



Appendix 5B

Scoping Materials



National Science
Foundation

Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

Overview:

The National Environmental Policy Act requires federal agencies to conduct an environmental review to assess the potential environmental impacts of federal actions that could significantly affect the environment.

Section 106 of the National Historic Preservation Act requires federal agencies to consult with interested parties and the State Historic Preservation Officer regarding potential effects of their proposed actions on significant historic properties.

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identification of viable alternatives. Additional opportunities for public participation will be available during the process.

Timeline for Public Involvement:

- **Scoping Comment Period:**
October 19 - November 25, 2016
- **Draft EIS target:**
Spring 2017
 - 45-Day Comment Period on Draft EIS
 - Public meeting on Draft EIS
- **Final EIS target:**
Fall 2017
- **Record of Decision target:**
Winter 2017-2018

Submit Comments:

You may submit written comments on or before November 25, 2016 by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov,
with subject line
"Green Bank Observatory"

Mail to: Ms. Elizabeth Pentecost,
RE: Green Bank Observatory
National Science Foundation,
4201 Wilson Blvd, Suite 1045
Arlington, VA 22230

Project information will be posted, throughout the EIS process, at www.nsf.gov/AST.



Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

Alternatives to be evaluated in the EIS will be refined through public input. Preliminary proposed alternatives include the following:

- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operations as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration
- Continued NSF investment for science-focused operations (No-Action Alternative)



Potential Resources to be considered:

An impact is a change or consequence that results from a proposed activity; it can be positive, negative or both. It may be mitigated to lessen or remove the impact. At present, NSF has preliminarily identified the following resource areas for analysis of potential impacts:

air quality

biological resources

traffic

geological resources

health and safety

solid waste generation

cultural resources

groundwater resources

socioeconomics

Section 106 Process for the Green Bank Observatory:

In coordination with the EIS, NSF will consult with the State Historic Preservation Officer and other consulting parties on potential effects to historic properties located within the Area of Potential Effects (APE).

- The APE is expected to be defined as the boundary of the existing Green Bank Observatory property.
- Consultation would be focused on identifying potential effects, if any, on historic properties eligible for listing or listed on the National Register of Historic Places. If any potential effects are anticipated, consultation with Consulting Parties would occur to identify measures to avoid, minimize, and/or mitigate those effects. Often those measures are memorialized in a Memorandum of Agreement.

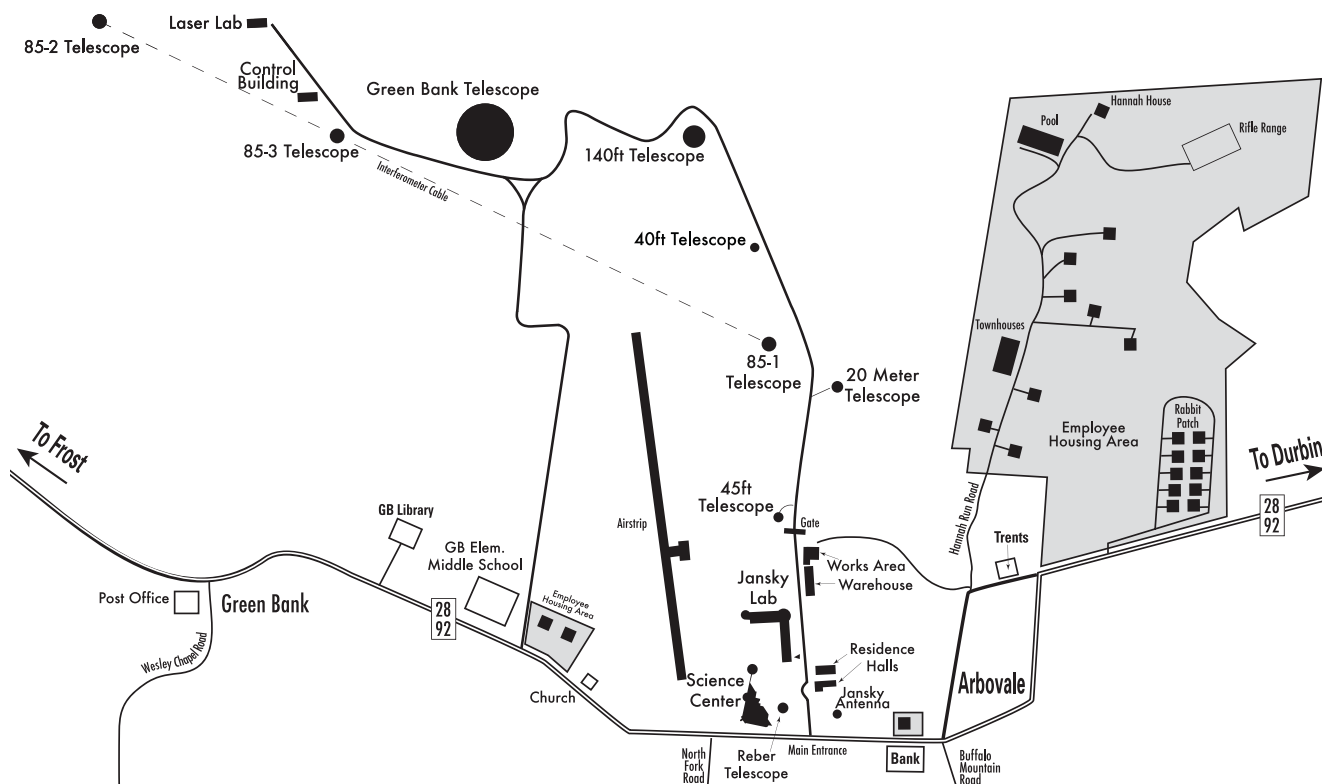
Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

The Green Bank Observatory is located on federal lands in Pocahontas County, West Virginia, adjacent to the Monongahela National Forest. It was established in the 1950s when Green Bank Observatory was formed as the first (and then, only) site of the National Radio Astronomy Observatory.



Site Plan





National Science Foundation



GREEN BANK
OBSERVATORY



GREEN BANK
OBSERVATORY

EIS Public Scoping Meetings

Green Bank Science Center

2016 November 9

3:00—5:00 and 6:00—8:00 pm

Green Bank Observatory Environmental Impact Statement (EIS) Scoping Meeting: *Overview*

- Introduction of team members
- Background information
- Preliminary proposed alternatives and resource areas to be studied
- EIS process
- Public comments



The Role of NSF

- The National Science Foundation (NSF) is the federal steward for ground-based astronomy and astrophysics.
- NSF provides funding for national and international telescopes and facilities and provides funding for research grants that allow individuals and groups to conduct specific science investigations.



Stewardship of NSF's Portfolio

- Over the past decade NSF has received advice from external review committees.
- The 2010 decadal survey, *New Worlds, New Horizons in Astronomy and Astrophysics*, stated: “NSF-Astronomy should complete its next senior review ... so as to determine which, if any, facilities NSF-AST should cease to support in order to release funds for (1) the construction and ongoing operation of new telescopes and instruments and (2) the science analysis needed to capitalize on the results from existing and future facilities.”



Radio facility recommendations

- The 2010 report's recommended review of the NSF Astronomical Sciences portfolio was completed in 2012.
 - 2012 Portfolio Review: *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*
- Regarding the Green Bank Telescope, the 2012 review recommended divestment and stated the following:

“The GBT is the world’s most sensitive single-dish radio telescope at wavelengths shorter than 10 cm; however, its capabilities are not as critical to *NWNH* [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities.”



Radio facility recommendations

- In August 2016, the *National Academies of Sciences, Engineering, and Medicine* published their *Midterm Assessment* of the 2010 decadal survey and reaffirmed the 2012 Portfolio Review's recommendations for divestment of these AST facilities:

“The NSF should proceed with divestment from ground-based facilities that have a lower scientific impact, implementing the recommendations of the NSF Portfolio Review, which is essential to sustaining the scientific vitality of the U.S. ground-based astronomy program as new facilities come into operation.”



Resulting Developments at GBO

- In FY12, NSF provided 95% of the site's funding.
- On March 22, 2013, in Dear Colleague Letter NSF 13-074, NSF announced that the Green Bank Telescope (GBT) would be separated from the National Radio Astronomy Observatory (NRAO) competition and requested ideas for collaborations involving GBT.
- On October 1, 2016, following the path published in NSF 13-074, NSF separated NRAO Green Bank from NRAO.
- The site was renamed the Green Bank Observatory (GBO), and Associated Universities, Inc. (AUI), continues to manage GBO under a cooperative agreement with NSF.



Current Status of GBO

- FY17 President's Request Budget (PRB) for "Other Astronomical Facilities" asked for \$11.5M total for GBO and the Long Baseline Observatory (LBO).
- FY17 PRB also shows an increase to \$11.85M in FY18, for planning purposes.
- Following a review of AUI's proposal that provides the exact division between GBO and LBO for FY17 and FY18, NSF allocated \$8.2M in FY17 should the PRB be appropriated.
- The \$8.2M level represents approximately 75% of the base budget for GBO that was part of previous appropriations to NRAO.



Current Status of GBO

- GBO has established collaborations with Breakthrough Listen, West Virginia University, and NANOGrav.
- GBO continues seeking new funding sources.



NSF plans moving forward

- Given previous astronomical community recommendations combined with current budget constraints, NSF has a need to reduce funding for a number of its astronomical telescopes and facilities.
- The NSF is initiating the EIS/Section 106 consultation process for the Green Bank Observatory.



EIS Preliminary Proposed Alternatives

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.



National Environmental Policy Act

- The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to consider the potential environmental consequences of proposed actions on the environment prior to making final decisions.
- NSF intends to prepare an Environmental Impact Statement (EIS) to evaluate the potential environmental effects of proposed operational changes due to funding constraints for the Green Bank Observatory
 - NSF will prepare a Draft and Final EIS
- On October 19, 2016, NSF announced the beginning of the scoping process for development of an EIS



NEPA Scoping Process

- The purpose of the scoping process is to seek public input regarding relevant issues that will influence the scope of the environmental analysis
- Comments will inform the EIS
 - We invite your input regarding relevant issues, including identification of viable alternatives and resource areas to be analyzed.
 - The more specific your comment, the more helpful to the development of the EIS



EIS Preliminary Resource Areas to Be Analyzed

- Air quality
- Biological resources
- Cultural resources
- Geological resources
- Solid waste generation
- Health and safety
- Socioeconomics
- Traffic
- Groundwater resources



Section 106 of the National Historic Preservation Act

- The Section 106 consultation process requires federal agencies to consult with interested parties and the State Historic Preservation Officer regarding potential effects of their proposed actions on nationally significant historic properties. There are four basic steps:
 1. Initiate Section 106 consultation
 2. Identify Area of Potential Effects (APE) and nationally-significant historic properties within the APE
 3. Assess whether there are adverse effects
 4. Resolve any adverse effects through a Memorandum of Agreement
- Section 106 consultation will occur in coordination with the NEPA process

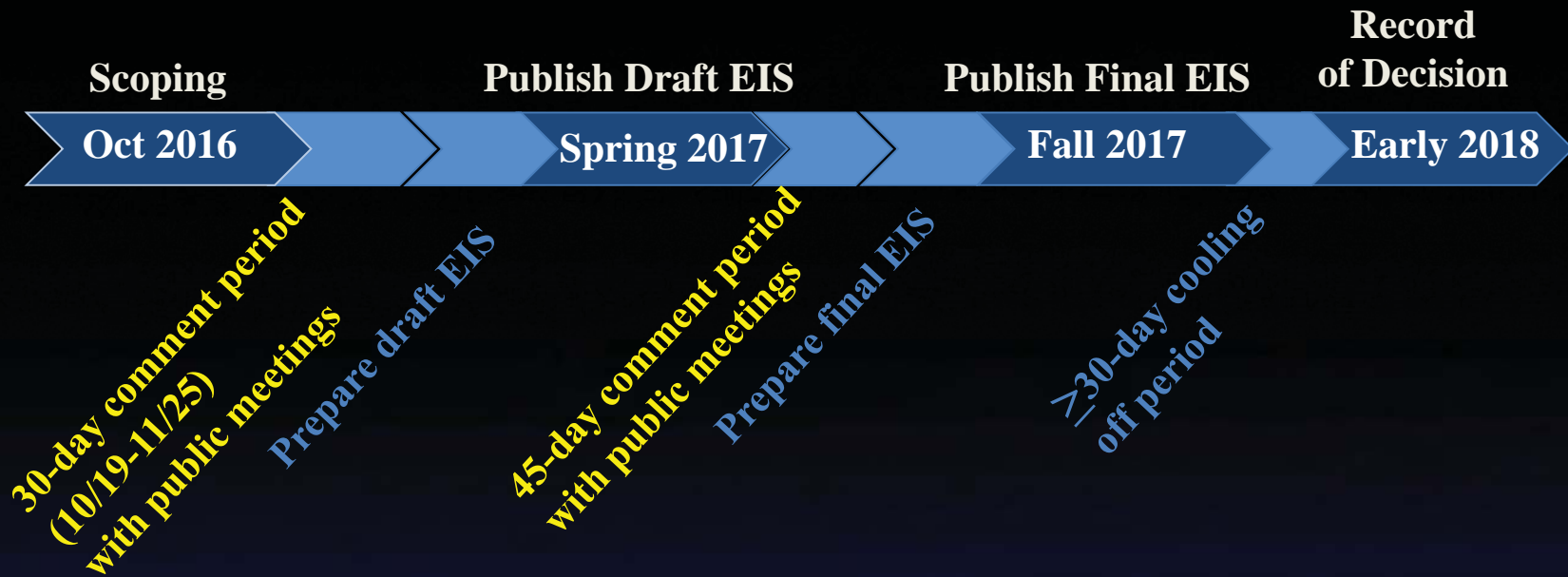


Endangered Species Act

- NSF must also consider whether the proposal's activities may impact threatened or endangered species and/or their habitat under the Endangered Species Act (ESA).
- If it is determined that such an impact may occur, NSF will consult with the US Fish and Wildlife Service to determine next steps.



Target Dates & Opportunities to Comment



National Historic Preservation Act Compliance

Endangered Species Act Compliance



How to submit comments

- Provide verbal comments today
- Submit written comments today
- Mail or email comments to NSF by November 25
 - envcomp-AST-greenbank@nsf.gov
 - Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230



Where to find Information

- The fact sheet, informational boards, and presentation will be posted at:
 - www.nsf.gov/AST
- Documents and meeting information will continue to be posted throughout the process





GREEN BANK OBSERVATORY



Appendix 5C

Scoping Transcripts

1 NATIONAL RADIO ASTRONOMY OBSERVATORY
2 (GREEN BANK OBSERVATORY)
3 EIS PUBLIC SCOPING MEETING - NUMBER 1
4
5 HELD AT THE
6 GREEN BANK SCIENCE CENTER
7 155 Observatory Road
8 Arbovale, West Virginia 24915
9
10 Wednesday, November 9, 2016
11 3:30 p.m.
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1 IN ATTENDANCE:

2 EDWARD A. AJHAR, Ph.D., Program Director
3 Division of Astronomical Sciences
4 National Science Foundation
5 4201 Wilson Boulevard, Room 1045.21
6 Arlington, Virginia 22230
7 Telephone: 703-292-7456
8 Facsimile: 703-292-9034
9 E-mail: eajhar@nsf.gov

10 CAROLINE M. BLANCO, Assistant General Counsel
11 Office of the General Counsel
12 National Science Foundation
13 4201 Wilson Boulevard
14 Arlington, Virginia 22230
15 Telephone: 703-292-4592
16 Facsimile: 703-292-9242
17 E-mail: cblanco@nsf.gov

18 ELIZABETH A. PENTECOST, Project Manager
19 Division of Astronomical Sciences
20 National Science Foundation
21 4201 Wilson Boulevard, Suite 1030
22 Arlington, Virginia 22230
23 Telephone: 703-292-4907
24 Facsimile: 703-292-9034
E-mail: epenteco@nsf.gov

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I N D E X

PAGE

PROCEEDINGS 4

P R O C E E D I N G S

1
2 Whereupon,

3 DR. EDWARD AJHAR: Thank you everybody for attending
4 our Environmental Impact Statement Public Scoping Meeting.
5 I also want to take this moment to thank our host, the
6 Green Bank Observatory and the director, Karen O'Neil.
7 They've been great hosts in helping us get all of these
8 logistics set up.

9 The other thing I want to mention just before we get
10 started is that you know you've heard a lot of things or
11 read a lot of things in the news. Not everything gets
12 translated perfectly so I'm going to try to clarify some of
13 those things for you today. I just want to emphasize how
14 important your comments are to us because contrary to some
15 of the things you may have heard, right, there has been no
16 decision made regarding Green Bank Observatory's future.
17 We have not decided to close it and that's why your public
18 comments are a very important part of this whole process.
19 You know, it's a challenging process for all of us right
20 now, but again, I appreciate your presence.

21 So what we're going to do I'm going to introduce
22 myself and the rest of the team. I'm going to go over some
23 background information so that you understand why we're
24 here and I will discuss what the preliminary proposal

1 alternatives and the resource areas that are going to be
2 studied as a part of this Environmental Impact Statement.
3 We will talk about the Environmental Impact Statement
4 process, and when all of that is done we will open the
5 floor to public comments.

6 So first of all my name. I'm Edward Ajhar. I am an
7 astronomer in the Division of Astronomical Sciences at the
8 National Science Foundation, and I'm the program officer
9 for Green Bank Observatory.

10 Joining me from our Division of Astronomical Sciences
11 is Liz Pentecost. Liz is back there. Thank you, Liz. And
12 we have Caroline Blanco and Christin Hamilton from our
13 Office of General Counsel. From our Office of Legislative
14 and Public Affairs we have Karen Pearce and Ivy Kupec.
15 Karen, Ivy, thank you. We also have a couple of
16 contractors with us Michelle Rouwe and Chris McDonough. I
17 don't know if any of them are here. They're sitting out
18 probably welcoming other people.

19 Let me now start talking about the role of the
20 National Science Foundation. We serve as the federal
21 stewards of ground-based astronomy and astrophysics, and
22 NSF provides funding for national and international
23 telescopes and facilities and provides funding for research
24 that allow individuals and groups to conduct

1 specific science investigations.

2 So what is our stewardship role of NSF's astronomy
3 portfolio? Over the past decade the National Science
4 Foundation has received advice from several external review
5 committees. These are made up of members of the
6 astronomical research community. In the 2010 decadal
7 survey titled New Worlds, New Horizons in Astronomy and
8 Astrophysics stated that, "NSF astronomy should complete
9 its next senior review so as to determine which, if any,
10 facilities astronomy should cease to support in order to
11 release funds for one, the construction and ongoing
12 operation of new telescopes and instruments; and two, the
13 science analysis needed to capitalize on the results from
14 existing and future facilities."

15 The 2010 report reports recommended review of the
16 National Science Foundation Astronomical Sciences Portfolio
17 was completed in 2012. That 2012 portfolio review was
18 titled, Advancing Astronomy in the Coming Decade:
19 Opportunities and Challenges. "Regarding the Green Bank
20 Telescope, the 2012 review recommended divestment and
21 stated the following, "The GBT is the world's most
22 sensitive single-dish radio telescope at wavelengths
23 shorter than ten centimeters; however, its capabilities are
24 not as critical to the decadal survey science goals as

1 higher-ranked facilities."

2 In August of this year, 2016, the National Academies
3 of Sciences, Engineering, and Medicine published their
4 midterm assessment of the 2010 decadal survey and
5 reaffirmed the 2012 portfolio reviews recommendation for
6 divestment of these astronomy facilities. To quote from
7 that report, "The NSF should proceed with divestment from
8 ground-based facilities that have a lower scientific impact
9 implementing the recommendations of the NSF Portfolio
10 Review, which is essential to sustaining a scientific
11 vitality of the U.S. ground-based astronomy program as new
12 facilities come into operation."

13 So given all of that input over the past several years
14 that I just tried to summarize very quickly for you, what
15 are the resulting developments here at Green Bank? Well,
16 going back to fiscal year 2012, the National Science
17 Foundation provided about 95 percent of this site's
18 funding, and on March 22nd, 2013, in a Dear Colleague
19 Letter that the National Science Foundation announced that
20 the Green Bank Telescope would be separated from the
21 National Radio Astronomy Observatory competition and
22 requested ideas for collaborations involving GBT. I will
23 have more to say about that in a second.

24 October 1st of this year following the path that was

1 published in that 2013 Dear Colleague Letter, the National
2 Science Foundation separated NRAO Green Bank from the whole
3 NRAO and this site was renamed the Green Bank Observatory.
4 Associated Universities Incorporated, AUI, continues to
5 manage the Green Bank Observatory under a cooperative
6 agreement with the National Science Foundation. I know
7 many of you were here. I was here last month when we had a
8 very nice inauguration ceremony for that
9 event. So those are the things that happened.

10 I want to give you some information about the current
11 budget for Green Bank Observatory. In the fiscal year
12 2017, President's Request Budget of other astronomical
13 facilities, that budget asked for \$11.5 million total for
14 the Green Bank Observatory and the Long Baseline
15 Observatory. In this fiscal 2017 President's Request
16 Budget, it also shows an increase to \$11.85 million in the
17 following fiscal year of 2018 for planning purposes. So
18 that's published. You can see that.

19 Following a review of AUI, that's the managing
20 organization, following review of their proposal that
21 provides the exact division between Green Bank Observatory
22 and Long Baseline Observatory for the current fiscal year
23 2017 and fiscal year 2018, the National Science Foundation
24 allocated \$8.2 million in the current fiscal year should

1 the President's Request Budget be appropriated. Of course,
2 that hasn't happened yet. We're operating under a
3 continuing resolution as many people are aware so the \$8.2
4 million level represents approximately 75 percent of the
5 base budget for Green Bank Observatory that was part of the
6 previous appropriations for the National Radio Astronomy
7 Observatory.

8 Another very important part of what's a part of Green
9 Bank Observatory now is that GBO has established
10 collaborations with Breakthrough Listen, which you've heard
11 a lot about probably in the news, and West Virginia
12 University and the North American Nanoherzt Gravitational
13 Wave Project known as NANOGrav. GBO continues to seek new
14 funding sources so that's where we are today.

15 So what are the National Science Foundation's plans
16 moving forward which is bringing us to one of the reasons
17 why we're here today. So given the previous astronomical
18 community's recommendations that I summarized very briefly
19 for you today, combined with the current budget
20 constraints, NSF has a need to reduce funding for a number
21 of its astronomical telescopes and facilities so that's why
22 the NSF is now initiating the Environmental Impact
23 Statement Section 106 consultation process which involves
24 you, the public, for the Green Bank Observatory. This is

1 in addition to similar processes which we've already
2 initiated for the Arecibo Observatory and the Sacramento
3 Peak Observatory so that's why we're here today.

4 The Environmental Impact Statement Preliminary
5 Proposed Alternatives for operations at Green Bank that are
6 being considered are the following, and I will go through
7 them with you, and these are preliminary and that's why
8 this is one of the important things that your comments will
9 be considered for these alternatives and other ones that
10 may come up in this process.

11 The first one is continued NSF investment for science-
12 focused operations. That's the no action alternative.
13 That's continuing what we are doing today.

14 Number two is the collaboration with interested
15 parties for science- and education-focused operations with
16 reduced NSF-funded scope.

17 Third one, collaboration with interested parties for
18 operation as a technology and education park.

19 The fourth one is mothballing of facilities. By that
20 we mean the suspension of the operations in a manner such
21 that operations could resume efficiently at some future
22 time.

23 The last alternative that we're looking at is
24 construction -- deconstruction of the site and site

1 restoration.

2 That's the range that we're looking at, and at this
3 point I would like to turn over the presentation to our
4 general counsel, Caroline Blanco, to go through some of the
5 details of this process. Thanks.

6 CAROLINE BLANCO: Well, thank you so much, and thank
7 you to you, Dr. Ajhar, who just gave me a promotion. I'm
8 the assistant general counsel for the National Science
9 Foundation. I oversee environmental matters.

10 My name again is Caroline Blanco, and I, too, would
11 like to thank you very much for coming this afternoon. I'm
12 going to speak a little bit about the process. This is an
13 unusual type of process perhaps for some folks, but it does
14 look at the environmental consequences to proposed
15 alternatives so these alternatives came from the
16 national -- or as a result of the National Environmental
17 Policy Act.

18 This is a statute that requires federal agencies to
19 consider the potential environmental consequences of their
20 proposed actions before a decision has been made. NSF has
21 decided to prepare an Environmental Impact Study -- an
22 Environmental Impact Statement to evaluate the potential
23 environmental effects of proposed operational changes due
24 to funding constraints for the Green Bank Observatory.

1 There is a set process that's established by law and
2 the process starts out with this very one which is the
3 scoping process. There is a 30-day public comment period.
4 It has been extended a little bit due to a technological
5 glitch but it's extended to November 25th, and you are
6 invited and welcome, encouraged to send public comments.
7 The comments really largely are focused on how the scope of
8 the Environmental Impact Statement will be shaped. Two
9 main things to look at are the proposed alternatives that
10 Dr. Ajhar just mentioned and any other viable alternatives
11 that you may suggest. Also the different resource areas to
12 be studied, and we will go through that in a moment.

13 So on October 19th is when we announced the beginning
14 of this scoping process and the development of the
15 Environmental Impact Statement. And, again, we invite your
16 comments on them on these relevant issues. Again,
17 including -- this is not just -- to be as clear as I can be
18 about it, it's not -- this process is focused on
19 environmental impacts. It's not a process to debate the
20 merits of science and, you know, those types of things.
21 We're looking at environmental impacts associated with
22 proposed alternatives so your thoughts on a range of viable
23 alternatives would be most welcome as well as resource
24 areas to be studied.

1 So looking to the resource areas that we preliminarily
2 identified that need to be analyzed in our Environmental
3 Impact Statement are air quality, biological resources,
4 cultural resources, geological resources, solid waste
5 generation, health and safety issues, socioeconomic
6 impacts, traffic, and groundwater resources.

7 What will happen after this is we will prepare a draft
8 Environmental Impact Statement and then there will be a 45
9 day for the comment period. The issuance of that draft EIS
10 will be announced, again, in the Federal Register. Also
11 you can see, and I will mention this again at the end, that
12 there will be the availability of the website NSF.gov/AST?
13 Yeah. You will be able to see ongoing documents there.
14 The draft EIS will be posted there as well. Then we will
15 come back and have another meeting, probably two meetings
16 afternoon and evening, and allow for more public comments
17 then.

18 Another process that we're doing at the same time is
19 Section 106 of the National Historic Preservation Act.
20 What 106 is is a consultation process that requires federal
21 agencies to consult with interested parties in the State
22 Historic Preservation Office regarding potential effects of
23 their proposed actions on nationally significant historic
24 properties.

1 There are four basic steps to this process. We
2 initiate our consultation process and then we identify an
3 area of potential effects, the ATE, which is likely going
4 to be within the boundaries of this observatory, and the
5 nationally significant properties within the area of
6 potential effects. The EIS process in contrast doesn't
7 look at the significance level of those historic resources,
8 but Section 106 does focus on those resources on the
9 nationally significant ones. Then we assess whether there
10 are effects. If so, whether they are adverse to those
11 nationally significant historic properties, and they can
12 include archeological, historic, or cultural resources.
13 Then we resolve those adverse effects with consulting
14 parties and through typically a memorandum of agreements.

15 You may have noticed when you signed in, and hopefully
16 everybody signed in, that's one way we can make sure we
17 communicate with you. When the draft EIS comes out we will
18 notify you. There's also a box or a column there where you
19 will see that there is a request did you want to be a
20 consulting party and that simply means that you would be
21 interested in participating in this process, the Section
22 106 one.

23 The other process that we're taking a look at is the
24 Endangered Species Act. This is an Act that NSF as a

1 federal agency is also required to comply with. It
2 considers whether the proposed activities impact threatened
3 or endangered species or their habitats, and if so, then we
4 consult with the Fish and Wildlife Service, the U.S. Fish
5 and Wildlife Service and look at ways to address those
6 impacts.

7 So looking forward, our target dates, as we mentioned,
8 the scoping process started October 19th and it will
9 continue through November 25th. We're having this public
10 meeting as well as the one beginning at 6 p.m. tonight.

11 Moving forward after that, we will accumulate your
12 comments, we will review them, consider them. We will be
13 working with our environmental contractors, CH 2 M Hill,
14 and we will prepare a draft Environmental Impact Statement
15 that will analyze, take a look at all of those proposed
16 alternatives that will hopefully be more typed up as a
17 result of this process, and then we will take a look at
18 impacts associated with each of those alternatives. The
19 resource areas that we listed if those change as a result
20 of the public comments we receive here we will take a look
21 at that as well.

22 We expect roughly that that will be published and
23 available in the spring of 2017, and that will, as I said,
24 that will start off the 45-day public comment period and

1 public meetings and then we will prepare a final EIS. That
2 process takes a bit and we're looking at publishing the
3 final EIS sometime in the fall of 2017. These are merely
4 target dates. Things may shift depending upon the number
5 of comments we received and how much information we may
6 need to complete our process.

7 After that, by law, we have to wait at least 30 days
8 before a Record of Decision is issued. That Record of
9 Decision is expected sometime in early 2018. That Record
10 of Decision will select ultimately an action. The process
11 for doing it will include several components, one of which
12 is the environmental consequences, but there will be other
13 factors such as scientific policies and budget issues and
14 NSF submission, a whole host of things will go and be
15 wrapped into that final Record of Decision.

16 As you can see at the base of the slide concurrently
17 we will be completing our National Historic Preservation
18 Act compliance. That's the Section 106 compliance
19 process. Again, if you're interested in participating in
20 that process, please make sure that you let us know.
21 Endangered Species Act as well we will be compliant with.

22 So how do you submit your comments? You can provide
23 verbal comments today. You can submit written comments
24 today. We have a written comment form. Also, just as a

1 note, hopefully all of you will have -- these are also
2 available on the website. This particulate is a fact
3 sheet, several pages that explain a little bit more about
4 this process and provides some additional information. You
5 can mail or e-mail your comments to NSF by November 25th.
6 You can submit them by e-mail or by regular mail but those
7 are the two addresses there.

8 Again, we have the fact sheet. We have informational
9 boards, the boards that are out there, all of that
10 information including this PowerPoint presentation will be
11 posted after today on our website and that's the
12 NSF.gov/AST website. The documents and meeting information
13 will be posted on that same website throughout this
14 process.

15 So now we're at the public comment portion of this
16 meeting. We have a court reporter here to transcribe.
17 This will become part of the public record and Elizabeth
18 Pentecost from the National Science Foundation will call
19 your name for those folks who have indicated that they
20 would like to provide oral comments.

21 If you would, please, when your name is called please
22 come here, take the microphone, and go ahead and provide
23 your comments. We have roughly about 27, 28 people that
24 indicated they wanted to comment so we're looking at --

1 we're not going to be hard and fast about it, but if you
2 could try to limit your comments to about three minutes,
3 that would be great. If we have more time left over at the
4 end we can always have you supplement and, again, just
5 because you provide oral comments here doesn't mean you
6 can't add additional written comments before November 25th
7 as well. That will be great. Thank you so much.

8 ELIZABETH PENTECOST: I would like to introduce
9 Congressman Evan Jenkins.

10 CONGRESSMAN EVAN JENKINS: Well, thank you very much.
11 Good afternoon. I'm Evan Jenkins. I'm the congressman
12 from the Third Congressional District. That goes from
13 Mason and Cabell County over on the west all the way right
14 here to Pocahontas County.

15 To all of the Pocahontas County residents, to the
16 employees of Green Bank, to those who have traveled from
17 out of state to come here to have your voice heard, thank
18 you. This was important for me as well to come over to
19 make sure that I join your voices to make sure that this
20 critically important asset is preserved.

21 I appreciate the Green Bank Observatory for hosting
22 this event and the wonderful accommodations, and I
23 appreciate, again, all that you do.

24 I want to thank the National Science Foundation for

1 their work and for their engagement in this facility. I
2 welcome you to this wonderful State of West Virginia. This
3 is a very special place. Green Bank Observatory is the
4 reason that the United States is a global leader in radio
5 astronomy. The Green Bank Telescope is leading the way in
6 tracking pulsars, investigating star formation, exploring
7 our galaxy, and even looking for alien life.

8 I understand that this is about an Environmental
9 Impact Statement. This is about impact. Without this
10 critical asset, the United States would lose its footing in
11 radio astronomy, a position that could take decades to
12 reclaim. Scientists from all over the world use the Green
13 Bank for cutting-edge research. Many of these scientists
14 at one time or another find themselves in this beautiful
15 mountainous area of Pocahontas County.

16 This bridge has been of key importance for the
17 students from our state and many others. Every year Green
18 Bank brings in 3 to 5,000 students and teachers to
19 participate in educational programs. Students are given
20 the opportunity to use the equipment and look for
21 astronomical bodies including discovering pulsars. These
22 educational programs are giving West Virginia students the
23 opportunity to have hands-on experience in science and
24 research fields. For many students, especially

1 underprivileged and female, these students, they need these
2 opportunities, and these are opportunities that they can't
3 get or have copied simply in the classroom or at home.

4 The Green Bank Observatory is giving a chance to
5 students that will truly change their lives. Green Bank
6 provides even more to the community than creating the next
7 generation of scientists. The facility provides an
8 irreplaceable economic boost to Pocahontas County and West
9 Virginia.

10 Green Bank as we know employs over 100 people year-
11 round and during the busy season about 400 -- 40 additional
12 seasonal jobs. During this time Green Bank is the largest
13 private employer in this county. The Green Bank
14 Observatory's employees contribute an all important \$17.1
15 million to the local economy and when included with the
16 economic impact from tourism, the Green Bank Observatory
17 adds nearly \$30 million to the West Virginia economy.

18 Our state is hurting right now. We are hurting.
19 Green Bank is the shining beacon for our future and for
20 hope for that future. There is a continued need for Green
21 Bank and it could not be more apparent than the recent
22 efforts being undertaken by the Breakthrough Listening
23 Project. Green Bank is a key part of investigating the
24 skies for intelligent life. The impacts of science for

1 education and for the community is why there is such an
2 outpouring as shown here today for this facility.

3 I want to make it perfectly clear, I think options
4 four and five on the chart are simply unacceptable. I
5 fully support the Green Bank Observatory and know that it
6 can be a critical asset for science and West Virginia for
7 decades to come. Thank you.

8 ELIZABETH PENTECOST: Okay, the next person is J.T
9 Jezierski from Senator Capito's office.

10 J.T. JEZIERSKI: I was going to make a
11 lame joke about finding pulsars was easier than saying my
12 last name but since this is public I won't make that joke.

13 My name is J.T. Jezierski. I'm born and raised in
14 Weirton, West Virginia, Hancock County. I work for Senator
15 Shelley Moore Capito. I'm in her Washington, DC office and
16 I support her work on the appropriations committee.
17 Unfortunately, she couldn't be here today so she asked me
18 to read this statement if I could.

19 "Ladies and gentlemen, fellow West Virginians. I am
20 sorry I am unable to attend today's meeting. Although I
21 regret not being there, I am glad you all are, particularly
22 the team from the National Science Foundation. They will
23 see how important and impactful the work of the Green Bank
24 Observatory is to our world, to West Virginia, and to

1 Pocahontas County.

2 There are many impressive stats and facts that one can
3 recite about this facility, but to be here, to see the
4 structure in person and to hear your stories, that is worth
5 more than any statistics.

6 It was my pleasure to experience this just a few weeks
7 ago when I visited Green Bank. You cannot help but be
8 inspired and excited for our future by seeing this unique
9 equipment or meeting the men and women who make it work.

10 We are gathered to talk about the future of the Green
11 Bank Observatory, but we are also here to talk about the
12 future of scientific research in the United States. I have
13 long advocated for the continued operation of this facility
14 supporting robust levels of funding and research. Doing so
15 will not only employ West Virginians but it keeps people
16 inspired whether current researchers or the thousands of
17 students who come through here wanting to become
18 researchers. We have to invest in science research in our
19 nation. The promise of discoveries are beyond our
20 imagination if we make the right investments.

21 Whether on the appropriations committee where I am a
22 member or working with my partners in this effort, Senator
23 Manchin and Congressman Jenkins, I will convey -- continue
24 to convey my support for Green Bank.

1 I look forward to reconnecting with Director Cordova
2 tomorrow to discuss the significance of this observatory.
3 I know there's a process to write this Environmental Impact
4 Study, and I plan to be involved every step of the way. I
5 recognize the challenges presented by a limited federal
6 budget and support any and all efforts to reduce waste and
7 inefficiencies; however, investment in Green Bank does not
8 fall into either of those categories. Every dollar
9 invested here is spent wisely. Meanwhile, Green Bank has
10 been a responsible partner with the National Science
11 Foundation in recognizing the budgetary challenges we all
12 face.

13 Green Bank has been extremely aggressive and forward
14 thinking to partner with educational institutions like West
15 Virginia University and with organizations such as the
16 Breakthrough Foundation to balance government investment
17 with private funds.

18 There are many quantifiable impacts of this facility
19 on this community and we know your study will factor and
20 measure them all. As you complete your study, we ask that
21 you please not overlook the less easily measured impacts.

22 Green Bank is not just looking towards the stars to
23 discover new worlds but looking towards students in West
24 Virginia and across our nation for new scientists,

1 astronomers, researchers, and teachers. May their
2 discoveries continue to inspire us all. Senator Shelley
3 Moore Capito."

4 Thank you for your time.

5 ELIZABETH PENTECOST: The next person is Peggy Hawse
6 from Senator Manchin's office.

7 PEGGY HAWSE: Good afternoon. I'm Peggy Hawse and I'm
8 a regional coordinator for Senator Joe Manchin. I live
9 about 80 miles from here in Hardy County, so please don't
10 hold that against me. I know Moorefield plays Pocahontas
11 County, that's why I threw that out there.

12 The Senator is very committed to Green Bank
13 Observatory. He sent not only myself today but the
14 legislative director from Washington on the senator staff,
15 Wes Congle, and I am very happy to be here.

16 GBO, Green Bank Observatory, is very near and dear to
17 my heart. I kind of consider it a friend and when you have
18 a friend sometimes you give them a nickname. I understand
19 that the nickname of the Green Bank Telescope is the Great
20 Big Thing. The first time I said that at my home my
21 husband said what in the world are you talking about. I
22 said it is the Great Big Thing and you have to see it, you
23 have to experience it to really understand that.
24 Obviously, U-Haul did because they chose the Green Bank

1 Telescope as the symbol of West Virginia to put on the
2 sides of their trucks so it is a friend. It is a status of
3 pride for all of us that live in West Virginia and also in
4 the USA.

5 I do have some comments from the Senator. The NRAO
6 was established here in Green Bank in 1956. The people of
7 this community and this region have made many sacrifices
8 and they have embraced it. Obviously, there's no cellphone
9 coverage, but if you ask anyone in this area they will say
10 that is not a big deal.

11 I want to emphasize the economic impact, what happens
12 here at GBO. Well, first of all, there is a \$17 million
13 contribution to the local economy. Taking this a little
14 bit further, there are over 50,000 visitors to GBO every
15 year so if you equate that to the impact on the economy of
16 this area, \$8 million turns into 30 million. Now, I don't
17 know about you, but my economics says if you take eight and
18 you turn it into 30, you're doing something right.

19 Tomorrow afternoon Senator Manchin along with Senator
20 Capito and Congressman Jenkins will speak directly to
21 Dr. France Cordova, the director of the National Science
22 Foundation, to ensure that she understands the importance
23 of the Green Bank Observatory to this community and to the
24 surrounding region and West Virginia.

1 Senator Manchin thanks all of you for taking your time
2 out of your busy schedules to come and make your voice
3 known in this process. We would welcome any additional
4 information you would like to share with us about how this
5 facility has impacted you and your family.

6 As a member of the Commerce Committee, Senator Manchin
7 will have the responsibility of interviewing and confirming
8 the next director of the National Science Foundation, and
9 we would like to do everything we can to ensure your voice
10 and your concerns are heard at the highest levels. So on
11 behalf of Senator Manchin, I strongly encourage the
12 National Science Foundation to maintain their commitment to
13 this facility and to the critical contributions it makes to
14 the international, and I will say that again, to the
15 international scientific community throughout this review
16 process. Thank you.

17 I want to recognize the members of West Virginia
18 University staff. I understand there's a large delegation
19 of students coming later and I appreciate that effort on
20 their behalf, so thank you all for coming, and as I say,
21 the Great Big Thing is one of my friends.

22 ELIZABETH PENTECOST: The next person is Senator Greg
23 Boso.

24 SENATOR GREG BOSO: Good afternoon. I am Senator Greg

1 Boso and it is a privilege to be with you this evening to
2 be able to talk about this essential piece of
3 infrastructure, scientific infrastructure that has an
4 impact worldwide on science, on education, on technology,
5 and on my profession which is as an engineer.

6 I'm a registered civil engineer, professional engineer
7 working in West Virginia, but I also get to serve as a West
8 Virginia Senator. As an engineer, I've learned that
9 science has as an impact on our society, on our people, on
10 our world. Why, because we get to take the science and
11 adapt it so that it's useful in today's society.

12 I have already gone on record by providing a letter to
13 Ms. Pentecost that she should have already received and
14 made that letter aware -- or distributed it as well on to
15 our congressional delegation. Our congressional delegation
16 has already done a good job of making you aware of some of
17 the key aspects, but this is an Environmental Impact
18 Statement.

19 I've prepared environmental impact statements and I'm
20 really concerned about the impacts that this facility --
21 any potential closure that's contemplated would have on
22 Pocahontas County and on the region of the 11th Senatorial
23 District in which I represent. Why, because when you get
24 to looking at just a hundred jobs, it's not just a hundred

1 jobs. We get to looking at the economic impact. We've
2 already mentioned the fact that there's a \$30 million
3 ancillary investment within the community. You pull that
4 out, all of a sudden we would be losing our firefighters,
5 our EMTs, and the local community, those people who invest
6 their philanthropic efforts back into the community so that
7 this community thrives.

8 The National Radio Quiet Zone was established when
9 this particular facility was established. In doing so, it
10 made radio communications very limited. Does that mean
11 that Pocahontas County has suffered as a result of that? I
12 don't think so. And the reason I say that is because
13 people talk to people. They interact. You know, I love
14 coming to Pocahontas County. Why, because we don't have
15 telephones, we don't have wireless communications, and so
16 guess what? I get to shake hands, we smile, we talk, we
17 enjoy a cup of coffee. Those are things -- those are key
18 human interactions that the rest of the world is suffering
19 from.

20 When you get to looking at the rest of the world it's
21 breaking down. Why, because they don't interrelate with
22 one another, but I can tell you that that is just a part of
23 why this particular facility is so quiet.

24 When we get to looking at the environmental impact if

1 we start talking about removing this particular facility
2 we're going to remove the financial flow of money into the
3 local businesses. We're going to see businesses within
4 Pocahontas County, Green Bank, Durbin, Bartow, Dunmore
5 closing. Why, because there's no money to support this
6 particular area.

7 We're going to see Green Bank Elementary School
8 suffer. Why, because the population of the workforce here
9 provides people in the local school. Then we're going to
10 see school closures. These are impacts that we cannot, we
11 must not allow.

12 When we started talking about closure we talked about
13 the environmental impacts. We're going to start seeing
14 things happen here in Pocahontas County like is happening
15 already in Southern West Virginia as a result of the loss
16 of coal jobs. People are picking up and leaving,
17 abandoning their homes, and we're seeing structures
18 deteriorate in local landscapes, and as a result, the
19 environmental impacts as those structures begin to decay
20 impacts our water, our groundwater, and other -- creating
21 other environmental problems.

22 It's for these reasons that I support a no action
23 alternative that is proposed as a part of this
24 Environmental Impact Statement. Thank you. And I will

1 continue to support Pocahontas County and the State of West
2 Virginia.

3 ELIZABETH PENTECOST: Mr. Fred King.

4 DR. FRED KING: Good afternoon, everyone. I'm Fred
5 King. I'm the vice president of research at West Virginia
6 University, and I am here to talk to you about what I
7 consider to be the socioeconomic impacts as opposed to
8 necessarily the research impacts although these things run
9 together, and of course, being from the University it's
10 really in terms of the educational impact and workforce
11 development.

12 Over the last 15 years the University has worked,
13 collaborating with Green Bank as we've grown astrophysics
14 at our university. We've created a university center for
15 astrophysics and we've also renamed the Department of
16 Physics as the Department of Physics and Astronomy,
17 because of the growth of this at the university.

18 We've moved from one faculty member working the area
19 of astrophysics to seven who are now engaged in
20 astrophysics. These faculty have secured funding and
21 awards over that time and perhaps most significant among
22 those are National Science Foundation PIRE award for
23 International Research Collaborations focused on the Green
24 Bank Observatory as well as in last year a National Science

1 Foundation Physics Frontier Center award. This focused on
2 gravitational wave research.

3 I want to point out that the National Science
4 Foundation's Physics Frontier Center awards are given to
5 the most important problems being addressed within the
6 physics community. A large part of that work is done in
7 collaboration with the Green Bank Observatory.

8 To date, our faculty have brought in some \$14.5
9 million to the State of West Virginia in support of
10 research at the Green Bank facility. The work has also
11 provided our state with an international reputation in the
12 study of physics of pulsars and their potential use in the
13 study of gravitational waves.

14 You may recall back in the fall there was a great
15 fanfare about gravitational wave detections. Scientists
16 working here at Green Bank are working in an alternative
17 approach to that detection at a different part of the
18 gravitational wave spectrum. To date, there have been some
19 56 journal articles that have come out of the collaboration
20 between WVU faculty and the staff at the Green Bank
21 Observatory. And, of course, as you grow faculty, you're
22 going to grow more importantly student impact.

23 Over the last decade since we've been working
24 together, there have been some 6,000 undergraduate students

1 that have gone through the intro course at the
2 university. For some of these it has opened a new career
3 path. A path in science, technology, engineering, and
4 mathematics that they may not have previously considered.

5 The number of students graduating with an
6 undergraduate degree in physics during this time has
7 tripled and the diversity of students pursuing those
8 degrees has doubled.

9 To date, ten students have completed their Ph.D. to
10 this program. We currently have nine in the pipeline.
11 These Ph.D. graduates have gone on to more faculty
12 positions at other universities, to serve at staff at a
13 variety of observatories, or to translate their skills in
14 signal detection and processing into positions within the
15 industry.

16 Perhaps one of the most significant broader impacts
17 that I'm aware of is the Pulsar Search Collaboratory. It
18 is a joint effort between the University and the Green Bank
19 Observatory to engage K to 12 students and teachers in the
20 quest for pulsars.

21 If you have not already done so, I recommend you to
22 view the documentary that's available on-line called Little
23 Green Men. This documentary provides a great overview of
24 the pulsar research collaboratory in its efforts to engage

1 students and their teachers in this quest for new pulsar
2 discoveries. This is a fabulous example of hands-on
3 science. More significantly, you hear from these students
4 how it has profoundly impacted their lives.

5 Many of them, particularly those from rural areas and
6 potential first-generation students, have come to see that
7 they can be a part of the scientific enterprise. They can
8 pursue a career in science and technology, and oftentimes
9 this was something that prior to engagement of the pulsar
10 research collaborative effort, they never dreamed of.

11 Some of these have discovered new pulsars, but that is
12 less important than the competence and skills that they
13 have developed as participants and as future members of our
14 nation's workforce and lead us as a nation.

15 They also gain hands-on experience in the increasingly
16 important area of data science and analytics. They realize
17 that they can do this kind of work. Remember I mentioned
18 the confidence building aspect of this. These are not just
19 schools in West Virginia, but there are schools across the
20 country where they're using software, analyzing data, and
21 looking for signs of a pulsar. They appreciate the need to
22 document what they observe and to verify what they believe
23 they have discovered. But also importantly is in this film
24 you see the true joy and inspiration that arises from their

1 participation in the program. This is really encouraging
2 students to think about science, technology, engineering,
3 and mathematics as a way to the future.

4 It is also clear that those who spend time at the
5 Observatory are inspired with a sense of awe at the
6 phenomenal engineering accomplishment that is the Green
7 Bank Telescope. It lets them see what human endeavor can
8 result and what we as humans can accomplish. That's
9 important these days.

10 To date, more than 2,000 students have participated in
11 this program. In terms of diversity roughly 50 percent of
12 these students come from underrepresented or
13 underprivileged groups. From a workforce development
14 perspective, 99 percent of these students are either in
15 college or plan to attend college. Of those, 68 percent
16 plan to pursue a post-secondary education in STEM or STEM-
17 related fields such as medicine. To date we've had roughly
18 20 of these students attend West Virginia University and
19 eight of them major in physics and astronomy. They're a
20 real joy to have around I must say.

21 The Green Bank Telescope is certainly a point of pride
22 for the State of West Virginia. It profoundly impacts our
23 efforts to grow technology in a STEM workforce across the
24 state. The educational outreach provided both within West

1 Virginia and regionally continues to change the lives for
2 students who come from rural and underserved areas.

3 I notice that Jan Taylor is here from the State
4 Science and Technology Office. I serve on the Science and
5 Technology Counsel, and when we recently selected topics
6 for the NSF, RII EPSCoR opportunity, those are clients that
7 we use to build infrastructure within the state to promote
8 science and technology. We recognize the potential that
9 astronomy had for developing these skills and the
10 collaboration with Green Bank, and for that reason, we
11 focused our proposal in this area and we were successful
12 and won this.

13 Certainly as we heard before there's a great economic
14 impact locally of the Green Bank Observatory. High wage,
15 high quality jobs are few and far between in Pocahontas
16 County, but equally important, as the Senator noted, is the
17 social impact that the staff of Green Bank Observatory has
18 in the local community and the roles these provide in terms
19 of community service and engagement of citizens within this
20 community. Outside of the work that they do at the
21 Observatory, the telescope and its staff provide this
22 community with a quality of life that would simply not
23 exist absent the telescope and the Observatory.

24 As West Virginia works --

1 ELIZABETH PENTECOST: Excuse me. If I could just ask,
2 we have over 20 more people signed up and if we have time
3 left over --

4 DR. FRED KING: I will conclude.

5 ELIZABETH PENTECOST: Thank you so much. Again,
6 please provide written comments. We are going to have to
7 limit comments to three minutes from this time forward to
8 allow everybody the opportunity to participate.

9 DR. FRED KING: Thank you.

10 ELIZABETH PENTECOST: Thank you so much.

11 DR. FRED KING: I appreciate that over six years Green
12 Bank Observatory has provided the state with great
13 opportunities and hope it continues to do so, and I agree
14 that options four and five are really not viable options
15 for the state. Thank you.

16 ELIZABETH PENTECOST: The next speaker is Mark
17 Devlin.

18 DR. MARK DEVLIN: Hello. I guess I'm the first person
19 who is not from West Virginia so I hope you don't hold that
20 against me. I come from Philadelphia, Pennsylvania. I'm
21 an astronomer. I teach physics and astronomy at the
22 University of Pennsylvania. I've been doing that for 20
23 years. I've been coming to Green Bank for ten years to do
24 research on the telescope.

1 I want to say over the course of ten years I've met a
2 lot of people here. I've become friends with the staff and
3 with the astronomers here. I know them. I've met some of
4 their families. Even though I have a vested interest in
5 what's going on, I do research on the telescope, what would
6 happen to me pales in comparison to what would happen to my
7 friends and colleagues here if this observatory were to
8 close. It also pales in comparison to how it would damage
9 the international astronomical community which I'm not
10 supposed to talk about science but I'm going to talk about
11 it anyway because I can ignore them.

12 So what I want to point out is that during the
13 initial -- during the first couple of minutes of the
14 presentations you might have gotten the impression that the
15 entire astronomical community has just basically written
16 off the Green Bank Observatory; we had a meeting, we all
17 voted, and we said forget this place, we don't want it
18 anymore. I'm here to tell you that can't be further from
19 the truth. In fact, a large percentage of the astronomical
20 community finds that some of the reports that were gathered
21 were deeply flawed and did not represent what was actually
22 going on and what the impacts on the community would be,
23 and I say community because it is an astronomical
24 community. Includes astronomers from all over the world,

1 okay. Not just obviously here at the Green Bank
2 Observatory. All over the country, in Europe, I've got
3 letters here from South Africa and Japan from people who
4 support what is going on here. Clearly they don't know the
5 staff and people around here as well as I do, but they do
6 care what happens at this observatory.

7 What I would like to do is to read -- I have pages and
8 pages of letters from astronomers, again, from all over the
9 world. I want to read just a few of their comments on
10 what's going to go on and I will be ending with the -- with
11 what's going on with the alternative, some of the
12 alternatives that are proposed.

13 From around the world: A decision to drop any one of
14 the current facilities such as the GBT would leave a
15 distressing and unfillable hole in the field of radio
16 astronomy. The most impressive upgrades of the GBT have
17 only recently been commissioned and are still undergoing
18 commissioning keeping the GBT poised for great discoveries
19 and new capabilities. What I mean by that -- what this
20 person means by that is that when the study that was done
21 to determine whether this Observatory was competitive was
22 done before the Observatory was working, okay. That's not
23 fair. It needs to be redone in the context of what the
24 Observatory is currently capable of doing which is

1 expensive.

2 I don't want to get cut off by that woman over there
3 so I'm going to skip forward here. She's going to cut me
4 off already? What? I can have your three? I'm going to
5 take his three.

6 Speaking to what we plan for the Observatory, theGBT
7 has been an excellent observatory for hands-on student
8 training; however, we would like to strongly discourage its
9 usage of a world-leading observatory as a pure educational
10 site, let alone an amusement park. Science and its high
11 technology facilities serve the public best when focusing
12 on breaking the frontiers of our very understanding of how
13 nature works. This can only be achieved by using
14 facilities for research, not by making them silent
15 monuments or tearing them down.

16 Another person comments imagine the impression on kids
17 and other visitors if all they see is a mothball or
18 dismantled instruments. What better way to reveal that the
19 U.S. is letting its lead in science slowly slip away.

20 I'm in trouble. I will stop. But I'm here to let you
21 know that you're not alone. There's people all over the
22 world care what happens here and I especially do, too.
23 Thank you very much.

24 ELIZABETH PENTECOST: Mr. Charles Sheets.

1 CHARLES SHEETS: Thank you all. Thanks for coming.
2 I'm Charles Sheets as she said. I'm a resident of Green
3 Bank. About a month ago we were here and we heard a lot of
4 scientists, researchers talking in glowing terms about the
5 Green Bank Observatory and all the efforts that they have
6 done and all the latest in technology experiences and
7 things in particular GBT can do.

8 I'm astonished to hear now as you all just have heard
9 that the National Science Foundation has made up its mind.
10 We just saw attorneys on the board there. Now if there
11 wasn't the federal law or federal regulations we wouldn't
12 be here today and they had already made up their minds to
13 this decision.

14 I was in Green Bank High School when the grounds broke
15 for this Observatory. All kind of rumors were going around
16 at that time; it was going to be a nudist colony coming in
17 here, all kinds of things. Our great principal, Virgil B.
18 Harris, called all the students together in the assembly
19 hall in old Green Bank High School and laid out the plans
20 of what was going to happen. It was a great time. It was
21 a great time celebration for the young kids in high school
22 to see what -- and we had no idea what a radio telescope
23 was at the time.

24 I just want to refer back to the three options. The

1 first two options are the only viable options for the
2 National Science Foundation. Robert C. Byrd right now when
3 he hears those last two options he's rolling around in his
4 grave. He is absolutely rolling around in his grave
5 because he was a friend of the National Science Foundation
6 apparently because he had \$95 million to build this great
7 GBT telescope. Thank you all very much.

8 ELIZABETH PENTECOST: Mr. Skip Crilly, C-R-I-L-L-Y.

9 SKIP CRILLY: Hello. Thank you for the opportunity
10 here to say a few words. I will make it short. I'm a
11 volunteer here. I've been working at GBO for two years.
12 I'm a retired electrical engineer and I decided to take
13 advantage of a fantastic opportunity to help work on the
14 40-foot telescope and improve it so as a volunteer, and I
15 want to specifically address the idea that the science
16 outreach volunteers need to have an observatory. They need
17 to have something that they can work with, a facility that
18 they can work with. It's very difficult to volunteer
19 otherwise.

20 As a volunteer, I have decided to essentially
21 volunteer my time and my money so I don't request any money
22 from the Observatory. I don't file expense reports. The
23 equipment that I've installed on the 40-foot telescope, the
24 educational telescope, is all equipment that I purchased.

1 This is what volunteers very often do. They need a
2 facility, they need something that they can work towards,
3 and without that, you know, what can they do.

4 I would like to use one quick example. I brought with
5 me another example of volunteer work. These are the
6 journals, the proceedings of the Society of Amateur Radio
7 Astronomers and I brought ten years of proceedings. This
8 organization is the premiere organization for radio
9 astronomy -- for amateur radio astronomy in the world and
10 it meets here in Green Bank every year, June-July time
11 frame and it's been doing that since the mid-1980s. So
12 I've got one-third of the proceedings here with me and this
13 is hundreds of papers are written.

14 We've been continuing to improve the telescopes on the
15 site for educational outreach and I've had two requests
16 from universities to try out the mobile interferometer that
17 we built here in SARA this year and we're going
18 to extend that.

19 So I would just like to say that, you know, it's
20 really important for the work of an organization like this
21 that are all volunteers that a place like this, the Green
22 Bank Observatory is available to do this science outreach.
23 Thank you very much.

24 ELIZABETH PENTECOST: Mr. John Dennis.

1 JOHN DENNIS: Hi. My name is John Dennis. I'm just a
2 citizen of West Virginia. I live in Parkersburg, West
3 Virginia. It's three-and-a-half hours west of here right
4 on the Ohio River, but I was born right over the mountain
5 here in Elkins.

6 My grandparents were from the Belington area and when
7 this place was built they brought me over here. They made
8 sure that I saw this place in the '60s when it was first
9 built so I've been coming back here as often as I can.
10 I've brought my children here. I will bring my grand kids
11 here when I come over.

12 As an amateur astronomer, optical, I don't do the SARA
13 radio stuff, but I'm an optical astronomer, I've got to
14 come over here with our two astronomy clubs that West
15 Virginia has, one in the Clarksburg area and one in the
16 Charleston area, and we bring in between 100 and 300 people
17 for a week over here. We have speakers nationally known.
18 We've had Seth Shostak here. We've had several of the
19 Ph.D. guys that are talking about pulsars from WVU. We've
20 had one of the students in our club that she grew up is now
21 working -- has worked through the WVU program undergrad,
22 Caitlin Aarons, and she is now working in planetary
23 sciences. She worked on the Mars' systems and now she's
24 working on the information that came back from Pluto so

1 it's fantastic to see what impact small places like this
2 do. It is a small area, just a few hundred square -- or
3 just a few square miles over here but it is impacting
4 people throughout the world.

5 In my family, you know, I hope that one of my kids
6 will eventually see this and turn into a scientist somehow
7 so that's all I can say. Thank you very much.

8 ELIZABETH PENTECOST: Carla Beaudet.

9 CARLA BEAUDET: So my name is Carla Beaudet. I'm an
10 engineer here at the Green Bank Observatory and I'm here to
11 talk about the socioeconomic impact to the local community
12 under any scenario in which the GBT were to cease
13 operations. The losses needed to be estimated in dollars
14 and these estimates need to make it into the Green Bank
15 EIS.

16 I have read the socioeconomics section of the draft
17 EIS for the funding of Arecibo Observatory and
18 a number of things concern me. Under housing it reads, "An
19 indirect effect of alternatives three, four, and five."
20 These are the alternatives where the science operations go
21 away. "Could be an increase in housing vacancies as the
22 workforce potentially relocates over time in search of
23 comparable employment." Could be. Yeah. Exactly. Could
24 be. Potentially relocates. I do not want to see this kind

1 of language in the EIS for Green Bank. A little research
2 will assure you that anyone employed at the professional
3 level and not prepared to retire will have to move to find
4 comparable employment. This will have a significant impact
5 on the local real estate market as it is flooded with homes
6 for sale. This impact can be estimated and it is your job
7 to do so.

8 In the same section under population, the Arecibo EIS
9 reads it is difficult to predict when and how many
10 workforce personnel were to relocate, therefore, the
11 potential loss of population is addressed qualitatively in
12 this section. Again, there is no excuse for not estimating
13 and quantifying this loss. If the only costs that can be
14 quantified are the costs to the NSF then the EIS is
15 designed to support a foregone conclusion.

16 A quick hand-waving estimate for you. The GBO
17 currently has 108 permanent full-time employees, offers an
18 additional 40 seasonal positions which all account for
19 giving us a nominal 118. Maybe ten percent of
20 those employees would choose and be able to find a way to
21 stay in the area. That's a loss of 106 people from the
22 Green Bank Arbovale area whose combined population in 2014
23 was 303, a loss of 34 percent of the total population.
24 This number is probably inflated because we don't all live

1 in Green Bank or Arbovale, but it's easy to find out where
2 118 people live and adjust these numbers.

3 In Section 4.9 economy, employment, and income are
4 lumped together, but only employment and income are
5 quantitatively addressed. It reads the direct effect of
6 the proposed alternatives on the employment and income of
7 the population of the municipality of Arecibo are
8 quantified while the effects on economy are qualitatively
9 described to account for the secondary indirect and educed
10 economic effects. Economic impacts are necessarily the
11 indirect product of employment or lack thereof and deserve
12 their own section as well as best estimates.

13 I know of at least one community sponsored agriculture
14 operation that would not likely be in business if it
15 weren't for the GBO. You could ask the local branch of
16 First Citizens Bank what the impact would be if they lost
17 all their Observatory employee accounts.

18 There are other quantifiable losses to the area that
19 come from losing the many volunteer services of Observatory
20 employees and the sharing of our facilities with the
21 community. Observatory employees volunteer as firefighters
22 and EMTs, as volunteers of yoga, aerobics, Zumba,
23 Taekwondo, as sound and lighting engineers at the Marlinton
24 Opera House, as soccer, basketball, football coaches and

1 that by no means is an exhaustive list.

2 CAROLINE BLANCO: Excuse me. Could you hold the
3 balance of your comments either for written submission or
4 if we have time left over. We're almost at four minutes.

5 CARLA BEAUDET: Okay. Thanks.

6 ELIZABETH PENTECOST: Sue Ann Heatherly.

7 CAROLINE BLANCO: We really appreciate it, folks. We
8 hate to cut people off but --

9 UNIDENTIFIED SPEAKER: You're cutting our community
10 off though.

11 SUE ANN HEATHERLY: I just want to make one point and
12 that is about those last three options and why they're not
13 good ones for us. My name is Sue Ann Heatherly. I'm the
14 education officer here at the Observatory. A lot of the
15 programs you've been hearing about, thank you so much for
16 bringing them up, are part of what I do for my job, the
17 Pulsar Search Collaboratory and other programs that we do
18 that I will put into the record.

19 The reason why options one and two are really
20 necessary is that the reason why our programs are so
21 impactful for the students that participate in them is
22 because they are in a working research facility. They're
23 not just pretending to be scientists and they're not just
24 playing at it. They're part of the community where you've

1 got professional scientists, professional engineers,
2 professional technicians, machinists, mechanics, the whole
3 STEM village here, and that's what makes our program so
4 impactful. Thank you.

5 ELIZABETH PENTECOST: Janet Ghigo. Sorry if I
6 mispronounced it.

7 JANET GHIGO: I'm Janet Ghigo and I'm just going to
8 say a few things about the community. First, a few of the
9 issues that have been brought up that had to do with health
10 and safety which was one of those items that were
11 mentioned, and I wanted to just briefly mention the Green
12 Bank Observatory and emergency medical services in the
13 area. I'm not going to do it all. I will send this in.

14 But I just wanted to mention that when EMS was first
15 invented in West Virginia in 1975 we had -- the local fire
16 department had a man that was an EMT. At that time the
17 Observatory had their own fire -- well, had two fire trucks
18 and an ambulance, but the local medic who started -- got
19 things started at the local fire department was associated
20 with the Observatory. She also became -- several of her
21 colleagues who are also associated with the Observatory
22 either employees or spouses became medics. She became an
23 instructor. She taught classes and her students then
24 became instructors, taught classes.

1 In one of my estimates recently is that if you count
2 the EMTs in the county that have been taught by Observatory
3 people we're talking 200 to 300 people. The backbone of
4 every agency is students of these instructors. Sorry.

5 I also wanted to mention the EMS Authority which is an
6 organization that represents all of the EMS services, and
7 if you look at the people who are members of that you can
8 go back to the very beginning with Tom who was an Observatory
9 employee. We had the people who are representing all of
10 their squads are students of NRAO spouse instructors.
11 For example, we also have -- I will submit this, but all
12 of the members and how they are -- all have ties to the
13 Observatory in one way.

14 Just as a final thing, I want to mention this past
15 year the county squads responded to over 1600 calls,
16 traveling close to a hundred thousand miles. Paid
17 paramedic service is now available from four of the
18 County's six squads along with continued volunteer
19 service. A majority of these squad leaders and active
20 members can trace their training back to NRAO spouses and
21 employees. At present, the assisted fire chief, rescue
22 chief, and assistant rescue chief for the local ambulance
23 service, and that includes that building you saw just
24 across the road there, which provides EMS and fire service

1 to this site which means that NSF does not have to provide
2 that money for that are all NRAO employees or spouses.

3 It's not the main role of NSF to provide community
4 services, but closing the Observatory for the necessary
5 movement of these employees as Carla mentioned, moving the
6 employees and spouses out of the county would be a
7 devastating blow to the network that's been built over 40
8 years.

9 ELIZABETH PENTECOST: Hanna Sizemore.

10 DR. HANNA SIZEMORE: Hi, everyone. My name is Hanna
11 Sizemore. I'm a planetary scientist which is a little bit
12 different than any of the other scientists here at Green
13 Bank. Basically I study planets, Mars, and asteroids based
14 on data from space craft missions flown by NASA. I'm also
15 a Pocahontas County native. I grew up here and I attended
16 local schools, kindergarten through 12th grade, and as a
17 high school student I had the opportunity to do research
18 here in Green Bank working with Ron Maddalena who is a
19 permanent member of the science staff and an active
20 researcher.

21 Now the training, the advice, and the exposure to the
22 international scientific community that I received here
23 were ultimately instrumental in me being accepted to
24 college, receiving the scholarships and grants that paid

1 for me to go to college, and ultimately getting advanced
2 degrees and working at NASA Ames Research Center.

3 Now about 16 years ago for personal reasons I decided
4 to move my family from California back to Pocahontas
5 County. When I did that people -- NRAO reached out to me
6 and offered me an adjunct position here in Green Bank, and
7 I want to emphasize this is a free unpaid position that
8 provides very cheap nominal administrative support for me,
9 but thanks to that position I was able to bring my mass of
10 work back here with me to the county and the grant money
11 that I bring in came back with me. I'm able to raise my
12 children here where I grew up and keep them in the public
13 schools and are allowed to be a part of this community
14 again.

15 My life would be very different if there were not a
16 world-class research facility staffed by active scientists
17 here in Green Bank. I think the importance of the
18 Observatory in my life personally is a microcosm of the
19 importance of the Observatory to the local community and to
20 the state as a whole. A reduction of science activities or
21 staff at GBO would be culturally and socioeconomically
22 devastating. Thank you.

23 ELIZABETH PENTECOST: Father Arthur Bufogle.

24 FATHER ARTHUR BUFOGLE: I'm Father Arthur. I'm the

1 Catholic priest here in Pocahontas County. I love a
2 pulpit, but I'm not going to preach to you today. I'm
3 going to talk about the second favorite topic of any
4 preacher and that is money.

5 We heard a lot about the economic benefits of GBO for
6 the county and the community. I second all of that, so add
7 all of that to my comments and that will make it sound like
8 I was really preaching for a long time.

9 There's a second area that I think got some expression
10 but not enough, and that is the economic benefit of this
11 facility not just to the area but to the nation. We heard
12 so much about making America great. Well, this place helps
13 makes America great. I'm a priest but I come from a
14 science background. I was a science teacher for many years
15 and then in plant science and soil science both at LSU and
16 Mississippi State, and I know what basic science does and
17 it's expensive. It doesn't have immediate results, but
18 it's the basis of what others use for the economic
19 benefits, and for our country something like this is not
20 just for us and our community but it is for the entire
21 nation and the entire world so I think it's very important
22 that we not be shortsighted and maybe save a few pennies
23 but lose a fortune and so I really support this place, and
24 I hope the National Science Foundation will look at the

1 wisdom that the people here, local people who are often
2 dismissed and limited to three minutes or less but really
3 have a lot to say and a lot of wisdom that you might
4 benefit from hearing. Thank you.

5 ELIZABETH PENTECOST: Mr. Ryan Lynch.

6 DR. RYAN LYNCH: My name is Ryan Lynch. I'm a staff
7 scientist here and I will try and make this brief and just
8 summarize my comments and submit the rest in writing.

9 I just want to say a little bit in my role as the
10 summer student program coordinator here at Green Bank so I
11 want to stress that the EIS really needs to include
12 education as its own impact area but as well as how
13 education intersects with socioeconomic and cultural
14 impacts.

15 I just want to summarize a little bit about the summer
16 student program here. We've had hundreds of summer
17 students come through Green Bank in the years that it
18 exists. For the last 25 years, 40 percent of those have
19 been women which is the highest percentage than the rest of
20 the astronomy field as a whole. Some of those students
21 have come back to Green Bank and to West Virginia because
22 they realized this is a special place but the impact -- the
23 region of impact is not just Pocahontas County or West
24 Virginia. It's the whole United States and really the

1 whole world.

2 Even though that's only looking at the summer students
3 here, hundreds of other students at research universities
4 across the nation and across the world rely on this
5 facility to advance their careers. Some of them go into
6 professional astronomy, many of them go into other STEM
7 fields in finance, in education, in journalism, and that
8 has a huge socioeconomic impact on the rest of the country
9 because those are high value jobs and they give back to the
10 rest of the economy.

11 Any reduction negatively impacts
12 those careers because the students are coming from
13 institutions that do not have the resources to necessarily
14 buy time on the telescope or to join up with another
15 private institution to offer its own facility so I'm going
16 to strongly urge that you include education as an explicit
17 area tied into the other areas of the impact statement and
18 that you recommend option one, no action alternative.
19 Thank you.

20 ELIZABETH PENTECOST: Ms. Savannah Horton.

21 SAVANNAH HORTON: Hello. My name is Savannah Horton.
22 I'm a 17-year-old student and I drove two hours and left
23 school early to come and attend this seminar. I live in
24 rural Broadway, Virginia, and it is so imperative that

1 Green Bank remains open and operative for women and STEM.
2 The Green Bank Observatory has profoundly impacted
3 the scientists. My research partner, Dana Jones,
4 is here today. We attend Massanutten Regional Governor's
5 School for integrated science and technology, and Green
6 Bank Observatory was our first view into the world of
7 astronomy.

8 Green Bank Observatory is what led us to go this
9 summer to go and work at Caltech and study active galactic
10 nuclei at the age of 17. I advocate for continued
11 investment and the no action alternative for Green Bank.

12 Jocelyn Bell Burnell who was a Cambridge student and a
13 young woman in the 1960s who discovered pulsars but was
14 wrongfully robbed of her Nobel prize. It would be an
15 embarrassment for a facility like GBO to be shut down as it
16 provides women in STEM an opportunity to succeed in a field
17 that was once dominated by men.

18 The GBO is critical to the next generation of
19 scientists and I stand here as an example of a young woman
20 who once doubted my abilities in science but Green Bank
21 opened the doors. Ryan Lynch was my mentor that has led me
22 to a complete world of astronomy that I once never expected
23 for myself.

24 Restricted funding harms cultural resources and

1 socioeconomic resources for students like Dana and I who
2 would never have had the abilities because of where we come
3 from to be able to study astronomy so I think it is
4 imperative to preserve science in rural areas and it is so
5 important that option one is considered today. Thank you.

6 ELIZABETH PENTECOST: Ricky Sharp.

7 RICKY SHARP: I am Ricky Sharp. I'm the principal at
8 Green Bank Elementary Middle School next door. I hope that
9 the NSF really steps back and they think about how deep-
10 rooted the GBO is in our community. Your ASB extends well
11 beyond the fence of this facility.

12 At our school we have 16 students that are
13 decedents -- or I'm sorry, their parents work here at the
14 scope. That's six percent of our student population. We
15 talk about tax base and how that is going to affect our
16 schools, but just pulling those students out alone if they
17 had to relocate would be a huge impact on our school. The
18 tax base for our school systems we're already struggling as
19 it is. We can't afford to have an additional cut.
20 Whenever we're talking \$17 million and \$30 million as it
21 comes across that's huge. That means a lot for our
22 system.

23 We talked -- Mr. Boso, Senator Boso talked about the
24 students and how it affects the students here, and yes,

1 we've had some struggles here with the Observatory and not
2 having wireless and not having some of the technologies
3 that other facilities do, but if you were to ask our
4 students which happens often because of the national
5 publicity that the National Science Foundation gains, we
6 see it time in and time out with the British Broadcast
7 Television, PBS, CNN, Chinese reporters come in, it's all
8 these different international broadcast facilities come in
9 and they ask questions to our students, how are you
10 affected by this. Do you know what our students say time
11 in and time out? Whenever our cousins or our relatives
12 come in all they want to do is they want to be stuck on
13 their phones and they're looking down. We want to talk to
14 them and we want to visit with them. We want to go out and
15 we want to play outside. We want to have a conversation
16 and they're not able to do that.

17 I'm proud to say that my students at my school can sit
18 and have a conversation with you and don't have to have the
19 interruptions of today's technology and they can operate
20 without that. What an important skill that we miss out on
21 in today's society.

22 The school and GBO, we talk about what they do for our
23 school, the location. They allow us to have our county
24 social studies fair, our math field days, our science

1 fairs. They offer their facilities for incentives to our
2 students which means a lot. In a community that does not
3 have a lot of funding for their schools and to offer these
4 programs and additional opportunities and we have to travel
5 so far and we pay for transportation and then we pay for
6 the fees, it's nice to have something in your backdoor to
7 where you can come over and you can encourage students and
8 you can have a video on the screen here and offer the
9 auditorium to them. You can use the pool, you can use the
10 rec area. What a nice thing to have in our backdoor.

11 We talk about the hundred staff members here and one
12 key part of our community that we don't have and we don't
13 recognize is there's a hundred people employed by this
14 facility and every single one of them value the importance
15 of education and play a crucial part in each student's life
16 that come into that building. They're volunteering their
17 time at our doors, they're serving as judges in science
18 fair, social studies fair. Their own kids. What they
19 offer goes well beyond what is here.

20 You talk about health and safety as being one of the
21 impacts and the things here. We're a very rural community,
22 very rural school. If we have to evacuate our building we
23 come to this site and different locations on this site.
24 That needs to be taken into consideration. There's not a

1 place with our community a close distance that I could
2 evacuate my students to if need be.

3 They assist with repairs on electronic equipment, they
4 assist with our radios for safety. In repairing those
5 radios -- and even school furniture they help with
6 construction, different projects. They're really crucial.
7 I know I have to cut it off. I will tell you that I have
8 listed all of this and this is on the site and everything
9 and --

10 CAROLINE BLANCO: If you can submit them written or --

11 RICKY SHARP: I have. I have. I've submitted them
12 written. I left a copy here and I also posted on-line,
13 too. Thank you.

14 ELIZABETH PENTECOST: Maury Johnson.

15 MAURY JOHNSON: My name is Maury Johnson. I come from
16 and bring greetings from your neighbors in Monroe County.
17 A few days ago I read an article in the Charleston Gazette
18 and I was astounded that options three, four, and five are
19 even thought of.

20 The first time I came to Green Bank I was about nine
21 years old, 1969, weeks before the Apollo moon mission
22 landed on the moon. My father brought myself, my brothers
23 up here. Coming around the bend I see this great big
24 telescope thing. It inspired us.

1 My brother, my older brother became a science
2 teacher. Teaches science in Monroe County and now
3 Greenbrier County. I became a teacher. I've taught
4 science. This has been a world of -- to so many students
5 across the area. Monroe, all the counties nearby, it's a
6 gem.

7 Now let's talk about something. Who wants to know
8 something about biological resources? This area mainly
9 because of this facility has some very unique endangered
10 species in the area. It's very diverse because of the no
11 pollution we have here. The cultural resources, well, the
12 cultural of the entire area is around this Green Bank is as
13 many people said, people talk to each other. We're
14 isolated. A lot of areas are not isolated anymore. You
15 have a culture here going back to pioneer days
16 and stuff, you've got a culture here that has found no
17 other place mainly because of this Green Bank facility.

18 There's a lot of things to say. I will let other
19 people speak. I will let you know that folks in Monroe
20 County a lot of them wanted to be here today. We have an
21 article in the Monroe Watchman and we will be with you. No
22 action alternative. Do not do anything with this facility
23 to hinder the science work it's doing and inspiring young
24 ladies.

1 ELIZABETH PENTECOST: Tracie Shrader Flack.

2 TRACIE SHRADER FLACK: Good afternoon. My name is
3 Tracie Shrader Flack and I, too, come from Monroe County.
4 I am the president of the Friends of the Second Creek,
5 Inc. We are a nonprofit organization whose mission is
6 water and water life preservation as well as historical
7 preservation of the Second Creek Watershed.

8 If you've never been to Monroe County I strongly
9 encourage you to come visit us where we have some of the
10 most beautiful farmlands like right here in Pocahontas
11 County. I noticed that when I was driving up here today.
12 So you come to visit us. We also have historically
13 significant features in Monroe County as well as here in
14 Pocahontas County.

15 West Virginia, Monroe County, and the Friends of the
16 Second Creek depend upon tourism as a major source of
17 income and support. I realize that the Green Bank
18 Observatory has been -- long been a tourism draw for the
19 state. I can remember as a small child my parents bringing
20 me up here and I stood in awe of this place and I still
21 brag about it. I lived in Arizona for 40 years and, of
22 course, you know, there's observatories out there and I was
23 talking about this place when I was out there. It's a big
24 tourism draw.

1 I support keeping this site open and operational as it
2 stands as a tourism source, and if you need more money see
3 if the state has got some tourism money to give you.
4 That's about all I got to say. I thank you all for coming.

5 ELIZABETH PENTECOST: Robert Sheets.

6 ROBERT SHEETS: Thank you all. I'm Bob Sheets. I'm a
7 lifelong resident of Green Bank, West Virginia. I sat on
8 my grandmother's porch right across from the entrance and
9 watched them tear down the fence and build the road for the
10 GBO. My mother was employee number three here at Green
11 Bank. I'm often asked what it's like to live near a radio
12 free quiet zone without cellphones. My answer is quite
13 simple, you should have been here before the Observatory.
14 It was really quiet.

15 My sister and I used to sit in the barn loft down the
16 road here and write down license plate numbers and if we
17 got an out-of-state plate we got really excited. Now when
18 I pull out my driveway below Green Bank I see people stop
19 their vehicle, jump out, pose, and take a selfie under the
20 Green Bank, Unincorporated sign. That speaks to our
21 national and international presence. It speaks to the
22 educational opportunities that are available here.

23 I taught English for 40 years, 35 of them in
24 Pocahontas County High School. I was a recipient of one of

1 the AUI scholarships in the 1960s to further my education.
2 I came back here. I've seen so many of our students
3 complete mentorships here. I was a member of the first
4 class at Green Bank High School that benefited from the
5 technological expertise of observatory techs. They came,
6 they taught me electricity and electronics. I still see
7 that going on as many of the programmers here are
8 volunteering their time to work with computer programming
9 classes at the high school. You cannot underestimate the
10 educational, the socioeconomic impact of the National Radio
11 Astronomy Observatory or as it is now called the Green Bank
12 Observatory which actually makes me kind of proud.

13 Now I will give you one other tidbit because not too
14 many people have talked about the historical component of
15 this particular place, but if you are so fortunate as to
16 pick up a copy of the Pocahontas Times today you will see
17 unfortunately my face on the front cover beside an
18 (inaudible) of King George III because about one-half mile
19 off the Green Bank Observatory site is actually the largest
20 governmental institution ever here in Pocahontas County.
21 In 1774 there were over 125 colonial militia stationed
22 there. This is a historic site. It's been that way for a
23 long time and it's been further enhanced by the presence of
24 the GBO. Thank you.

1 ELIZABETH PENTECOST: Paul Marganian.

2 PAUL MARGANIAN: Hi. I'm Paul Marganian. A lot of
3 you know me. I am a software engineer here at the
4 Observatory. Obviously, you know, options four and five
5 would have a huge impact on me personally, but I want to
6 talk -- I don't want to talk about the impact of me or
7 Green Bank or even West Virginia. I want to talk about the
8 impact on our nation.

9 My father was an immigrant. He came to this country
10 in part because at the time in the 1950s this was where you
11 went to get a cutting edge education. This was the center
12 of science and research, and I'm proud to say we still are
13 in my lifetime.

14 This time last year I happened to be in China on
15 observatory business. I was in China because they're
16 investing in science and research. They're building
17 facilities larger than ours. One day I was sitting in the
18 Xixiang astronomy building and there was this huge
19 construction site next to us and this huge 30-story
20 building. I said, you know, what's going on there. They
21 said, oh, that's our new lab. I come back here and options
22 four and five are staring at us in the face. That doesn't
23 make a lot of sense to me. So I would like to ask why
24 we're abdicating our leadership role in the world as

1 leaders in science and technology.

2 If my own children want to go into science and
3 research, are they going to have to go to China to receive
4 that best education? I certainly hope not.

5 Now the Father already stole my punch-line, but I just
6 wanted to say, you know, there's been a lot of talk about
7 making America great again. Options four and five are
8 obviously steps in the wrong direction. Thank you.

9 ELIZABETH PENTECOST: Larry Garretson.

10 LARRY GARRETSON: Hi. My name is Larry Garretson. My
11 wife and I live here in Pocahontas County. My wife Paula
12 and I have been here in Northern Pocahontas County for ten
13 years and have been operating a bed and breakfast the
14 entire time we have been here.

15 We settled in this area because the importance of
16 tourism with the GBO being one of the primary destinations
17 for our guests. We've seen a steady increase of visitors
18 both tourists staying with us who want to visit the GBO and
19 to see for themselves the science and technology that's on
20 display here. Also scientists and engineers who come here
21 to work and stay with us during their visit. Our business
22 depends on the continuation of the GBO's existence and
23 enjoys a good relationship with the GBO and the employees
24 that work here both at the facility and in the community

1 which we all live. We enjoy ten to 15 percent of our
2 business coming from the existence of GBO and expect that
3 to grow each year primarily from tourism.

4 We respectfully request that you consider the economic
5 impact of small businesses like ours and the ability to
6 continue to grow and to draw visitors to our beautiful
7 county.

8 We have to say that guests walk in the door those that
9 are not aware of GBO existence and ask what that giant
10 telescope here is and must say that they are all inspired
11 by the technology that's located here.

12 Speaking of guests that stay with us, not only do we
13 have tourists, not only do we have scientists who stay with
14 us, we have also had a quite a number of people stay with
15 us who are what I term electronic -- electromagnetically
16 sensitive. In other words, they come here to get away from
17 the noise, the pollution of the rest of the world. That's
18 not just a few guests. We've had probably ten to 20
19 couples come here and stay with us that are like that.

20 The other thing about our list of guests is that we've
21 had quite a number of people that come here because the GBO
22 is -- creates the quiet zone. To list a few, NBC has been
23 here and stayed with us, BBC was here and stayed with us,
24 Al Jazeera film crew was here and stayed with us. There

1 are others that I can't remember but we've had quite a
2 few.

3 So all I ask is your careful consideration of the
4 personal and economic impact of the GBO on our small
5 community and consider us when you do finalize your EIS.
6 Thank you.

7 CAROLINE BLANCO: Folks, just to let you know what's
8 going on, it is five o'clock and our next meeting is at 6.
9 We realize we have about 20 more people to comment. We
10 were going to take a break for an hour in between. We're
11 just going to keep on going to allow you to comment but at
12 six o'clock we have to stop because the next meeting
13 starts.

14 We're going to take five to give the court reporter a
15 break so he doesn't hurt his fingers. When we do come back
16 please, please, please, so many people are going over and
17 we would like to get everybody as much of an opportunity --

18 UNIDENTIFIED SPEAKER: Wait a minute, everybody. This
19 gentleman needs to leave and what is your name.

20 JOSEPH RILEY: Joseph Riley.

21 ELIZABETH PENTECOST: Joseph Riley.

22 JOSEPH RILEY: Thank you for letting me step up here a
23 little bit because I'm supposed to be at a board meeting in
24 Marlinton at six and I saw the superintendent already

1 leave.

2 My name is Joseph Riley. I'm the principal at
3 Pocahontas County High School and prior to that was
4 principal at Marlinton Middle School. I just want to take
5 and add to what Sue Ann Heatherly talked about.

6 Whenever we look at the opportunity students have we
7 can do a lot with teachers and we can do a lot in our labs,
8 but we don't have quite what they have here. To give you
9 an example, my little daughter just came back on two
10 occasions where she came to a science day here at the
11 Observatory and came back one time with a toothbrush that
12 had wires all over it and she put a battery out of a watch
13 in it and it run all over the table and she could explain
14 how all of that worked. Another year she come back with a
15 Christmas ornament that blinked different colors and would
16 do different sequences and that was something that she
17 learned here. I don't know that we could have did that
18 within the labs we have at Marlinton Middle School.

19 Moving on through, I mean, even with the science fair
20 they sent people down to help students with projects at the
21 science fair so if they made it on to the state level they
22 could keep moving so they give support in that.

23 Looking at the high school standpoint, one thing that
24 the Department of Education is wanting us to do is to get

1 more computer science involved. Well, this is not
2 something that we're getting a lot of training in so I have
3 teachers that are struggling trying to get into saying
4 okay, what do we do in order to get this STEM in, what are
5 we going to do for computer science. We have people that
6 come from the Observatory on a weekly basis to give kids
7 this is more information and this is what we can do so that
8 aspect.

9 Memberships. We sent out memberships to come to the
10 Observatory to get training whenever they're seniors to say
11 okay, is this really something you want to do, and we did
12 from the science aspect, but we also did from the machinist
13 side. I had kids that learned things about welding that
14 they never even knew existed because they were working with
15 a machinist in the machine shop here at the Observatory.

16 To end with, I want to talk about one little aspect
17 that really hit home with me. We were at math field day
18 last year and this was all full of kids from across the
19 county when they were announcing who had won and all that,
20 and Hanna Sizemore came up here to the front and she did a
21 presentation and had a picture of Mars and she talked to
22 the kids about this is what I'm studying, does anyone know
23 what it was. Once she said it was Mars and the kids were
24 like -- and she was telling them everything they were

1 doing, she had them. Then the last thing she said was and
2 I was sitting in the seats that you all are one day back
3 before I was a participant in math field day and look what
4 I'm able to do.

5 At Pocahontas High School we're trying to figure out
6 how we can keep kids here that want to stay here. This can
7 be avenues for it so I would really like for to you think
8 about our kids also in being able to keep them within the
9 county. Thank you.

10 ELIZABETH PENTECOST: One more before the break.

11 CAROLINE BLANCO: One more and then we will take a
12 five-minute break.

13 ELIZABETH PENTECOST: Sarah Riley.

14 SARAH RILEY: Thank you all for your patience for one
15 more. If anybody else is going to Hillsboro I'm having to
16 get a ride; otherwise, I have to take him to the board
17 meeting because we only have one car. But my name is Sarah
18 Riley. I'm the executive director of the High Rocks
19 Educational Corporation which is a regional nonprofit that
20 is dedicated to educating and empowering and inspiring
21 young people in West Virginia so what I have tried to do
22 for the last 20 years is move young people from the very
23 first beginning of adulthood when they're about 12 years
24 old up until about the time they're 35 when they're

1 establishing their career.

2 What I want to talk about is access and equity in
3 education and that is both cultural and socioeconomic.
4 There is -- the Green Bank Observatory has been an
5 incredible partner both as a business partner for us as a
6 business from everything from providing volunteers, board
7 members, I can certainly speak to that, and even they
8 looked over our personnel policy and helped us make it
9 better so they're sharing all those resources, but as an
10 education partner in helping us think about how we can
11 serve these communities.

12 West Virginia and Appalachia are in a really, really
13 hard place. The programs that I run are reflective of the
14 communities that we serve. That means 70 percent of the
15 kids that we serve are free and reduced price lunch. It
16 means that more than half of the children that we serve are
17 first-generation college students and the idea that you
18 could not only go to college but you could have a
19 professional pathway ahead of you, you can't introduce
20 that. You can't have people understand that unless they
21 can be here and be experiencing it.

22 I'm really honored to be a formal partner with the
23 Green Bank Observatory and a new program that we're doing
24 to help first-generation West Virginia students complete

1 their first two years in an undergraduate level of STEM and
2 to have a hundred percent retention of this new pilot that
3 we're going to do and to be working with them. I'm really
4 thinking about for rural America, for Appalachia and for
5 West Virginia specifically how we can build computers,
6 science, education pathways so that our kids can grow up
7 and my kids can live two miles away from me and have a
8 great life, and I'm really looking forward to it so there
9 is so much opportunity for growth and partnership here and
10 there's such important and deep issues about equity and
11 access so thank you.

12 ELIZABETH PENTECOST: We will take a ten-minute break.

13 (Recess was had.)

14 CAROLINE BLANCO: Thank you for your patience. We
15 have now I understand about 11 people still but we're
16 really going to try to stick to the three minutes as much
17 as possible. Thank you.

18 ELIZABETH PENTECOST: You have the opportunity to send
19 in your comments as well.

20 The next person is Mali Minter.

21 MALI MINTER: I'm Mali Minter. I've lived in Green
22 Bank for 21 years or the Greater Green Bank Arbovale
23 Metropolitan Area as we like to call it, and I don't know
24 if I can add much more than Carla or the young lady

1 Savannah spoke about because they just said things so much
2 better than I could so I'm just going to talk about one
3 little thing, which is that I have nine nieces and
4 nephews, and every single one of them, every one, from the
5 youngest all the way through out of school are in STEM-type
6 programs because of the GBO.

7 My nephew Conner has Asperger's, and I get emotional.
8 Sorry. He comes every year from Minnesota for a week and
9 all he wants to do is go to the telescope, can we go to the
10 telescope, can we go to the science center, I need to see
11 that stuff. He is so excited about science and it focuses
12 him. It's just the science is here. Keep it here.

13 I know they keep saying talk about viable options.
14 Three, four, and five are awful. I really think there
15 should be a zero. Honestly. I don't know how viable it
16 is, but honestly there should be a zero, one, and two.
17 Zero should be go back and fund us fully. Do it. Find the
18 money. Find it. Fund us. Help us.

19 ELIZABETH PENTECOST: Rodney Waugh.

20 RODNEY WAUGH: Yes, my name is Rodney Waugh. I'm a
21 lifelong West Virginia resident. I'm an amateur
22 astronomer. I've taken part in Star Quest. It's been here
23 for 13 years. It's an optical astronomy educational
24 undertaking.

1 As a West Virginian and American, I'm very proud of
2 this facility. There's cutting edge research that takes
3 place here. It adds to the culture of the local area.
4 This is something that all West Virginians can be proud of
5 and I'm going to leave before my three minutes are up.
6 Thank you.

7 ELIZABETH PENTECOST: Brynn Kusic.

8 BRYNN KUSIC: Hi there. My name is Brynn Kusic. I'm
9 the operations manager of the Pocahontas County Opera House
10 in Marlinton, West Virginia. The opera house is a center
11 for performing arts in our county but it is also a center
12 for civic and cultural engagement. People are surprised to
13 hear that Pocahontas County has an opera house like they're
14 surprised to hear that the Green Bank Observatory exists
15 here.

16 I just wanted to say that it's been very inspiring to
17 be here. The Green Bank Observatory is a very important
18 part of our community. It's a great neighbor and we've
19 heard that from many different voices whether it be in our
20 schools or in areas of performing arts. I say that whether
21 it's a performance series event at the opera house or a
22 Chamber of Commerce dinner, Green Bank Observatory
23 employees are present.

24 Green Bank Observatory makes it possible for people of

1 the highest caliber to live and work in Pocahontas County.
2 These community members are not only making great
3 contributions in the field of science, but they are
4 dedicated to participating in the community in real ways
5 that matter and that affect positive change both for our
6 students and for all of our community members, and like I
7 said, the Green Bank Observatory employees are integral in
8 every part of the opera house. They donate their time,
9 their technical expertise. They attend performances. They
10 are the performers on the stage. They organize events.
11 They are us. It is our community. We are a community
12 together, and I think that is something that I hope you
13 hear and that you take away from today.

14 This is not just a place where people come and work.
15 This is the people who work in this place, our community,
16 and they're making our community a really -- a place to
17 feel proud of living and they're enriching the people that
18 live here in every element and in every way they
19 participate in our community.

20 I also want to say that we have board members at the
21 Pocahontas County Opera House that are employees. The
22 Green Bank Observatory and the National Radio Astronomy
23 Observatory have been local business sponsors of our
24 performance series for the last 16 years which is the

1 entire time that we've been presenting performing arts
2 opportunities and cultural experiences in this community so
3 the opera house is now we actually -- people know about us
4 in other parts of the state, in the rest of the country,
5 and that would not be true if we did not have the technical
6 expertise and volunteered time and dedicated energy of
7 volunteers who are literally at the opera house from the
8 minute that the door opens until after everybody has
9 cleared out when the doors are closed, and that's true for
10 everything that we do there, so I just can't imagine
11 Pocahontas County without this place.

12 I hope that you choose option one and keep it going as
13 it is to continue to inspire people not only in this
14 country and this county but across the country and around
15 the world. Thank you.

16 ELIZABETH PENTECOST: Judith Clark. She wasn't sure
17 if she could stay.

18 UNIDENTIFIED SPEAKER: She doesn't like to drive when
19 it's dark.

20 ELIZABETH PENTECOST: Okay. Maybe she can submit her
21 comments.

22 Erica Engquist.

23 ERICA ENGQUIST: Thank you all for giving me the
24 opportunity to speak today. I would like to voice my

1 strong support for full NSF funding and continued operation
2 of the Green Bank Observatory, option one.

3 Ever since I first became interested in the field of
4 astrophysics and technology, the Green Bank Observatory has
5 been an absolutely tremendous resource in so many ways. As
6 a young student from rural West Virginia, the Green Bank
7 Observatory's education and science center staff have
8 provided me with so many amazing and inspiring educational
9 opportunities like none other in the state or region.

10 From starting out with the Radio Astronomer for a Day
11 program and the Skynet Junior Scholars programs to get
12 to participate in the summer long radio frequency
13 interference litigation project under a talented and an
14 accomplished astronomer here, Dr. Richard Prestage, all of
15 these opportunities are continued not only to teach but to
16 inspire and encourage me to want to pursue a career in
17 STEM.

18 I'm not the only one that GBO's STEM education
19 opportunities have touched. Students of all backgrounds
20 from around the country benefit from these programs and
21 camps every year. One particularly shining example is the
22 Physicists Inspiring the Next Generation or PING camp which
23 brings underserved, minority, and female students from
24 across the country together and gives them extremely

1 valuable exposure to a world-class research facility while
2 introducing them to several fields of science.

3 Over the time I've been coming to Green Bank I've
4 started hearing stories of other young people particularly
5 two women from rural West Virginia who the GBO has inspired
6 to pursue careers in STEM. These two women, Hanna
7 Sizemore, who you heard from earlier, and Naomi Bates,
8 worked on projects here at the Observatory as high school
9 students like me and went on to get their Ph.D.s and pursue
10 successful careers at the Planetary Science Institute and
11 the Delaware Geological Survey.

12 These scientists are an inspiration to me and many
13 others and are a great testament to the tremendous
14 effectiveness of the educational programs at Green Bank.

15 As a young female hoping to pursue a career in a
16 historically male dominated field, my experiences at the
17 GBO have been extremely heartening. The atmosphere is very
18 open and all-inclusive. In my time here I've had many very
19 rewarding interactions with scientists and students alike
20 and never felt that I was treated differently because of my
21 gender.

22 In a similar vein, it is very unusual and
23 exciting that the GBO is currently home to three female
24 scientists from around the world. Clearly, the GBO is

1 helping grow the next generation of women scientists from
2 grade school to grad school and beyond.

3 I see the Green Bank Observatory is playing a key role
4 in ensuring that in the future the scientific community
5 will fully reflect there was diversity and
6 inclusiveness.

7 In addition to this, the GBO is also a top-of-the-line
8 science facility with uniquely versatile and cutting edge
9 capabilities for research and everything from planet
10 formation to cosmology to searching for life beyond earth,
11 and it's really still a very up-to-date and tremendous
12 facility. It's not even fully reached its full
13 capability. It's still growing and spawning these new
14 technologies for radio astronomy across the country and
15 across the world in a way that no other research facility
16 can do because of its unique nature.

17 The single dish steerable structure is very unusual.
18 It's the largest one of its kind in the world and it's just
19 extremely important to the field of radio astronomy and
20 astronomy in general really.

21 So for all these reasons I think it is absolutely
22 essential to the State of West Virginia, the United States,
23 and the entire scientific establishment that Green Bank
24 Observatory continues to receive full NSF funding for years

1 from now.

2 ELIZABETH PENTECOST: Deanna White.

3 DEANNA WHITE: Thank you all for having me. We've
4 driven four hours this evening and will be driving four
5 hours back. We wanted to -- this is very important to us.
6 We've been coming here for 18 years as a family. That was
7 my daughter.

8 So I want to thank you for allowing me to have the
9 opportunity to go on public record to register my strong
10 support for the National Science Foundation to provide full
11 funding for the Green Bank Observatory. I've already
12 submitted a written comment. That was from the head. This
13 one is from the heart.

14 Each time my family and I visit I'm more and more
15 convinced this place is magical. Bear with me. To start
16 simply, just from using your senses you can see the
17 beauty. The juxtaposition with the technological wonders
18 of each decade represented by each of the telescopes
19 against the majestic quiet mountains. Imagine taking a
20 walk down the Observatory road, listening to the breeze
21 whispering through the pines, seeing the sun reflect at all
22 different angles off the hills and telescopes whenever so
23 quietly one of the telescopes turns to its next
24 (inaudible). Right there and then in the peace and beauty

1 of your evening stroll it could be that the next discovery
2 of an exotic binary pulsar system, the secret to dark
3 matter, or even the first sign that we are not alone could
4 be happening. This is exciting, all inspiring magic.

5 Seeing a group of young students gather together
6 around the display and the science exhibit hall, receiving
7 instruction from a staff member, participating in a STEM
8 activity, or independently operating the 40-foot telescope
9 is magic. This is not your typical
10 experience. It is beyond that. Young minds are learning
11 and being challenged to learn concepts, operate equipment,
12 and analyze data in a way that is satisfying by seeing real
13 unique results that only their decisions and actions
14 yield.

15 College undergraduates have the opportunity to design
16 features that will put in place in an actual operating
17 facility. High school students have the opportunity
18 through the Pulsar Search Collaboratory to analyze data
19 that could yield fascinating new discoveries. Middle
20 school students from all over the country representing
21 minority and female future scientists can participate in a
22 Physicists Inspiring the Next Generation camp each summer.

23 There are many more unique programs available here
24 that thousands of students have had the opportunity to

1 participate in and regain excitement about learning and
2 problem solving that are more traditional methods of
3 teaching that teachers are struggling with. This is
4 magic.

5 To see my own daughter and son both have -- both have
6 always been artistically inclined. To grow and learn from
7 their experiences at the Green Bank Observatory has been
8 utter magic. My daughter has had the amazing opportunity
9 at 16 to work alongside of an undergraduate student from
10 Oregon Tech and under the leadership of a highly
11 accomplished astronomer, Dr. Richard Prestage, to learn
12 computer coding, statistical analysis, research paper
13 protocol, and presentation skills. She has been aspired to
14 pursue a career in engineering and science from her first
15 visits to the Green Bank Observatory and these experiences
16 only increase her enthusiasm about this field of study.

17 My son, a computer animator and enthusiast, is
18 encouraged by his exposure to the multiple uses of
19 computers and coding to process and analyze the tremendous
20 amount of data generated from observing the GBT.

21 The Green Bank Observatory inspires students of all
22 backgrounds to learn about or even pursue careers in
23 science, technology, engineering, and math. The
24 inspiration experienced at Green Bank in turn enriches

1 those fields by benefit of incorporating art and other
2 talents to solve our future challenges. This again, is
3 magic.

4 To learn about distinguished scientists whose careers
5 began at the Green Bank Observatory particularly two
6 accomplished women who you've heard about, Hanna Sizemore
7 with the Planetary Science Institute who works on site, and
8 Naomi Bates, (inaudible) educated Ph.D. in civil and
9 environmental engineering who now works at the Delaware
10 Geological Survey at the University of Delaware.

11 CAROLINE BLANCO: Excuse me.

12 DEANNA WHITE: I'm almost finished. Both of whom will
13 readily tell you the invaluable experiences that they
14 (inaudible) research methodology and (inaudible) skills as
15 level high school students is inspiring.

16 So the Green Bank Observatory arising in the midst of
17 this rural out-of-the-way radio quiet zone where
18 groundbreaking scientific discovery and innovation is
19 happening, where students are being inspired, satisfied by
20 their contributions and challenge to think deeper in more
21 complicated ways, where a community thrives to its very
22 existence must be fully funded by the NSF to continue to
23 provide this magical experience. Thank you.

24 ELIZABETH PENTECOST: Grayg Rousnyder.

1 GRAYG ROUSNYDER: Hello. My name is Grayg Rousnyder,
2 KCSVT, and I am a -- one of the volunteer people after
3 work. Go out and I like working with kids and working 4-H,
4 and scouting and different areas, different STEM
5 activities, and this facility has been awesome for that.

6 I come from -- I live in Kanawha County and came over
7 for this. We bring kids over here and we have like a girls
8 (inaudible) code class learning to program PYTHON, you
9 young girls in middle school, and they come out here and
10 they were able to go up to the GBT the control room and
11 look at the same programming code that they're working with
12 is the same stuff that runs it. A lot of what this
13 facility does is let kids see that these things are
14 accessible to them. The telescope and the science and the
15 professors, you know, we have some of the world leaders in
16 astronomy are here -- or at Morgantown and come here and
17 these kids can come and sit right with them, you know, like
18 (inaudible) other people and sit right with people that are
19 (inaudible) top people in the fields and have published
20 books, etcetera, so they see it's accessible and so they're
21 willing to try to do something so try to make things equal
22 access, equal opportunity for everyone and that's part of
23 that.

24 You know, this is -- also the Society of Amateur Radio

1 Astronomers they have their annual meetings here. We come
2 here every year. Have one of our annual meetings. These
3 are people from all around the world come just for a club.
4 They're in a club, Amateur Radio Astronomy Club, and they
5 come here. This is the place they want to go.

6 Also another thing to get involved with is the Pulsar
7 Search Collaboratory which was mentioned before which
8 students from all around the country come to this thing
9 every year. Students get to work with real data that
10 astronomers have not looked at that have been collected by
11 the GBT and they get the first crack of looking at data and
12 a lot of these kids have found pulsars and other
13 astronomical events and it's like that is so awesome.
14 These are kids. They get the first crack at this stuff.
15 Nobody else has seen any of this information before that
16 was collected.

17 You know, this is -- I'm going to say this is on my
18 list as a kid of things to do in life was to go to Green
19 Bank. Grew up in Ohio. Go to Green Bank, hamfests, go to
20 McMurdo one day, but you know, this was the place that I
21 always wanted to go.

22 Like the previous lady said, it is a magical place.
23 You come here every time, it's like this is exciting. You
24 bring kids. We bring different groups of kids out here and

1 we have an awesome staff here that just does whatever to
2 help any kid and things come out of kids, you know, that
3 how smart and how bright they are and what they can do.

4 Real quick example, they have the 40-foot teaching
5 telescope down here which is accessible to the public to
6 use with some training, and my 12-year-old son, you know,
7 we had class with Sue Ann here one day and that evening he
8 and I went down and got on the telescope. He said, Dad, I
9 got this, and he produced these really nice graphs. Let me
10 show them here. But a whole bunch of nice graphs of
11 looking at hydrogen clouds in the spiral arms of the
12 galaxy, you know, like that and the astronomer is like wow,
13 that's cool, this kid is 12 and first time. So now he sees
14 wow, this is accessible, I can do this kind of stuff. Take
15 the mystery away from it. I think, you know, that's --

16 CAROLINE BLANCO: If you could please wrap up. We've
17 got two more.

18 GRAYG ROUSNYDER: Yeah, I will. I apologize. I
19 will. Sorry. So just as part of your potential resources
20 to be considered should be the educational impact.
21 Probably add that to that. That's so important. This is
22 just a hidden treasure in West Virginia. Thank you.

23 ELIZABETH PENTECOST: John Taylor.

24 JOHN TAYLOR: Hello. My name is John Taylor. I'm the

1 vice president of the Central Appalachian Astronomy Club.
2 We're centered out of Clarksburg, West Virginia. I would
3 like to urge you to fully fund this facility. If you can't
4 fully fund it, keep it operating. It's vital to our
5 organization and to amateur astronomers all around.

6 Let me say that we operate a little star party called
7 Star Quest every year right here at Green Bank. Star Quest
8 is we inundate this place with several hundred people and
9 we receive just fabulous cooperation from this facility.
10 We do this in partnership with Kanawha Valley Astronomical
11 Society and also with some support through several years
12 from Dominion Energy and we bring a number of people in and
13 do an educational operation. We like to think of it as the
14 largest optical and radio star party in the nation and we
15 can only do it because we have this marvelous magical
16 facility here. We have speakers for four nights. We have
17 speakers all day for four days. We have an absolutely
18 fantastic event and it's only because of this facility.
19 Our people -- amateur astronomers come in and get trained
20 and work the 40-foot telescope. You know, this next coming
21 year will be the Star Quest 14. We've been doing this for
22 quite sometime now and it's only from this facility that we
23 can do this.

24 Now, let me tell you, this is a world-class science

1 facility. I'm sure others can speak much better to this,
2 but it boggles my mind to think that one would even say
3 they were considering shutting down the largest fully
4 steerable radio telescope in the whole world. How could
5 you even think of that? It's disgraceful to even say it.

6 I can't speak to this as an education facility near as
7 much as some other people probably already have, but about
8 25 years ago I came here as a classroom teacher for a
9 weeklong National Science Foundation funded science
10 facility, science workshop, and ran the radio telescope
11 every night for a week. It was a marvelous experience that
12 I took back to my classroom and shared with my students.
13 Many other students -- many students, actual high school
14 students, come here for programs. They have a nice
15 bunkhouse down there to house them in and they come here
16 for programs. It's a fantastic experience for those kids.

17 Please, please fully fund this facility, and if you
18 can't fully fund it, keep it operating. This is a vital
19 magical facility that needs to be here in West Virginia.
20 This is the only radio quiet zone in the whole world.
21 Where else can you have a facility like this? Keep it
22 going. Thank you.

23 ELIZABETH PENTECOST: Anthony Minter.

24 DR. ANTHONY MINTER: I'm privileged to be an

1 astronomer here at Green Bank Observatory. Astronomy gets
2 kids interested in science very early in their
3 development. What three-year-old hasn't grabbed a
4 cardboard box and taken that rocket ship to the stars just
5 because they saw a picture of a planet or an image of a
6 galaxy, but that's not enough to get them into science,
7 keep them there, and get them to a STEM education. The
8 programs here in Green Bank do that extremely well.

9 We have programs for elementary schools, middle
10 schools, high schools, kids in college. All get to come
11 here and those programs work because we have telescopes
12 they have access to because we are a science facility. You
13 take that science away, those telescopes go away, those
14 opportunities to get the kids interested in science is
15 diminished greatly if it doesn't go away itself.

16 Now why did I say it was a privilege to be an
17 astronomer here? It's because I get to interact with those
18 kids that come here all the time. That's one of the
19 greatest things about working here is working with the
20 youngsters and getting them interested in science or
21 keeping them interested in science. We have had kids come
22 through our programs at various levels. One was an
23 astronaut. Several have gone on as you've heard to get
24 their degrees in various fields. We've had medical

1 doctors. We've had lots of engineers. Even a few
2 astronomers have come through here. The privilege is to
3 take that three-year-old sitting in a box and help guide
4 them through their whole educational career and see them
5 become world-class scientists. You cannot produce that in
6 any other facility that I'm aware of other than here at
7 Green Bank. It is a tremendous privilege to work here.
8 Thank you.

9 CAROLINE BLANCO: Okay, folks, thank you so much for
10 staying. It's an hour after our specified time. The next
11 meeting is going to start now. They will be reviewing the
12 boards outside and then we will come back here for our
13 presentation again (inaudible) the one we started at three
14 o'clock today. Thank you all so much for coming.

15 If you didn't have a chance to either complete your
16 comments please put those in writing. I hope you
17 understand there are a lot of people that want that
18 opportunity and we're trying to accommodate (inaudible) but
19 we do look forward to having you participate as fully as
20 you can, and remember we will be taking these comments back
21 and reviewing them, preparing a draft Environmental Impact
22 Statement, and at some point in the spring when it's ready
23 it will be issued. If you've signed up you have the e-mail
24 address on there. We will notify you when it's ready and

1 then we will have another meeting that will be heard at the
2 45-day time period. Thank you again.

3 (Whereupon, this public meeting
4 was concluded at 6:00 p.m.)

5 - - -

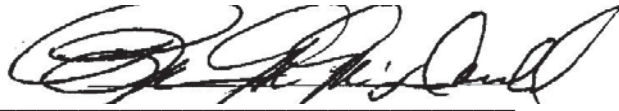
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CERTIFICATION OF REPORTER

I do hereby certify that the above and foregoing is a true and complete transcription of my stenotype notes and electronic recording of the meeting held at the time and place aforesaid.

I further certify that I am not interested in the outcome of this case, nor am I related to any of the parties herein.



Brian M. McDonald

Certified Shorthand Reporter

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1 NATIONAL RADIO ASTRONOMY OBSERVATORY

2 (GREEN BANK OBSERVATORY)

3 EIS PUBLIC SCOPING MEETING - NUMBER 2

4

5 HELD AT THE

6 GREEN BANK SCIENCE CENTER

7 155 Observatory Road

8 Arbovale, West Virginia 24915

9

10 Wednesday, November 9, 2016

11 6:30 p.m.

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I N D E X

PAGE

PROCEEDINGS 4

P R O C E E D I N G S

1
2 Whereupon,

3 MS. BLANCO: Dr. Ajhar.

4 DR. EDWARD AJHAR: Thank you. Thank you for coming to
5 our Environmental Impact Statement Public Scoping Meeting,
6 and I want to thank the entire staff of Green Bank
7 Observatory and Karen O'Neil may have just stepped out, our
8 director here. They've been very supportive of all
9 logistics that we have to do.

10 I want to again thank you all for coming and just
11 start out letting everybody know that a lot of times
12 there's things that are published, things that are
13 discussed, they're not always accurate so we want to try to
14 get some of those points there, and fundamentally, it's
15 very important that you understand that we have made no
16 decision to close Green Bank Observatory. We are here as a
17 part of a process looking at different things but there's
18 been no decision at this point.

19 What we really need today are your comments and your
20 input in the beginning of this process considering the
21 different alternatives so that's our main purpose for being
22 here today.

23 I'm going to start by introducing myself and the rest
24 of the team members and then we're going to talk about some

1 background information and why we're here, what's the
2 background for -- that brought us here today and we will
3 talk about the preliminary proposed alternatives that
4 you've seen published and the resource areas to be studied
5 and that's what we're seeking input on. We will talk about
6 the Environmental Impact Statement process, and once our
7 brief presentation is over, we will open the floor to
8 public comments.

9 So my name is Edward Ajhar. I am an astronomer in the
10 Division of Astronomical Sciences at the National Science
11 Foundation, and I'm the program officer for Green Bank
12 Observatory.

13 Joining me today in our Division of Astronomical
14 Sciences is Liz Pentecost. She's back there. She will be
15 helping to direct the people making comments today.

16 From our Office of General Counsel we have Caroline
17 Blanco and Christin Hamilton.

18 In our Office of Legislative and Public Affairs, Karen
19 Pearce and Ivy Kupec.

20 We have some contractors that are helping us from CH 2
21 M Hill, Michelle Rouwe and Chris McDonough. I don't know
22 if they're in the room. Back here is one. Thank you.

23 So what is the role of the National Science
24 Foundation. We at NSF are the federal stewards of ground-

1 based astronomy and astrophysics. We provide funding for
2 national and international telescopes and facilities, and
3 we provide funding for research grants that allow
4 individuals and groups to conduct specific science
5 investigations.

6 As the stewards of the National Science Foundation's
7 Astronomy Portfolio we get a lot of input. Over the past
8 decade the NSF has received advice from external review
9 committees made up of the astronomical community and the
10 2010 decadal survey which is titled New Worlds, New
11 Horizons in Astronomy and Astrophysics stated the
12 following: "NSF Astronomy should complete its next senior
13 review so as to determine which, if any, facilities should
14 Astronomy cease to support in order to release funds for
15 one, the construction and ongoing operation of new
16 telescopes and instruments, and two, the science analysis
17 needed to capitalize on the results from existing and
18 future facilities."

19 So the 2010 reports recommended review that I just
20 mentioned of the NSF Astronomical Sciences Portfolio was
21 completed in 2012 and that portfolio review report is
22 titled Advancing Astronomy in the Coming Decade:
23 Opportunities and Challenges. So regarding the Green Bank
24 Telescope the 2012 review recommended divestment and stated

1 the following: "The GBT is the world's most sensitive
2 single-dish radio telescope at wavelengths shorter than 10
3 centimeters; however, its capabilities are not as critical
4 to the decadal survey science goals as the higher-ranked
5 facilities."

6 In August of this year, 2016, the National Academies
7 of Sciences, Engineering, and Medicine published their
8 mid-term assessment of the 2010 decadal survey and
9 reaffirmed the 2012 portfolio review's recommendation for
10 the divestment of these astronomy facilities. The quote is
11 "The NSF should proceed with divestment from ground-based
12 facilities that have a lower scientific impact implementing
13 the recommendations of the NSF Portfolio Review which is
14 essential to sustain the scientific vitality of the U.S.
15 ground-based astronomy program as new facilities come into
16 operation."

17 So as a result of that input we received from several
18 committees over the last few years I want to kind of go
19 over the resulting developments at Green Bank Observatory.
20 Starting in FY 2012, fiscal year 2012, the NSF provided 95
21 percent of this site's funding. On March 22nd, 2013, the
22 NSF published a Dear Colleague Letter, and there's the
23 number 13-074, and in that letter NSF announced that the
24 Green Bank Telescope would be separated from the National

1 Radio Astronomy Observatory competition and requested at
2 that time ideas for collaborations involving the Green Bank
3 Telescope, and we will say more about that in a moment.

4 On October 1st, 2016, just last month, following the
5 path published in that Dear Colleague Letter, 13-074, the
6 National Science Foundation separated NRAO Green Bank from
7 NRAO and the site was renamed the Green Bank Observatory,
8 and Associated Universities, Incorporated, AUI, continues
9 to manage Green Bank Observatory under a cooperative
10 agreement with the National Science Foundation.

11 I was here and many of you I'm sure were for the
12 inauguration ceremony last month and very nice ceremony
13 kicking off the new Green Bank Observatory.

14 So the current status then again to clarify what are
15 the budget levels and things, in the current fiscal year,
16 FY 2017, the President's Request Budget for other
17 astronomical facilities asked for \$11.5 million total for
18 Green Bank Observatory and Long Baseline Observatory and
19 the fiscal year 2017 President's Request Budget also shows
20 an increase to \$11.85 million in the following fiscal year
21 2018 for planning purposes.

22 Following a review of AUI's proposal that provides the
23 exact division between Green Bank Observatory and Long
24 Baseline Observatory for the current fiscal year 2017 and

1 following year fiscal year 2018, NSF allocated \$8.2 million
2 in fiscal year 2017 should the President's Request Budget
3 be appropriated, and as many of you know, we're operating
4 under continuing resolution. There is no fiscal year 2017
5 budget yet but that's so you know what the plan is.

6 This \$8.2 million level represents approximately 75
7 percent of the base budget for Green Bank Observatory that
8 was part of the previous appropriations to NRAO.

9 The collaborations that I talked about a few slides
10 ago, Green Bank Observatory has established collaborations
11 with Breakthrough Listen, West Virginia University, and
12 North American Nanohertz Observatory for Gravitational
13 Waves known as NANOGrav. Green Bank Observatory continues
14 seeking new funding sources so that's where we are today as
15 far as the budgets go.

16 Now what are NSF's plans moving forward? Well, given
17 the previous astronomical community recommendations that I
18 quickly summarized combined with current budget
19 constraints, NSF has a need to reduce funding for a number
20 of astronomical telescopes and facilities and because of
21 that the NSF is initiating the Environmental Impact
22 Statement, Section 106 consultation process for the Green
23 Bank Observatory as it already has with Arecibo Observatory
24 and the Sacramento Peak Observatory. So this is why we're

1 here today to start that process as part of beginning of
2 this process.

3 You've seen these Environmental Impact Statement
4 preliminary proposed alternatives that have been published
5 as part of the notification of these meetings and the
6 comment period. So we are interested in knowing comments
7 about these is this the right step of alternatives, are
8 there other suggestions so that's a part of the comments.

9 These proposed -- preliminary proposed alternatives
10 are the first is continued NSF investment for science-
11 focused operations. That's a no action alternative.
12 That's where we are today.

13 Number two is the collaboration with interested
14 parties for science- and education-focused operations with
15 reduced NSF funded scope.

16 The third, collaborations with interested parties for
17 operation as a technology and education park.

18 The fourth is mothballing of facilities, and by that
19 we mean a suspension of operations in a manner such that
20 operations could resume efficiently at some future date.

21 Finally, the last alternative being considered here is
22 deconstruction and site restoration.

23 So that's where we are with -- that's how we got to
24 the point we are today and that's why we're here to hear

1 your comments and a very important part of this process is
2 to hear directly written and oral comments from the public
3 on these alternatives so I'm going to turn over the rest of
4 the presentation to Christin Hamilton from our Office of
5 General Counsel. Christin.

6 CHRISTIN HAMILTON: Hello. Good evening. Thank you
7 for attending. We had a 3 p.m. meeting as well that was
8 very well attended. Your voices are important to the
9 environmental review process so we appreciate you taking
10 the time this evening to be here.

11 As Dr. Ajhar said, I am from the Office of General
12 Counsel, but I like to clarify that I'm actually not an
13 attorney. I'm an environmental compliance officer and I'm
14 here to walk you through the Environmental Impact Statement
15 process as I suspect a lot of you are unfamiliar with that
16 process.

17 It's dictated by the National Environmental Policy Act
18 or what we call NEPA which requires federal agencies to
19 consider the potential environmental consequences of
20 proposed actions on the environment prior to making final
21 decisions so we do this very early on in a decision-making
22 process.

23 There are three levels of investigation that occur
24 under NEPA and for this particular proposal because of the

1 nature of potential impacts we're taking the most in-depth
2 look which is the Environmental Impact Statement. We
3 intend to prepare one of these statements to evaluate the
4 potential environmental effects, proposed operational
5 changes due to funding constraints for the Green Bank
6 Observatory. We will do a draft and final EIS.

7 We announced the beginning of this process which is
8 very public on October 19th. That began the scoping
9 process for the development of this EIS.

10 So what is scoping? The purpose of scoping is to seek
11 public input regarding relevant issues that will influence
12 the scope of that environmental analysis. So what you say
13 here today and what you submit in written comments will
14 inform that Environmental Impact Statement -- will be
15 addressed in it.

16 We invite your input regarding all of the issues to be
17 evaluated including the identification of viable
18 alternatives and the resource areas which I will get to in
19 a minute.

20 The more specific your comment, the more helpful to
21 the development of the EIS. I also want to clarify that
22 this evaluation is to look at environmental impacts. The
23 that's what the focus is. It's not to provide an analysis
24 on the state of the science, for example.

1 So there's two sort of pieces of information that we
2 have developed at this early date and that is the list of
3 preliminarily identified proposed alternatives that
4 Dr. Ajhar presented and it is also in your fact sheet.
5 That's one piece of information that we do have at this
6 point, and the other is this list of preliminary resource
7 areas that we expect to evaluate in that Environmental
8 Impact Statement.

9 These are our diverse range of aspects of the
10 environment from air quality to biological and cultural
11 resources to socioeconomics, traffic, and groundwater
12 resources.

13 Concurrent to the NEPA process we will also be doing
14 consultation under what we call Section 106 of the National
15 Historic Preservation Act. This requires federal agencies
16 to consult with interested parties and the state historic
17 preservation officer regarding potential effects of their
18 proposed actions on nationally significant historic
19 properties.

20 So there are four basic steps outlined here to this
21 process: Initiation, identification of the historic
22 properties within the area of potential effects, an
23 assessment as to what are their adverse effects on the
24 historic properties, and then resolution which is often a

1 form of a memorandum of agreement.

2 This process will occur in coordination with a NEPA
3 process, and the way that works is the information that's
4 developed through this 106 process you will also see that
5 same information in the draft EIS, for example, and the
6 final EIS as well so they will track each other.

7 We invite consulting parties to participate in this
8 and we've asked you to sort of self-identify if you're
9 interested in participating as a consulting party on the
10 sign-in sheets so you had the opportunity to check if
11 you're interested and we will follow up with you via e-mail
12 to confirm your interest in participating in 106
13 consultation as a consulting party.

14 One more statutory obligation that I wanted to mention
15 today is the Endangered Species Act. We need to consider
16 whether the proposal's activities might affect a listed
17 threatened or endangered species or their habitat, and if
18 this potential exist, we would consult with the U.S. Fish
19 and Wildlife Service. Again, that same information that we
20 gain from the consultation will be seen in our draft and
21 final EIS.

22 I want to go through target dates and the
23 opportunities for comments. As I mentioned, October 19th
24 we began the public scoping process. There's a 30-day

1 comment period. We delayed a little bit due to an
2 issue with e-mail so we wanted to make sure we had the full
3 30 days when you can e-mail in comments. We're having
4 these two public meetings today.

5 We will take that input, we will be preparing a draft
6 Environmental Impact Statement. We're targeting spring to
7 release that. Everybody who is on our e-mail list and if
8 you signed in today you will be on our e-mail list will get
9 notification when that is released and it will be on our
10 website as well.

11 Following that release we will have a 45-day comment
12 period and, again, we will have two public meetings, a
13 daytime and an evening to try to accommodate people's
14 schedules. Those times again will inform the final
15 Environmental Impact Statement which we're targeting for
16 sometime around fall.

17 Concurrent to those processes we will be doing, as I
18 mentioned, a National Historic Preservation Act
19 consultation and potentially Endangered Species Act
20 consultation as well.

21 We're required by regulation to wait at least 30 days
22 following the release of the final EIS before making any
23 agency decision. The agency decision is recorded in what
24 we call the Record of Decision which we're targeting for

1 early 2018. That considers not only the environmental
2 considerations and any mitigation measures that are
3 identified in the final Environmental Impact Statement, but
4 also any other factor that is of importance to the National
5 Science Foundation and that could be science priorities or
6 budgetary constraints.

7 As for how to submit comments, you can provide verbal
8 comments today. We will have a full transcript of this
9 meeting attached to the draft Environmental Impact
10 Statement. You can submit written comments today. We have
11 written comment forms out at the tables where you signed
12 in. Give your comments to anybody with a name tag and we
13 will make sure that they get on the record.

14 You can also mail or e-mail your comments to NSF by
15 these two methods which are also on your fact sheet if you
16 want to refer to it later and it's also at our website
17 which I will get to in a moment.

18 So at any point along the way if you need information
19 on the process or if you need to review documents, please
20 see our website www.NSF.gov/AST, that's for Astronomical
21 Sciences Division.

22 The fact sheet, the copies of the informational boards
23 that are out there and this presentation itself will be
24 posted there, and as we move forward, for example,

1 documents relevant to that 106 consultation
2 will also be posted there.

3 So at this point we're ready to move into the public
4 comment period. We will be having my colleague Liz
5 Pentecost will be announcing according to how people signed
6 up.

7 Because of the number of people who are interested in
8 speaking today we really want to make sure that everybody
9 who wants to speak can speak. So much as we hate to set a
10 time limit we're going to try to keep comments to three
11 minutes each and if we have more time at the end and you
12 didn't get to complete your comments we will invite you to
13 come back up so I know when I'm speaking I never know how
14 much time has gone by so what I will do is I will time it.
15 I will be sitting right there and when I get to two minutes
16 I will stand up so that you know you have one minute more
17 to sort of wrap things up. Thank you for your
18 participation.

19 ELIZABETH PENTECOST: The first person Kathryn
20 Williamson.

21 DR. KATHRYN WILLIAMSON: Hi. I used to work here as
22 the public education specialist. My name is Kathryn
23 Williamson. I worked here until this past December and it
24 was a few years that I was here and it was transformative

1 for me. The Observatory helped me finish my dissertation.
2 I started working here before I got my degree. It was
3 inspiring.

4 I mean, I had all these degrees in physics, but I had
5 no practical skills so I came here and I learned about real
6 true STEM based education and I saw firsthand how
7 inspired students can be so I worked with the 40-foot
8 telescope and also the 20-meter telescope through Skynet
9 online.

10 I know you've heard a lot of comments from people that
11 have used the 40-foot educational telescope so I won't
12 repeat how that can be.

13 Now I teach at WVU in Morgantown and I use the
14 20-meter online with my students and you can do the same
15 types of experiments. We can detect hydrogen gas in the
16 Milky Way, map our solar systems rotation around the
17 Galactic Center, and even find information about the
18 presence of dark matter. All of this with like the
19 hundreds of students who take my class each semester,
20 college students from all kinds of backgrounds that are
21 non-science majors and they're getting this authentic
22 experience in large numbers.

23 In my letter that I wrote, you can see many of their
24 comments how transformative it was, how it made them feel

1 like real scientists, and how they realized it's actually
2 not that hard to do science. Many of my students have
3 wanted to continue in astronomy or science after taking my
4 class and using the 20-meter because there's no other way
5 to give them that kind of authentic radio astronomy
6 experience.

7 You know, a lot of astronomy labs around the country
8 use regular optical telescopes but you can only do basic
9 astronomy with those. You can't find evidence of dark
10 matter with those especially not in cities like Morgantown
11 where the light pollution is really bad so not only are my
12 students getting this like really different authentic
13 science experience, they're having this pride that is in
14 West Virginia and they collected their own data and it's
15 different. It's different than anything they've ever done
16 before and so I just -- I hope you consider the impact of
17 all the telescopes on site, not just the GBT, for its
18 educational and inspirational impact. So thank you.

19 ELIZABETH PENTECOST: Dave McLaughlin.

20 DAVE MCLAUGHLIN: I promise you I will be short. A
21 few comments I thought about today that came up. My name
22 is Dave McLaughlin, and I would like to thank National
23 Science Foundation for providing this time for public input
24 concerning the future of the GBO.

1 First things, as Pocahontas County Commissioner, you
2 would expect me to address the economic impact GBO has on
3 the local economy. Well, with 100 to 140 jobs, depending
4 on the GBO, I'm quite sure that is what is on top of most
5 folk's minds here today. That paycheck they earn is spread
6 throughout our county and communities. So every business
7 in the county is affected when that doesn't happen. Very
8 important for any small county like ours.

9 Secondly, I ask why if the NSF would continue to
10 pursue scientific research like what is done at the GBO,
11 why would they even consider defunding this site? Most
12 companies and businesses would do a cost-benefit ratio
13 process when they consider downsizing or realigning their
14 company. We know what the cost is of the GBO, but how is
15 it possible to put a dollar figure on the benefit side at
16 the GBO?

17 Discovering a new galaxy, a new planet, or even
18 extraterrestrial beings are priceless to a scientist and
19 that is what is happening here.

20 I don't know exactly how the NSF is funded, but I did
21 read in your pamphlet some of that so I understand a little
22 bit now. But I do know that millions of tax dollars are
23 invested at this site. I believe that NSF has to have a
24 very good argument if they plan on walking away from this

1 investment made by all taxpayers in the United States.

2 With the GBT being the largest fully steerable
3 satellite in the world is being used by several students,
4 scientists around the world. Shame on all of us if we let
5 it be taken out of service. It is one of the greatest
6 also -- it is one of the greatest resource -- research
7 tools ever built by man. Also, where else in the world or
8 U.S. can a radio free zone be established like the one at
9 Green Bank?

10 One final thought. The Green Bank Observatory the
11 last 50 years has become a great community partner. We
12 have help with our schools, emergency services, fire
13 service, and always willing to help with any community
14 activity when asked.

15 The GBO isn't some big secret site where the general
16 public isn't welcome. They always extend a hearty welcome
17 and a helping hand so please consider very carefully what
18 is at stake and what will be lost if defunding continues at
19 the GBO. Thank you again.

20 ELIZABETH PENTECOST: Dennis Egan.

21 DENNIS EGAN: Hi. I'm here to speak for the BFD Fire
22 and Rescue, the fire department that's served this area.
23 I'm also indirectly going to speak for the two just south
24 of here where we also get service.

1 The GBO is a significant supporter of the fire and
2 rescue in this end of the county. Oftentimes when we have
3 to have someone air evaced we use the airstrip down here as
4 an air evacuation landing zone and it's one of the better
5 ones we have because it is actually an airstrip.

6 The GBO site here is also our certified Red Cross
7 emergency evacuation area so it can be used for when we
8 have disaster in the county to bring people here. When we
9 had the storm in this area, a significant area here
10 was out of power and this was one of the few places where
11 people who were on oxygen could come and plug their oxygen
12 generators in and things like that so that's very
13 significant for this county. When we have floods, when we
14 have power outages especially in the wintertime we have
15 heat and electricity here.

16 Also, it's an emergency staging area. When we had a
17 helicopter go down from the Army National Guard, I guess
18 the National Guard, this is the area where everybody comes
19 to coordinate and there's facilities here to feed large
20 numbers of people and there's facilities here that they can
21 get warm and get rested so it's very important to this
22 area. It is a very rugged area. It's hard to get to
23 another place where you can do something like that.

24 The GBO also supports us with emergency equipment

1 repair sometimes if we have something that is -- that we
2 need fixed right away for the emergency services we can
3 bring it here and the facilities here can do that.

4 One of the biggest things that the Green Bank
5 Observatory provides is water. We have nowhere right
6 nearby here where we can get water in any kind of a fire so
7 we would have to draft out of the stream. The Green Bank
8 Observatory here provides us with water which is one of the
9 major things that helps us with our ISO rating which is an
10 insurance rating so you talk about -- you talk about
11 economic impact, the insurance -- fire insurance for this
12 area would go up 15 to 20 percent within about six miles of
13 here which is most of the Green Bank area. Would be about
14 15 to 20 percent if we didn't have the water here with GBO
15 so that's a significant impact.

16 We also have indirect benefits here. The people here
17 who work for the Green Bank Observatory are people who have
18 technical abilities that help us a lot. Radio and any kind
19 of -- a lot of mechanical things they can help out with
20 maintenance and with getting things set up so it's very
21 important that if those people were to go away -- if the
22 technical people were to go away that are here only for the
23 science if they were to leave we would have a very
24 difficult time from about halfway to Durbin down to about

1 Dunmore serving this area at all.

2 CHRISTIN HAMILTON: I'm going to have to stop you
3 there, sir. If there's more time afterwards you can come
4 back.

5 ELIZABETH PENTECOST: Alex Bryant. The next person
6 after Mr. Bryant is Ruth Blond or is it Bland?

7 RUTH BLAND: Bland.

8 ELIZABETH PENTECOST: Sorry.

9 RUTH BLAND: That's okay.

10 ELIZABETH PENTECOST: Mr. Bryant. Is Mr. Bryant
11 here? I guess not.

12 RUTH BLAND: Good evening, and thank you very much for
13 affording me the opportunity to speak concerning the GBO.
14 I am Ruth Bland, and I am the Director of Student Support
15 Services Transportation and Technology for the Pocahontas
16 County Board of Education.

17 The Pocahontas County Board of Education supports
18 total funding from the NSF for the Green Bank Observatory.
19 I have been an employee here in Pocahontas County schools
20 for 34 years and spent ten years as a principal at Green
21 Bank Elementary-Middle School.

22 The National Radio Astronomy Observatory at the time
23 provided many services for Green Bank school and when the
24 Internet first came to Pocahontas County, the technicians

1 here at the Observatory wired that school. We now have
2 over ten miles of hardwiring in that school that the
3 Observatory has helped us purchase, to maintain, and to
4 continue to grow the network. Even though it isn't
5 wireless it is growing throughout the building. We just
6 had a major upgrade over \$41,000 from our E-Rate and the
7 help that we received from the Green Bank Observatory to do
8 that is instrumental in being able to keep that system
9 functioning.

10 The other thing is as a principal we live in a
11 laboratory here, not only with the stars, but with the
12 environment in general, and the wetlands, and the
13 opportunity to have a Golden Eagle station on
14 this property for our students to observe the Golden Eagle
15 in their natural habitat was just absolutely phenomenal.

16 I'm going to put aside my profession and I'm going to
17 talk to you as a mother. My youngest daughter is now a new
18 first-year teacher teaching biology and earth science at
19 Pocahontas County High School. She has a biology degree,
20 not earth science, but this summer in a cooperative program
21 with Fairmont State University she was able to take two
22 weeks of classes here to prepare her to be a better teacher
23 for those kids at Pocahontas County High School so those
24 type of programs are instrumental for us as a community and

1 as families. My daughter has come back to live in
2 Pocahontas County because of this opportunity. Thank you
3 very much.

4 ELIZABETH PENTECOST: Next is Joe Gonzalez and then
5 Alan Balogh.

6 JOE GONZALEZ: Thank you. I don't think I've ever
7 been restricted to three minutes but I'm going give it a
8 try.

9 First of all, I would like to thank all of you for
10 coming and giving us all an opportunity to participate.

11 The Green Bank Observatory is the community in
12 Northern Pocahontas County, every aspect of it, all the
13 employees, all the support that's given.

14 I'm the president of the Central Appalachian Astronomy
15 Club that we co-sponsor the Green Bank Star Quest as you've
16 heard earlier testimony. I'm the former communications
17 director for the state emergency medical service so we've
18 had for many, many years the opportunity to work with the
19 Observatory in maintaining a healthy radio quiet zone so
20 everybody can work together because our interest was in
21 public safety and without communications people can die.
22 It's just that simple.

23 The important thing is option four and five are not
24 even to be considered. It's ludicrous to think that you've

1 got nearly a one billion dollar facility of taxpayers'
2 money that's invested in this area to even think of ever
3 closing it.

4 The amount of science that has been created here, the
5 new technologies that's been created here is an ongoing
6 thing. You can put the GBO up against any other facility
7 in this country and they are number one in their
8 accomplishments.

9 The science alone, the things that we do with the
10 Green Bank Star Quest we've been very fortunate to have
11 Alan Bean, fourth man to walk on the moon; the Rocket Boys;
12 Carolyn Shoemaker; Seth Shostak, all those folks come here
13 and it's the only facility that's available that you can
14 collaborate with the general public, anybody, and to be
15 able to learn science.

16 We've got a new administration and maybe I ought to
17 knock on some doors and see how we can restructure to
18 refund science because in the past decade we have not had
19 science in the United States. We wish you well. Let us
20 know what we can do for you to help keep the facility
21 open. Thank you.

22 ALAN BALOGH: Thank you. My name is Alan Balogh. I'm
23 the Mountain Party's candidate for the 43rd District House
24 of Delegates this year.

1 I would urge the National Science Foundation to
2 continue funding the facility here for a number of
3 reasons. One, the Observatory it's a historic site at this
4 point. I mean, it does pretty much define Green Bank. It
5 does important work here, and like it's been said before,
6 there aren't many places in the Eastern United States that
7 are quiet zones like this. I mean, I've driven a truck,
8 retired earlier this year, been to 48 states and six
9 Provinces of Canada, and I'm keenly aware of what a rare
10 area this is for this type of thing.

11 It's also a tourist attraction. When we moved here,
12 my family and I 27 years ago, this was one of the
13 attractions. It's just really cool having this here in
14 this county. Many of my friends and relatives that have
15 visited this is where they wanted to come and visit.

16 Also, the facility is used by local groups. My wife
17 is real prominent in the Pocahontas Nature Club and they've
18 used the facilities here to hold meetings. It's in this
19 end of the county, it's a great place to do that.

20 The other thing is Pocahontas County, it's, you know,
21 a lot of farming and timbering, and if you're a kid it
22 isn't oriented toward that type of thing. The facility
23 here, the scientists and the technicians and their
24 families, it's a great opportunity for other students to

1 spark an interest in different careers that they wouldn't
2 normally have.

3 This is a general comment. I know you're not really
4 looking for that but I think we need to think about it.
5 What we're really talking about is economic man versus
6 culture man. Science, art, music, literature, these are
7 the things that separate us from animals. I mean, animals
8 have economies; ants, beavers, but what makes us special is
9 places -- science and art and so forth, and if you put
10 everything on just a profitability basis, it's not going to
11 work. Some things are worth sacrificing for.

12 I think the money is out there. We spend like a
13 budget probably every day and somewhere overseas
14 and the next day they rebuild it so the money is there.
15 But if our governor-elect would pay his taxes it would
16 probably be funded for a third of the year or so, but what
17 we really need to do in the long run is to elect people to
18 office who put people in culture ahead of just profits;
19 otherwise, we're going to sacrifice everything like this.
20 Thank you.

21 ELIZABETH PENTECOST: Loren Anderson, and I know I'm
22 going to mispronounce your name. Kaustubh Rajwade.

23 KAUSTUBH RAJWADE: Rajwade.

24 ELIZABETH PENTECOST: Rajwade. Okay. Sorry.

1 DR. LOREN ANDERSON: All right. My name is Loren
2 Anderson. I'm a faculty member at West Virginia
3 University. Fifteen years ago WVU only had one
4 astronomer. Today we have seven including Kathryn who
5 spoke earlier.

6 The Department at that time 15 years ago had zero
7 graduate students. We currently have over 20, many of whom
8 are in the audience today. We have accounted eight post-
9 docs and hundreds of undergraduates at WVU,
10 many of whom are from the local area, so as our Department
11 has grown, our scope has grown and we're able to educate a
12 much larger number of students now today.

13 All of this growth is due to our connection with the
14 GBT so we bring many students down here for training. All
15 of us faculty members come down here and stay for a couple
16 of weeks each year and this is where we train our
17 students. This gives our students hands-on experience
18 doing science that is not available for most departments in
19 the country.

20 If the NSF decides to remove funding for the telescope
21 entirely or even decrease funding to a level where it is
22 difficult for us scientists to get telescope time, all of
23 those gains would go away.

24 Our connection with the telescope is so strong that it

1 has brought all of us faculty members here to West
2 Virginia, and if the connection were reversed all of us
3 faculty members, I'm convinced, would leave and that would
4 have serious detrimental effects on our ability to educate
5 West Virginia students. Thanks.

6 KAUSTUBH RAJWADE: Good evening, everyone. My name is
7 Kaustubh Rajwade. So I'm a graduate student in the Department
8 of Astronomy at West Virginia University and I come from India
9 so when I started applying for graduate schools WVU was one
10 of my top choices and the reason was that I always wanted
11 to do radio astronomy when I was looking for grad schools.
12 The only reason I came here was for so that I could use
13 the Green Bank Telescope. It has been the only reason
14 that I was able to do research in the last three years at
15 grad school.

16 When I say this, I believe I say this for all the
17 other international graduate students that are there in the
18 Department that this has been one of the major factors that
19 has attracted so many international students to WVU
20 especially the Department of Astronomy. If this facility
21 is closed it is going to have a severe impact on the
22 international reputation of not only the Department but
23 also at the university in general. So I hope the NSF takes
24 that it into account when they take a decision on GBO.

1 Thank you.

2 ELIZABETH PENTECOST: Nick Pingel and Pete is it
3 Gentile?

4 PETE GENTILE: Gentile.

5 ELIZABETH PENTECOST: Gentile. Close.

6 NICK PINGEL: Thank you. My name is Nick Pingel and
7 I'm also a graduate student at WVU. I come from one of the
8 smaller kind of research groups where it's just myself, my
9 advisor, and two other grad students.

10 Since when I started here in 2013 we collectively have
11 observed on the GBO 600 hours and that 600 hours is
12 translated to \$1.5 million in grant money using that
13 research so I only say this to point out that you are
14 getting a return in your investment when you fund the
15 science for this telescope, and I hope you consider that
16 when -- if you would close it, the economic effects that it
17 would have on the state level and, of course, the local
18 level as well so thank you.

19 PETE GENTILE: Hi. We are so lucky to be here, right
20 here in West Virginia. Over the past couple of years I've
21 had the opportunity to say those exact words in middle
22 school and high school classrooms to prospective and
23 current West Virginia University students and to amateur
24 astronomers at their club meetings across the state and

1 then I get to tell them why. Because their state, their
2 home is home to the largest fully steerable telescope that
3 man has ever built.

4 Space is inspiring. It touches us. Apollo 11, the
5 Hubbell Deep Field Image, the Pale Blue Dot, they all have
6 this uncanny way of exercising that universal feeling of
7 awe in connection to nature. The Green Bank Telescope
8 makes that connection with astronomy a two-way connection.

9 Perhaps more than any other telescope it lets students
10 touch space. In programs like the one I work with, the
11 Pulsar Search Collaboratory, kids can come to Green Bank,
12 literally touch the telescope, go to the control room, sit
13 behind the computer, and with a guide in hand students can
14 control the Green Bank Telescope. It shows these students
15 that science and astronomy isn't reserved for some academic
16 inner circle but if you like this crazy cool sciencey stuff
17 then it's for you.

18 This isn't some ideal version of what we as people who
19 are trying to connect students with science hope will
20 happen here. This is what has happened here. This is what
21 is happening here.

22 We keep in touch with these students and astounding
23 numbers of them tell us how their experiences at Green Bank
24 have changed the path through high school and college,

1 through life, and they want to share these experiences that
2 have inspired them here at Green Bank with their fellow
3 students back home so in the age of Pokemon GO, I kid you
4 not, these kids go back home and start pulsar clubs. How
5 nerdy and awesome is that.

6 It's all because the Green Bank Observatory does what
7 a thousand Petes or a thousand Kathryns could never do. It
8 lets students make their own connection with science and
9 lets them know that they can go as far as their curiosity
10 will take them, and so I urge you to consider funding the
11 Green Bank Observatory because it's simply too unique and
12 too important not to. Thank you.

13 ELIZABETH PENTECOST: Ryan Lynch and then Will
14 Armentrout.

15 DR. RYAN LYNCH: Hello again. The last time I talked
16 as the summer student program coordinator. I'm going to
17 put my science hat on today and talk as a member of the
18 NANOGrav collaboration and just as a user of the GBT from
19 the pulsar astronomy community.

20 I know you said in the beginning the scientific merits
21 are not in consideration here, but I really think the
22 impact on the scientific community at large needs to be a
23 part of the Environmental Impact Statement because science
24 is the primary reason that this telescope exists in the

1 first place. So in that vein I just want to mention a few
2 keep points.

3 The first is that you mentioned earlier that the
4 community has recommended that lower impact facilities
5 might be divested from, but the GBT is not a low-impact
6 facility. Frankly, the portfolio review that recommended
7 closure is outdated. It's been eclipsed by the science
8 that has occurred in the last four years.

9 We in NANOGrav are on the verge of discovering low
10 frequency gravitational waves from black holes throughout
11 the universe. Gravitation wave astronomy has been
12 highlighted by the NSF, the whole NSF, not just the
13 astronomy division as one of five big idea areas that NSF
14 would like to invest in in the future. It's also been
15 highlighted by the decadal survey reviews as a key science
16 frontier discovery area for astronomy in particular.

17 The other thing I want to mention is that reading the
18 Arecibo draft report I was struck by how limited the scope
19 was in terms of the bigger picture, the bigger context.
20 The NSF is really talking about shutting down potentially
21 or severely reducing the amount of time available for
22 science on its two large single-dish radio telescopes. You
23 can't really look at one without looking at the impact of
24 the other because if we lose both of those then we

1 effectively see U.S. leadership in low frequently radio
2 astronomy just at a time when we are on the verge of making
3 some of the biggest discoveries in the field really in
4 history.

5 There is a lot of talk about using other facilities
6 like the VLA as a fill-in for that. The Very Large Array
7 is a fantastic facility but it cannot make up for the GBT
8 or Arecibo.

9 There's been a lot of talk about international
10 facilities that are coming online in the future such as
11 FAST in China and MeerKAT in South Africa, but these
12 facilities are not yet completed. We don't yet know
13 whether or not they're actually going to work as
14 advertised, and we don't yet know what U.S. astronomers
15 will have in terms of access and time on these facilities
16 so we could be losing our leadership at a time when
17 the rest of the world is investing. That is going to cause
18 astronomers to leave the U.S. and take their expertise
19 elsewhere and basically leave us without that core
20 community.

21 That has a huge socioeconomic and cultural impact as
22 well because these people give back to the communities that
23 they're in as we've heard time and time again here today
24 and they contribute to the types of things that Pete just

1 talked about in terms of building a culture that
2 appreciates science and takes pride in what it does.

3 The only other thing I want to say is that we've heard
4 a lot, rightly so, about how options four and five really
5 are just unacceptable and I reiterate that, but really any
6 cut in the amount of open-skies science time that is
7 available for the wider astronomical community is going to
8 severely impact the large community at Green Bank.

9 The facility -- the people who are here if we cannot
10 continue to do high-impact science some of them are going
11 to consider going elsewhere. There are other impacts that
12 will propagate throughout the community even if it is -- we
13 do stay open under options one through three, and that's
14 why I would strongly urge you to recommend option one.
15 Thank you.

16 WILL ARMENTROUT: Hello. My name is Will Armentrout
17 and I'm a doctoral student at West Virginia University. I
18 will reiterate a bit of what you've heard from other Ph.D.
19 students at the university, but kind of lay it out in a
20 three-tier process.

21 I would like to talk about the educational impact on
22 students, the public, and professionals from around the
23 West Virginia area and from the international community.

24 If you can imagine this pure middle structure where at

1 the bottom we have public outreach, the middle we have
2 students, and at the top we have professional astronomers
3 coming here to work and to interface at meetings.

4 Now the Pulsar Search Collaboratory as Pete mentioned
5 is a way to engage very heavily students for weeks at a
6 time in the summer in learning pulsar astronomy,
7 understanding the basics of science, but the outreach at
8 the Observatory, the public museum, and outreach efforts
9 that the Observatory does is important in engaging tens of
10 thousands of people throughout the community to draw them
11 here maybe to spark their interest in science or in
12 technology for years to come in the future. That's a very
13 important stage or step we have in West Virginia to really
14 engage the next generation of scientists.

15 I will move from the base structure then to kind of
16 this middle section, and the middle section, like I said,
17 is engagement with students at the university. This is a
18 huge draw for graduate students attending West Virginia
19 University. If you are a graduate student in the audience
20 from West Virginia University could you raise your hand?
21 You can see we have dozens here. We have dozens back at
22 home who couldn't make it. They get the chance to
23 interface with the telescope from day one becoming
24 technical astronomers that use not only the Green Bank

1 Observatory but observatories from all around the world and
2 they're really honing those skills here.

3 The last stop that I would like to talk about is the
4 importance of the Green Bank Observatory and the
5 professional community. So every few years the Green Bank
6 Observatory has a single-dish observing school that brings
7 astronomers here, students, and professionals from all
8 around the world to really hone their skills as a technical
9 astronomer and they have other meetings throughout the year
10 that highlight many different high-impact areas of science,
11 but it is a way to connect professional astronomers and
12 student astronomers and the public at all three of these
13 very important levels to give you the full path of science
14 in America and science in West Virginia. Thank you very
15 much, and I urge you to consider options one through
16 three.

17 ELIZABETH PENTECOST: Robert Wilson and Paul Baker.

18 ROBERT WILSON: Hi. I'm Robert Wilson. I would like
19 to thank you for allowing me to speak here on behalf of the
20 GBM, GBT. I'm an undergraduate at West Virginia
21 University. I'm an aerospace engineering major, not
22 physics or astronomy, but I have been involved in things in
23 the past where -- that have brought me to the Green Bank
24 Observatory. It has had a profound impact on my life.

1 I remember being six or seven years old and coming
2 here with my dad when it just opened up. I will talk about
3 when I first started at WVU back in 2014 I joined something
4 that Kathryn Williamson who is in the audience started
5 which is the Space Public Outreach team for West Virginia.

6 What the Space Public Outreach team does is it fosters
7 the spreading of the word of science kind of to the K
8 through 12 students and I guess students in the state of
9 West Virginia.

10 What we do in the Space Public Outreach team is we go
11 to students in West Virginia and we try to communicate
12 science to them in a way that's understandable to them.

13 When you try to talk to students about science
14 sometimes things can get abstract. When you want to talk
15 about pulsars these are things that are out in space that
16 these students will never see in their lives. It's very
17 easy to just make these things kind of seem very detached
18 from what these students usually go through in their
19 day-to-day lives.

20 When you have something like the Green Bank
21 Observatory and something that they can physically link
22 these students to the kind of things that are out there,
23 it's a great tool for me when I'm trying to explain to
24 these kids what these things are. It's a really great tool

1 and it's something that is really profound that we have
2 here in West Virginia.

3 The low income areas in the state it's very difficult
4 for some of those students to actually you know just
5 understand -- not understand, but be informed of kind of
6 some of the science that's going on. Essentially --
7 sorry. I'm blanking here. It's kind of embarrassing. No,
8 no, it's fine.

9 It's really important that these kids kind of grow up
10 and are able to, you know, interject themselves into a
11 society and have the ability to become professionals and
12 having the GBT here is a great way to do that. It's very
13 important that these students know this state has a future
14 in science and technology and it's not just coal and
15 natural gas. You can't put a dollar sign on the things
16 that the Green Bank Observatory is doing for the students
17 in the State of West Virginia.

18 DR. PAUL BAKER: Hello. I'm Paul Baker. I'm a
19 postdoctoral fellow in the Center for Gravitational Waves
20 and Cosmology at West Virginia University. I'm also a
21 member of the NANOGrav Collaboration.

22 NANOGrav uses the Green Bank Telescope for most of its
23 observing, and seeing the facility close down would be a
24 huge detriment to that effort so NANOGrav is looking to

1 detect low-frequency gravitational waves and we saw with
2 the recent LIGO detection of gravitational waves it brought
3 up a great deal of public enthusiasm in science and physics
4 and astrophysics. I see using the Green Bank Telescope for
5 NANOGrav to continue on in that as a way to reach out to
6 not just students but the general public in thinking about
7 these fundamental questions of science.

8 Also, my decision to come to West Virginia to work at
9 West Virginia University hinges on the university's
10 involvement in NANOGrav and this particular project and the
11 Green Bank Telescope, so I think without the Green Bank
12 Telescope, West Virginia University and the State of West
13 Virginia would be missing out on people coming to this
14 state to work on science. Thanks.

15 ELIZABETH PENTECOST: Navid Motlaghi. Did I pronounce
16 it right? I hope. And Michael Lamb.

17 DR. MICHAEL LAMB: Hi. So I'm Michael Lamb. I'm a
18 postdoctoral fellow at West Virginia University and I'm
19 also a member of the NANOGrav Physics Frontier Center. I
20 am the NANOGrav PFC post-doc for West Virginia University.

21 I just wanted to talk about the impact on students
22 from the broader national community. In 2009 I was a
23 member of the NRAO Research Experience for undergraduates
24 in Charlottesville, not at Green Bank, but we came over to

1 Green Bank to do a lot of training and we met with students
2 here at Green Bank and we used data at Green Bank. We took
3 observations from Charlottesville, and I want to say like
4 what a huge impact this has been for me.

5 I went to a small teaching college where there was
6 only one astronomer at the time so the astronomy research
7 opportunities were very limited. I ended up working in the
8 pulsar astronomy community. That informed my decision of
9 what I wanted to do for graduate school was to continue
10 working in pulsar astronomy so I attended Cornell
11 University. I finished my dissertation this past year and
12 now I'm at West Virginia continuing to do what I think is
13 really, really amazing forefront science.

14 Without the Green Bank Telescope I would echo what a
15 number of people have said, I don't think that West
16 Virginia University and I don't think the State of West
17 Virginia would really have a huge impact on science. I
18 think that the amount of people that it brings in both
19 internationally, which has also been mentioned, locally,
20 and nationally, people are coming from all over the place
21 to use the facility to do really, really good science and
22 to really make a difference. Thank you.

23 ELIZABETH PENTECOST: Paul Brook and Laurel Dilley.

24 DR. PAUL BROOK: Hi, guys. My name is Paul Brook, and

1 I'm a postdoctoral researcher at West Virginia University
2 also. I just wanted to add my voice to those who have
3 talked about coming from elsewhere in the world to come and
4 study or work here in West Virginia.

5 I finished my Ph.D. last year at the University of
6 Oxford in England and when I was looking for the next step
7 in my career the reason I wanted to come to West Virginia
8 University is because as we've heard, there's a great bunch
9 of people in the physics department. It is a growing
10 department and they work on really important and
11 interesting science in areas of particular interest to
12 myself. Also, I've had -- the main reason for all those
13 positives is not in small measure due to the Green Bank
14 Telescope.

15 There's not many English people in Morgantown, West
16 Virginia. When I'm walking around doing my shopping and
17 speaking to members of the general public and they hear my
18 accent which they initially think is Australian and then
19 eventually they can see that I'm English, it doesn't take
20 very long for the question what the heck are you doing in
21 West Virginia. We have a little conversation about that,
22 but the bottom line is always I'm here because Green Bank
23 Observatory is here.

24 So if you want to continue to attract people from all

1 over the world, which I hope you do, then we have to
2 recognize that this is in big part due to the telescope
3 here and the Observatory. Thanks.

4 ELIZABETH PENTECOST: Lesley Goodall and Adam
5 Kobelski.

6 UNIDENTIFIED: I think you've got Laurel Dilley still.

7 ELIZABETH PENTECOST: Oh, I'm sorry.

8 LAUREL DILLEY: Hello. I'm Laurel Dilley. I have two
9 things I wanted to address tonight. The first is just as a
10 lifelong resident of West Virginia and huge advocate for
11 the state. I grew up in neighboring Pendleton County and
12 the Observatory was always such a cool thing to have right
13 next door. We would be so excited when we could go on
14 field trips over here to Green Bank.

15 I attended West Virginia University and majored in
16 math and helped out with the governor's school for math and
17 science for several years and I know it was stationed here
18 occasionally. There's just so many cool academic
19 opportunities for kids in this state.

20 I also think West Virginia suffers from the rural
21 brain drain and this is something that can actually reverse
22 that and get students who want -- are interested in West
23 Virginia and want to come back it gives them something in
24 technology or engineering or science field that they can

1 actually look forward to and come home.

2 The second thing I wanted to address is I teach math
3 and computer science at the high school. Computer science
4 was just started about two years ago with the help of a
5 math coach in our county and nobody had any background in
6 computer science. I was one of the math teachers so I
7 volunteered to do it, but I absolutely would not have been
8 brave enough to do that or would not have been possible if
9 it wasn't for the Observatory.

10 Ray Creager specifically stepped up and he comes to
11 our classroom one day every single week and volunteers his
12 time to teach the kids to code PYTHON.

13 The NRAO also -- or the GBO hosts the Hour of Code
14 field trip for all the ninth graders every single year so
15 that they can come and see just what coding is all about
16 and learn binary and get to see the machine shop. It's a
17 really, really cool experience for these high school
18 students.

19 We only had a graduating class of about 62 last year.
20 Ten of those 62 seniors were in the first computer science
21 class, and five of them are now majoring in computer
22 science in college. This year we have 17 students in that
23 class and almost all of them say they either want to major
24 or minor in computer science, so once again, that wouldn't

1 be possible if not for the collaboration of Green Bank with
2 our schools.

3 They've also hosted math field day regionally and so
4 many other things. Anything we ask them to do at the high
5 school they are very cooperative and it is a huge
6 inspiration to me as a teacher to know that I have that
7 support. Thank you.

8 LESLEY GOODALL: I'm Lesley Goodall. I guess what I'm
9 going to say is kind of putsy compared to everybody else.
10 I'm an occupational therapist. I work in the schools. I
11 work in the home health and intervention and the
12 hospital. I know pretty much everybody in the county or at
13 least their child or their grandchild.

14 Almost every aspect of my life has been touched by the
15 GBO. We need the population to keep our schools and our
16 hospitals going.

17 Most of what the GBO meant in my life is through my
18 son who is now 20, but he attended the Green Bank school
19 and there was Star Lab, which I was asking somebody, do you
20 all know what that is, the cool thing that the kids get to
21 see? Okay. Yeah. That's such a cool thing and it goes
22 to -- we have five schools in this county. It goes to all
23 the schools and they teach the kids about the universe and
24 all these great things.

1 Most of the judges for our social studies fair,
2 science fair, if I'm not mistaken, come up from up here.
3 What I'm trying to say is the employees of GBO contribute a
4 lot to our schools and to our communities.

5 My son was able to become an Eagle Scout because some
6 of the staff up here and their kids all -- we did Boy
7 Scouts up here. We did the overnights. My son and I both
8 became EMTs due to Janet Ghigo because she teaches it up
9 here. She teaches it every year, and her husband works
10 here if I'm not mistaken.

11 My son got his first paying job painting the satellite
12 dish and is now certified to climb way up in the air which
13 is great because he wants to work in the rain forest.

14 Also, he's at Virginia Tech. No boos, please. But I
15 am from Virginia. He considers himself from West Virginia,
16 but he's constantly defending West Virginia, and the one
17 thing that he can talk about is yes, the satellite dish.
18 Wow, you got near that. Wow, that's like brain stuff.
19 It's really good for our state. He was actually on the
20 plane to Spain with Ms. Minter whose husband also works
21 here, and he was saying that to some Russian -- some
22 foreign group and he got off the plane and he goes man, he
23 said those guys asked me where I was from. He said you
24 don't know. They were like where. He said West Virginia.

1 Oh really. He said, yeah, this little place called Green
2 Bank. Oh yeah, it's the telescope. You know, they knew
3 it. But GBO is really a part of our community.

4 I'm also in the book group that's run by -- where is
5 she? Out there. Yeah. That's run by people that are
6 staffed here.

7 I think our churches would shut if we didn't have the
8 GBO. It means a lot to the community. The walking trails
9 and the riding trails it's where everybody gets our
10 exercise. Please fund it.

11 DR. ADAM KOBELSKI: Hi. Thanks for being here. I
12 know this has got to be a long day for you all so I
13 appreciate you taking the time for this. I'm Adam
14 Kobelski. I used to be a post-doc here and I came all the
15 way from Alabama to attend this and be here today so if
16 there's nothing I say here that is relevant, hopefully that
17 carries some weight to it.

18 One of the things that I think is really important
19 about places like this which there are very few of these
20 places left of real science camps, places where you can
21 come and be cut away and do your science. We all do our
22 work now at our desktops in our offices and we never
23 actually get away and actually connect to the data to what
24 we're trying to do and get our heads out of doing laundry

1 and connecting all these other chores. This is one of the
2 last facilities left to do that.

3 On that same note, this is also one of the last
4 facilities where as a scientist you get to see and meet and
5 talk to and know everybody that's involved in doing the
6 science.

7 I know most of the people in this room. Where I work
8 now I know very few people in the building. But you know
9 everyone in the town, everyone who makes the telescope
10 work, and it's an amazing team that is unrivaled anywhere
11 else at least as these types of facilities and it's not a
12 commonplace thing and it's really gone just because of the
13 state of how we have to do science now and it's real
14 important to at least keep a few of these going.

15 One of the last things I wanted to talk about is how
16 facilities like this provide the opportunity to train
17 cross-disciplinary science which is something that often
18 is lacking.

19 I'm a solar physicist. I moved here with very little
20 radio astronomy knowledge and I am now somewhat qualified
21 to do radio astronomy. I now am able to use these skills
22 to use other NSF facilities to study the science there at
23 the sun which is the huge benefit to all the other
24 opportunities and things available for NSF so it's really

1 great to keep places like this alive to train other people
2 like me to be able to use all the facilities that NSF has
3 to offer. Thank you.

4 ELIZABETH PENTECOST: John Leyzarek.

5 UNIDENTIFIED: I believe he's out in the other room.

6 UNIDENTIFIED: He will hear you. You can do the next
7 person.

8 ELIZABETH PENTECOST: He's the last person.

9 UNIDENTIFIED: If someone didn't sign up can they
10 speak?

11 ELIZABETH PENTECOST: Did you sign --

12 UNIDENTIFIED: I guess also if there's anybody from
13 the last session who didn't have an opportunity to finish
14 their comments if they would like to, I would like to offer
15 them that opportunity as well.

16 ELIZABETH PENTECOST: Did you sign in to begin with?

17 UNIDENTIFIED: Yes, but I didn't know how many people
18 would be speaking so --

19 ELIZABETH PENTECOST: That's fine. You can speak
20 after Mr. Leyzarek.

21 CHRISTIN HAMILTON: Liz, you had another hand back
22 there as well.

23 JOHN LEYZAREK: My name is John Leyzarek. Thank you.
24 I'm sorry for the delay. I was going to put this in

1 writing. I appreciate the opportunity to be here. This is
2 a place I only want to say should be preserved and it
3 has -- it's a unique phenomenon in not only Pocahontas
4 County and West Virginia, but in the country and in the
5 world. It makes an enormous contribution to the cultural
6 environment as well as the scientific world here in
7 Pocahontas County.

8 Among the alternatives that I've seen discussed are
9 the deconstruction and restoration, and that's kind of in
10 addition to being a dreadful thought it's almost laughable
11 because as far as I can tell this place is already managed
12 with a high degree environmental responsibility and it
13 apparently maintains an enormous deer herd.

14 I don't want to waste anybody's time. This is a long
15 night, but I want to support very strongly the second
16 alternative that I've seen proposed which is to maintain
17 National Science Foundation involvement and also make the
18 facilities available to and solicit funding from the widest
19 possible range of potential users.

20 I understand to some extent this is already being
21 done, but I think without being a marketer, without having
22 studied the market for all the different facilities that
23 there are here, I'm sure many more players can be involved
24 and have been so far, and anything I as an individual can

1 do to promote that, I'm sure there are a lot of other
2 people who would like to do that also.

3 I think collaboration, privatization is a wonderful
4 thing, the coming thing. We can only look at the
5 transition of physical space exploration out of the
6 exclusive hands of government into partnerships between
7 government and private entities so I strongly support,
8 hopefully the Observatory will stay here and thrive and
9 make its contribution even more widely. Thank you.

10 UNIDENTIFIED: Liz, if we can just hold on one
11 second. We can go one, two. People who haven't spoken
12 yet. Three, four, five.

13 ELIZABETH PENTECOST: I think this lady right here
14 first, please. Go ahead.

15 CHRISTINA CUNNINGHAM: Well, my name is Christina
16 Cunningham, and I wasn't going to speak at first because
17 there's actually so much to talk about. I will be writing
18 a letter and I will be addressing most of the concerns.

19 I have a unique background in that I wouldn't have
20 been here at Pocahontas County if it wouldn't have been for
21 the Observatory. My dad decided to move us here and give
22 us an opportunity to live in rural West Virginia. I have
23 made friends, I have made people we consider aunts and
24 uncles, I have made all kinds of contacts, and I have been

1 shown by the Observatory that you can actually live your
2 dreams. It does happen here. You can see it. It's real.
3 You can touch it.

4 Also, I have a different background from a lot of
5 people that have spoken because I went into forestry. I
6 have had my certified -- arborist certification, and if you
7 want to talk about environmental impact, I know the
8 Observatory is very well maintained. I believe that the
9 sewage system won an award for being very environmental
10 friendly.

11 You talk about air quality. You can't get any better
12 air quality here. The telescopes would not be emitting
13 anything so I can't see how that would even be an issue.
14 That should be null and void because they listen.

15 To be honest with you, you can't get any better
16 water. This is the birthplace of seven rivers in West
17 Virginia.

18 I don't really know what else to say other than I hope
19 that you have listened to everybody and I hope that you
20 will definitely be taking this seriously because it is
21 affecting not just people here but it's worldwide. Even
22 though we are a very tiny state in the nation, we are the
23 third largest land county in the state, but one of the very
24 most rural populated areas, but it would be devastating to

1 see this place shut down. Thank you.

2 DI PANG: Hi. My name is Di Pang. I'm a Ph.D.
3 student at WVU. I'm studying computer science there. I'm
4 from China by the way so I'm from some rural area like
5 this. When my friends ask where I am I tell them I'm in
6 West Virginia. They don't know much about West Virginia
7 but they know two things. One is the song, Country Roads,
8 Take Me Home. The other one is the big telescope.

9 So in the past year, I've been working on
10 algorithms and look for pulsars in single pulse search so
11 pulses are weak and radio frequency interference is strong
12 so you don't know how sweet the words radio quiet zone
13 means to me. I really like those words.

14 You think of the GBT algorithms that's -- in
15 the past all those parts have to be diagnostically pulsar
16 signal part have to be inspected manually and there are
17 like hundreds of thousands of parts. We were able to
18 reduce this parts that need to be inspected by people by 90
19 percent and write up all of this so once we finished our algorithm,
20 this algorithm can be used by pulsars researchers, all pulsar
21 researchers, most specifically around the world, at the
22 universities as well.

23 So I'm also -- I came this summer to camp. I
24 met many talented students. Looking for -- we worked on

1 this pulsar. It's not we're only inspiring
2 people to study physics. Also inspire people to study
3 computer science, engineering, electronics.

4 In our department there are several professors who
5 work on the astronomy signal as well. So,
6 okay, we don't -- if you keep -- the students here want to
7 learn astronomy. You don't want to take them to China
8 because it cost a lot.

9 ELIZABETH PENTECOST: The next person. Anybody else?

10 JENNIFER NAIL: I want to say something.

11 UNIDENTIFIED: One, two, three, four.

12 JENNIFER NAIL: I was three or four. I can't
13 remember.

14 UNIDENTIFIED: You're a mathematician.

15 JENNIFER NAIL: I'm here now. They were just
16 pointing.

17 UNIDENTIFIED: We will come to you as well.

18 JENNIFER NAIL: Hello. I'm Jennifer Nail. I'm a
19 teacher at Pocahontas County High School. I also teach
20 math. What I want to talk about is the impact that this
21 has on our school systems.

22 Like Laurel talked about a minute ago, they
23 facilitated the field trip for our freshman class for the
24 last several years and this has been an incredible

1 opportunity for our students to see over the past few
2 years.

3 Also, guys, it's really hard to get people to move
4 here. I moved here from Charleston five years ago to teach
5 here because they offered me a contract first. There are
6 at least 20 school employees whose spouses work here. If
7 we lost 20 teachers we would not have qualified teachers in
8 our schools. As it is right now, I am proud to say that I
9 feel like we have a very strong school system and if that
10 happened we wouldn't.

11 It is so difficult to convince people to move here
12 because you're asking them to move here to the middle of
13 nowhere where your Internet is terrible and where they
14 don't have cellphones, and for people my age that's like
15 living without water so it's very important.

16 I would also like to talk on a personal note to when I
17 moved here five years ago I was a poor beginning teacher
18 and I needed a second job. So I worked here one summer at
19 the Observatory as a tour guide and I can say that that was
20 one of the best and most welcoming opportunities I've had
21 since moving to Pocahontas County. I met so many people
22 from working here and it made me feel so much more at home
23 than I was when I started here. I can say that if I didn't
24 have that opportunity I might not still be working in

1 Pocahontas County right now. So thank you.

2 UNIDENTIFIED: After this gentleman, who else has not
3 spoken before I go in the back of the room? Have you
4 spoken before? And you have not. We're going to take
5 people who haven't spoken first and then we will go back to
6 people who already had an opportunity and if they want to
7 supplement their responses because they ran out of time
8 they will be welcome to do that. We could even stay a
9 little bit later to accommodate that.

10 So the gentleman in the back will be after this
11 gentleman here. You can be after him. Who else was there
12 that wanted to speak?

13 UNIDENTIFIED: I was.

14 UNIDENTIFIED: You did. Okay. So oh do we have
15 another person here who didn't speak before? New speaker?
16 Did you speak already?

17 UNIDENTIFIED: No.

18 UNIDENTIFIED: So then you will follow this young
19 woman and then we will go.

20 BOB VANCE: I'm Bob Vance. First of all, I want to
21 say these people from the University of -- West Virginia
22 University, I was there a long time ago. I had an
23 astronomy class and you had to meet on top of the physics
24 building and we were supposed to look at stars. We

1 couldn't see anything but fog so when I
2 graduated I graduated with an education degree, math and
3 science.

4 I had to -- I spent one year teaching high school,
5 went in the service because I had a commission. Came back
6 to the Observatory in 1961 as a telescope operator because
7 we did everything manually at that time. That was the
8 requirement, they wanted math or electronics. So I spent
9 about three years as the operation group, 85 foot, 300
10 foot, and 140 foot. Then I moved to the computer group.

11 We didn't have much computer group at that time.
12 Computer science was not even one of the options in
13 Morgantown. From there I worked with all the astronomers
14 that came through. We had people from -- we had
15 astronomers from Russia. We had them from everywhere. The
16 staff was made up of several people from Germany. Well,
17 they just -- all kinds of foreign countries the staff was
18 made up of.

19 I was working the night that the 300 foot fell down in
20 1988 in the lab. And from that point Senator Byrd got
21 money to build the GBT and it was put into operation I
22 think in the year 2000 because I retired in 1999.

23 The telescope was a savior for the Observatory. It
24 was also a savior to the scientific community. The whole

1 community dearly loves that telescope and the observatory
2 is very -- it's a very economical part of the whole
3 county. There's several people who live in the outskirts.
4 Most of the people retired are still here or somewhere in
5 the neighborhood. It's not a good place to be. The
6 hospital and things are too far away, but they like Green
7 Bank and the Observatory is a very -- it's just a common
8 person for everybody, and I would like to urge the National
9 Science Foundation to do all they can to keep the GBT in
10 operation since it would also be a big morale booster for
11 the community as well.

12 BUSTER VARNER: I'm Buster Varner from Durbin. I'm
13 the local fire chief, president of the fire department --
14 rescue squad and fire departments for this area. I've
15 taken classes here for EMT class that Janet Ghigo has
16 taught every year here for several years that supplies the
17 EMTs for all of Pocahontas County. That's a very vital
18 thing here. I met a lot of people that has come here. Got
19 a lot of friends. My assistant chief is Dennis Egan that
20 works here. If we have problems with our trucks
21 ambulances, anything; I'm local business owner, I own
22 several businesses, if I need a special part or something
23 made I can have it made here.

24 Just I can't -- I've heard everybody talk and I

1 understand a lot of it, but business wise, how could you
2 take and spend the money you have spent in this area for
3 this telescope and this nice facility here and even for a
4 second think about closing it down? I can't understand how
5 this would happen. I mean, this is everybody's money and
6 we're known worldwide because of this telescope and all the
7 people that come here.

8 I think you're barking up the wrong tree. You need to
9 look at somewhere else to shut something down because if
10 this facility went out of here this would be a ghost town
11 in this area.

12 UNIDENTIFIED: Amen.

13 UNIDENTIFIED: Keep the money in America.

14 BUSTER VARNER: Yes. But I just want you to seriously
15 consider do not do anything different.

16 I can ask Mike Holstein for anything. We come here
17 when the helicopter crashed. Whenever the power goes out
18 or we have any kind of catastrophe here I can go to Mike.
19 I know I went to Mike when the power was off. They had a
20 scheduled power outage and a friend of mine had passed
21 away. Wasn't going to have no power at the funeral home
22 that day. I called Mike up. Mike, got a problem, buddy.
23 What is it. I said, well, lady is going to be at the
24 funeral home at two o'clock for a funeral, there's not

1 going to be any power there. It was really hot that day.
2 I will take care of it. What more can you ask for?

3 So this is things that goes way beyond what you
4 think. I don't know much about this science or nothing
5 like that. There's a lot of people here that does and
6 that's great. But I do not want to see anything to happen
7 to this facility. Period.

8 MARY SUE BURNS: My name is Mary Sue Burns, and I
9 moved to Pocahontas County in 1980 because I was offered
10 the job of Green Bank Middle School science teacher. That
11 was when the building was condemned and I had to work in
12 temporary housing down at the high school.

13 In 1985 I was talked into transferring to Pocahontas
14 County High School. I fought to be the chemistry teacher
15 which was fine and they said oh, by the way, you have to
16 teach the physics class, you're all we've got. You've got
17 enough credits we can get you a permit. Okay.

18 Teaching physics was the last thing I had ever
19 considered and it so happened that in 1987 -- I kind of
20 struggled along there a couple of years. In 1987 the
21 Investigating the University Workshop for teachers pilot
22 project for West Virginia teachers was held here at at that
23 time NRAO and a group of West Virginia teachers were
24 intensively trained in radio astronomy. We called it radio

1 astronomy boot camp.

2 From that I not only learned a lot but I made
3 incredible contacts and realized the tremendous resource I
4 had here and ended up making kind of lifelong collaborative
5 relationships with astronomers and engineers here who then
6 mentored my students and the kind of trickled down effect
7 from that was tremendous.

8 I was also on the staff for that project that
9 Ms. Bland mentioned, the Earth Space Science Passport grant
10 in collaboration with Fairmont State University. We
11 trained 36 West Virginia teachers in new science standards
12 this summer.

13 I was on the geology team so even though this is an
14 astronomy facility we were able to find sites within NRAO
15 and Green Bank, NRAO at that time, and Green Bank in order
16 to reconstruct geologic history of this area and give
17 teachers the inquiry experience into that kind of research
18 as well as the astronomy research so I think we have a rich
19 facility here and I would really like to see it
20 maintained.

21 I just retired from 37 years of teaching science in
22 West Virginia and in a moment of insanity agreed to long-
23 term sub position back at Green Bank Middle School so I
24 will be here for the science fair on December 6th and I

1 know that a lot of the staff here are going to be serving
2 as judges and hosts for that event, and I want to thank
3 them for that because a lot of them are here right now, and
4 thank you all for coming and listening. I tend to talk
5 really fast so this guy is good here. Thank you very much.

6 UNIDENTIFIED: And after our next speaker do we have
7 anybody else who has not had the opportunity to speak that
8 would like to?

9 UNIDENTIFIED: I would like to say something.

10 UNIDENTIFIED: Anybody else? No. Okay. Then you
11 were first. Did you want to speak?

12 UNIDENTIFIED: I already spoke but I want to go
13 again.

14 UNIDENTIFIED: Okay. So we will go after her go to
15 the other new speaker and then you and then you and then
16 you. Thank you, folks.

17 DIANE SCHOU: My name is Diane Schou. I'm a resident
18 of Green Bank and I did not check the form to talk but I
19 sort of gathered --

20 UNIDENTIFIED: You're on it now.

21 DIANE SCHOU: Thank you. I'm coming to about -- want
22 to talk about Green Bank from another direction, another
23 perspective. One, about air quality in Green Bank. This
24 is something that is very rare in the world here to be in

1 the national quiet zone.

2 I was injured by a cell tower that was built a third
3 of a mile away from my home. I didn't argue with it all
4 because I'm told that it was safe. Nine months later I got
5 symptoms of radiation sickness. I had a headache. I slept
6 very rarely. I had, what do you call it, chronic fatigue.
7 I had a rash. I thought I was eating something wrong. I
8 lost hair. I thought I was getting older.

9 My son took a class or was studying for a hand radio
10 license and in that book of learning about getting the hand
11 radio license there was a chapter about the radio -- the
12 hand radio operators what they experience when they stand
13 in front of antennas, and he put two and two together that
14 that sounds like what mother has.

15 My husband is a scientist so we did some simple
16 experiments. He drove me away from home, my headaches
17 disappeared. I felt much better. Came back home, the
18 headache returned and this happened repeatedly. When I was
19 returning home from the grocery store or from the post
20 office I was driving up top of a hill heading home and as I
21 approached the top I had a headache that was sort of like a
22 sledge hammer hitting me on my head. When I was coming
23 from another direction maybe about ten miles away I had a
24 tiny headache. Just barely discernible but the closer and

1 closer we got to home the headache grew. Because of that
2 is why I'm living here in Green Bank because I can live --
3 I'm acute person here. I don't have the health effects.

4 Am I running out of time?

5 CHRISTIN HAMILTON: You still have another 30
6 seconds.

7 DIANE SCHOU: Oh dear. I want to talk about safety
8 and health. I want to talk about the socioeconomic of
9 being in Green Bank. The historical preservation of
10 needing to keep this as a radio quiet zone and keep it as a
11 safe area because people around the world come here. Their
12 health improves, they go back home, they become ill again.
13 They come here, their health improves. They go back
14 home -- but they have to go back home because their family
15 is important.

16 From another perspective, instead of just asking for
17 the first preference for the Observatory, I would like to
18 ask for additional funding so that we can have some meters
19 to prove that people like me we are detecting things
20 because why on some days I feel ill, another person feels
21 ill, a third person feels ill, a fourth person had an
22 accident because that person was feeling ill. I even
23 called Virginia. They were feeling ill. I even called
24 Indiana. That person was feeling ill. So why were all

1 these people at the same hour detecting something. Thank
2 you.

3 LAURA HEIST: Hi. Most of you all know me. My name
4 is Laura Heist. We've lived in this area for a long time.
5 My husband is a tenth generation Pocahontas County
6 individual. We love this area for how unique it is and it
7 is unique in part because of the National Science
8 Foundation funding this observatory here.

9 I work for the Forest Service and I'm able to work at
10 home and work for Milwaukee, Wisconsin, and it's great to
11 be able to choose where you want to be and this is a
12 special place.

13 I would ask that you would look at the direct,
14 indirect, and cumulative impacts of the economic impacts to
15 the local area, to the state, and I'm just really wondering
16 just like they've said before, why are we spending so much
17 money to get this here and to invest in it and then to just
18 walk away with that much money? You may say it is outside
19 of your NEPA scope, but I'm asking you to look at it, and
20 if you're going to dismiss it for consideration, I would
21 like you to explain why you're dismissing it from
22 consideration. We want to know why you would be putting
23 money down in Chile instead of spending money in the United
24 States.

1 Whether you like him or not, we have a new president
2 who says he wants us to invest in America. I'm asking you
3 to invest in America and this is a great place to do it.
4 You've already put the money here so explain to me why you
5 would want to deinvest from this area. You can say that your
6 scope of your analysis is just to look at the alternatives
7 of what to do with this facility, but did you ever do the
8 analysis to come to this conclusion? I would just like to
9 understand it more and I think you can provide that
10 information in your response to comments to the public.
11 Thank you.

12 UNIDENTIFIED: No more new speakers; correct? I think
13 she was first and then you're next.

14 CARLA BEAUDET: Okay. To pick up where I left off and
15 actually -- Carla Beudet. I work at the Observatory. To
16 pick up, the previous speaker kind of, you know, pointed to
17 the points I made earlier that the socioeconomic impact
18 needs to be quantified in ways that it has not been done
19 for the EIS at Arecibo.

20 But to pick up, there are other quantifiable costs to
21 the area that come from losing the many volunteer services
22 of Observatory employees and the sharing of our facilities
23 with the community. Observatory employees volunteer as
24 firefighters and EMTs, as volunteer teachers of aerobics,

1 yoga, Zumba, Taekwondo, as sound and lighting engineers at
2 the Marlinton Opera House, as soccer, basketball, football
3 coaches and that is by no means an exhaustive list.

4 The Observatory partners with the parks and rec office
5 to offer swimming and dance lessons at Observatory
6 facilities for minimal cost. This in a place where the
7 nearest municipal swimming pool is at least an hours drive
8 away.

9 The impact to the community of losing the pool and the
10 exercise room can only be assessed by considering the cost
11 of a municipal wellness facility to replace those
12 services. Will your EIS consider that?

13 As my husband and I have been the ones doing sound and
14 lights at the opera house for the past 12 years we've
15 looked into the cost of having an outside sound company
16 come in. About \$1500 per show maybe 14 shows a year.
17 These things can be quantified and I want to see them
18 quantified in the Green Bank EIS if only estimated.

19 I cannot finish without expressing my disbelief that
20 this is even happening. The NSF's recommendation to defund
21 the GBT left a lot of people, particularly a scientific
22 community of users, completely dumbfounded given the recent
23 construction, innovative design, and scientific vitality of
24 this instrument. the GBT's capability has continued to

1 evolve. It is, in fact, just coming into its own with
2 high-frequency multi-receivers.

3 This is no dinosaur but rather a cutting edge
4 instrument with sensitivity unattainable by any array of
5 smaller dishes. It's capable and these are absolutely
6 unique in the scientific community. Just
7 not apparently from the majority of scientists selected to
8 serve on the NSF's 2012 Portfolio Review Committee. Thank
9 you.

10 PEGGY HAWSE: Good evening. I'm Peggy Hawse. I'm
11 Senator Manchin's representative and I work in West
12 Virginia. I represent him in Pocahontas County, and I've
13 already spoken. I've been here since three o'clock and I
14 stayed because I feel it is so important. The senator
15 thought it was so important that he also sent his
16 legislative director from Washington, and unfortunately, he
17 had to leave because he had to go to Charleston so I
18 stayed.

19 I wanted to add those of you who came in late, don't
20 worry, I'm not going to give my comments again. Just a
21 couple. There were representatives here earlier from
22 Senator Capito's office. Excuse me. Congressman Jenkins
23 was here, Senator Boso was here, and there may have been
24 some other locals that were here so it is important and

1 certainly your West Virginia delegation recognizes that.

2 I'm only going to make just a few comments repeated.

3 First, I want to say to the WVU students you have made a
4 tremendous impact by coming tonight. Thank you. I have
5 been privy to sit here and listen to everything and there
6 have been so many great comments made but I have to tell
7 you when you started speaking from your heart and there are
8 others have spoken from their heart, too, but you have come
9 here, you've chosen to come to West Virginia University to
10 further your experience to share your expertise. You made
11 a decision to do that. You're not getting a paycheck at
12 Green Bank Observatory. This isn't a job here for you.
13 You are passionate and that came through, and from a local
14 standpoint from somebody from West Virginia, you have made
15 me so proud and I want to thank you for that.

16 I want to tell you what the senator is doing
17 tomorrow. Tomorrow -- let me find my note here. Tomorrow
18 afternoon Senator Manchin along with Senator Capito and
19 Congressman Jenkins will speak directly to the Director
20 France Cordova, the director of the National Science
21 Foundation. I hope I'm saying the name right. To ensure
22 that she understands the importance of the Green Bank
23 Observatory to this community, the surrounding region, and
24 the State of West Virginia as well as the USA.

1 Senator Manchin thanks you for coming, and I want to
2 add one more thing. As a member of the Congress Committee,
3 Senator Manchin will have the responsibility of
4 interviewing and confirming the next director of the
5 National Science Foundation. We would like to do
6 everything we can to ensure your voice and your concerns
7 are held at the highest levels.

8 Mr. Vance, you called the Green Bank Telescope a
9 person. Well, when I gave my comments earlier I said that
10 the Green Bank Telescope was my friend. When I started
11 coming here I started calling it the Great Big Thing, and I
12 said, you know, you give nicknames to your friends so the
13 Green Bank Telescope has become my friend, and I'm so happy
14 to know that it has friends all over the world. Thank you.

15 DR. KATHRYN WILLIAMSON: Hi again. My name is Kathryn
16 Williamson. I'm a professor at WVU. I talked about the
17 20-meter telescope and how my students use it on Skynet
18 They control it online. It kind of worried me I heard that
19 I was the only person who mentioned the 20-meter because
20 it can be used online from anywhere and students from
21 more than WVU, more than just the hundreds the students
22 who take my classes use it. Students from all over the
23 country use it and I, unfortunately, don't know how many
24 but it's in the tens of thousands.

1 Earlier this year in January I submitted a grant to
2 the NSF to create workshops and activities for college
3 astronomy with the American Astronomical Society, the
4 people who offer the teaching workshops are there so that's
5 with EWAS people, and with other universities around the
6 country, and that grant review did extremely well but was
7 not funded because of the uncertain future of Green Bank
8 and the 20-meter.

9 Our grant had funding in there for it and it's just --
10 it blows my mind that the NSF would choose to know best for
11 one facility and ask for amazing educational opportunities
12 and then review those very well and then not
13 fund it because of the NSF's own decision so I just want to
14 reiterate that the 20-meter is an important telescope.
15 Everybody talks about the GBT, it's amazing, the 40-foot
16 telescope is an amazing opportunity, but the 20-meter
17 telescope is connected to the Internet so the possibilities
18 are endless for education. You don't have to come here.
19 It doesn't cost much of any at all to bring that kind of
20 quality science to our students so I just want to reiterate
21 the importance of the 20-meter. Thank you.

22 UNIDENTIFIED: Promised him first. And then, again,
23 we will have a hard stop at 8:30 if anybody else wants to
24 consider speaking.

1 DR. RYAN LYNCH: Okay, I will make it quick. I'm Ryan
2 Lynch. I'm a staff scientist here. So I talked earlier
3 about the student program and I want to just mention that
4 there's very, very few places in the world that allow
5 students to come and get a hands-on experience at a
6 telescope like this, but having gone through grad school I
7 came here first as a student back in grad school ten years
8 ago and now I'm here as an employee. It wasn't just
9 because I got to use a telescope which is great for my own
10 personal research. If that was all that this facility
11 offered I wouldn't be back here today as an employee.

12 Our summer students who come here they don't just
13 leave having had an experience. They learn something.
14 They walk away with the thing that I think I've taken away
15 from every comment here so much which is that this is such
16 an incredible community with such an incredible network of
17 people in every aspect of making this place work and the
18 community around it supports it.

19 When people come here they recognize that and it
20 inspires them to keep working through a career that can
21 often be very difficult or stressful. It helps get them
22 through those difficult times, and you can't really
23 quantify that easily, but it's a huge, huge, huge cultural
24 impact on the students that come here, on the other

1 astronomers that come here, and on every single person who
2 comes here to work and be a part of the community so I just
3 wanted to -- that was my time to speak from the heart.
4 Thank you.

5 UNIDENTIFIED: Anybody else want to speak after him?
6 You do. Okay.

7 PETE GENTILE: Pete Gentile again. I don't think I
8 mentioned it the first time but I'm a grad student at WVU
9 and I wanted to mention because it might seem a little
10 funny actually for people to have an emotional connection
11 to a telescope or to an observatory, and as hard as it is
12 maybe to understand it's much harder, I think, to quantify
13 that so it struck me tonight how many people said or
14 embodied the phrase I didn't sign up to speak tonight but I
15 wanted to get up and say something.

16 I think that's really indicative of the emotional
17 connection that this observatory has, not only with this
18 community but with the state and all of us here so I just
19 didn't want it to go without mentioning at least once how
20 emotion plays a part, even tonight. Thank you.

21 DR. LOREN ANDERSON: Hi. I'm Loren Anderson. Again,
22 WVU professor. One point I didn't think I had time for
23 last time was the amount of grant money that is tied to the
24 GBT so over the last few years we've been very successful

1 as faculty at WVU in bringing in money that is associated
2 with observation conducted on the GBT and that number is
3 almost \$10 million over just the last few years.

4 Most of that money goes to funding personnel. That's
5 post-docs and grad students and they spend it in the
6 community mostly on pizza and beer as far as I can tell so
7 those are good West Virginia dollars that stay very local
8 when you bring in those monies which we've been very
9 successful doing. Thanks.

10 UNIDENTIFIED: I believe this is our last speaker.

11 REBECCA GARVER: My name is Rebecca Garver, and I'm a
12 community member here. I honestly have no idea why I
13 decided to talk, but I just want to voice my concerns. I
14 completely get what everybody is saying but I want to say
15 from my perspective I don't think you understand how
16 devastating this would be to this community without this
17 here. It would be horrific. Buster Varner said it would
18 be a ghost town. He's not kidding.

19 My husband works at the high school. I'm not so
20 concerned about us not having good schools if this were to
21 close and the teachers were to leave; I worry about us
22 having no school. I worked at the bank across the street.
23 A couple years ago when we were worried this was going to
24 go down we were terrified there we were going to lose our

1 jobs because of how close we are and all of the community
2 members that we needed for our business. This would
3 trickle down to every single aspect of this community and
4 it would be an absolute nightmare for here and I just don't
5 want to see that happen. I couldn't sit and not say
6 anything.

7 UNIDENTIFIED: Amen.

8 UNIDENTIFIED: Thank you all so very much for coming
9 out. I know it's been a long day for many people and I
10 know it's hard to add something like this on at the end of
11 a long day or whatever endeavor you're involved in.

12 We thank you very, very much. We're going to take the
13 comments back, look at them, and review it, and they will
14 help shape the preparation of the draft of the
15 Environmental Impact Statement which is the next phase of
16 this process.

17 So, again, that will be -- we expect roughly spring of
18 next year we will be issuing the draft Environmental Impact
19 Statement. Thank you again. Be safe driving home.

20 (Whereupon, this meeting
21 was concluded at 8:30 p.m.)

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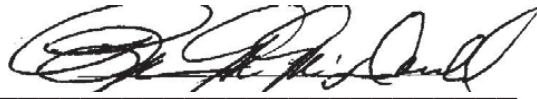
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CERTIFICATION OF REPORTER

I do hereby certify that the above and foregoing is a true and complete transcription of my stenotype notes and electronic recording of the meeting held at the time and place aforesaid.

I further certify that I am not interested in the outcome of this case, nor am I related to any of the parties herein.



Brian M. McDonald

Certified Shorthand Reporter

<hr/> <p style="text-align: center;">\$</p> <hr/> <p>\$1.5 32:12 \$10 76:3 \$11.5 8:17 \$11.85 8:20 \$1500 69:16 \$41,000 25:6 \$8.2 9:1,6</p> <hr/> <p style="text-align: center;">1</p> <hr/> <p>10 7:2 100 20:3 106 9:22 13:14 14:4,12 17:1 11 33:4 12 40:8 69:14 13-074 7:23 8:5 14 69:16 140 20:3 59:10 15 23:12,14 30:6 17 46:22 1961 59:6 1980 62:9 1985 62:13 1987 62:19,20 1988 59:20 1999 59:22 19th 12:8 14:23 1st 8:4</p> <hr/> <p style="text-align: center;">2</p> <hr/> <p>2 5:20 20 23:12,14 30:7 47:18 57:6,7 20-meter 18:8, 14 19:4 72:17, 19 73:8,14,16, 21 2000 59:22 2009 42:22 2010 6:10,19 7:8</p>	<p>2012 6:21,24 7:9,20 70:8 2013 7:21 32:10 2014 40:3 2016 7:6 8:4 2017 8:16,19,24 9:2,4 2018 8:21 9:1 16:1 22nd 7:21 27 28:12</p> <hr/> <p style="text-align: center;">3</p> <hr/> <p>3 11:7 30 15:3,21 66:5 30-day 14:24 300 59:9,19 34 24:20 36 63:11 37 63:21</p> <hr/> <p style="text-align: center;">4</p> <hr/> <p>40-foot 18:7,11 73:15 43rd 27:23 45-day 15:11 48 28:8</p> <hr/> <p style="text-align: center;">5</p> <hr/> <p>50 21:11</p> <hr/> <p style="text-align: center;">6</p> <hr/> <p>600 32:11 62 46:19,20 6th 63:24</p> <hr/> <p style="text-align: center;">7</p> <hr/> <p>75 9:6</p> <hr/> <p style="text-align: center;">8</p> <hr/> <p>85 59:9 8:30 73:23</p>	<hr/> <p style="text-align: center;">9</p> <hr/> <p>90 55:18 95 7:20</p> <hr/> <p style="text-align: center;">A</p> <hr/> <p>abilities 23:18 ability 31:4 41:11 absolutely 25:15 46:7 70:5 abstract 40:14 academic 33:15 45:18 Academies 7:6 accent 44:18 access 36:15 accident 66:22 accommodate 15:13 58:9 accomplishments 27:8 account 31:24 accounted 30:8 accurate 4:13 Act 11:17 13:15 14:15 15:18,19 action 10:11 actions 11:20 13:18 activities 14:16 73:2 activity 21:14 acute 66:3 Adam 45:4 49:11,13 add 44:2 70:19 72:2 addition 52:10 additional 66:18 address 20:2 45:9 46:2 addressed 12:15 addressing 53:18</p>	<p>administration 27:16 Advancing 6:22 adverse 13:23 advertised 36:14 advice 6:8 advisor 32:9 advocate 45:10 aerobics 68:24 aerospace 39:21 Affairs 5:18 affect 14:16 affected 20:7 affecting 54:21 affording 24:13 Africa 36:11 afternoon 71:18 age 34:3 57:14 agencies 11:18 13:15 agency 15:23 agreed 63:22 agreement 8:10 14:1 ahead 29:18 53:14 air 13:10 22:3, 4 48:12 54:11, 12 64:23 airstrip 22:3,5 Ajhar 4:3,4 5:9 11:11 13:4 Alabama 49:15 Alan 26:5 27:11,22 Alex 24:5 algorithm 55:19,20 algorithms 55:10,14 alive 51:1 allocated 9:1 allowing 39:19 alternative 10:11,21 52:16 alternatives 4:21 5:3 10:4, 7,9 11:3 12:18 13:3 52:8 68:6</p>
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Appendix 5D

Scoping Comment Matrix

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
1	a	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The Green Bank Observatory is nestled in Pocahontas County where community members, students, and tourists take advantage of all it has to offer. This superior science site has offered the students of Pocahontas; County opportunities and assistance in various areas. Ibis facility serves as a hands on learning site, a conference center, a post-graduation summer employment site, and assist with annual fundraising events.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	b	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	Students of Pocahontas County High School (PCHS) have participated in multiple work experiences at the Green Bank Observatory over the years. The Forestry classes have assisted -with the removal of trees, the ground preparation and planting of new trees, and the measurement of growth for each tree. Students are developing skills, building relationships, and learning about the real-world work environment. Pocahontas County students also participate in a friendly competition during the annual science fair sponsored by the Green Bank Observatory. Once again, reinforcing communication skills, the importance of teamwork, and the opportunity for students to receive constructive criticism from experts in this field. Students from the Agriculture program at PCHS attended a conference held at the Green Bank site last year. This conference consisted of developing and implementing a program to assist our Ag department with growing and harvesting potatoes. The Ag students were responsible for planting, maintaining, and harvesting the potatoes. For this project, the Green Bank Observatory granted the use of some property in order for our students to receive funds from the selling of the potatoes. This project assisted in teaching students communication skills, work ethic, and responsibility.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	c	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	College students often return seeking employment during the summer months, The Green Bank Observatory offers various work experiences for these students. They are able to learn basic ground maintenance skills, public speaking skills while providing tours of the site, and life saving techniques while being a lifeguard at the pool. There are also opportunities to acquire skills in painting, food service, and housekeeping on site. Over the past several years, seniors at PCHS have completed a Mentorship Project for graduation, Students at PCHS have had the opportunity to complete their Mentorship Project at the Green Bank Observatory. Seniors are able to choose a career path that interests them in and then they must obtain 40 hours of onsite experience in that pathway, The Green Bank Observatory is the perfect place to complete this project, due to its location, various level of employment opportunities, and the vested interest of the employees at the site to assist the students of PCHS with their career paths and future goals.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	d	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The Green Bank Observatory donates materials, staff, and funds to PCHS, Our students have benefited from generous donations that fund academic trips, post-graduation scholarships, and at times we have received various pieces of technology that have assisted with keeping PCHS up-to-date on the latest equipment being used, Staff from this site have assisted with wiring and running internet cables, the purchase and installation of new speakers at our football field and gymnasium, and assisted with the heating and cooling system at PCHS, A few years ago, PCHS implemented a Computer Science Course, the students have an opportunity to work one-on-one with an expert in this field from the Green Bank Observatory. This site also serves as a fundraising site for the PCHS Boys and Girls Track Teams with their annual Turkey Trot 5K or 10K. This fundraiser also provides a scholarship to an outstanding track athlete each year. At times, due to our isolated area, athletic teams travel from long distances to participate in games and tournaments held at PCHS. The Green Bank Observatory has graciously opened up the dorms on site for these teams to have a place to rest overnight before making the long journey back to their hometown.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	e	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The individuals that are employed by the Green Bank Observatory have roles on various committees that benefit the students of Pocahontas County. They serve on Local School Improvement Councils, the county Technology Committee, the local Board of Education, and they serve as announcers for our local radio station to broadcast events. Often times, individuals from the Green Bank Observatory are volunteer coaches for various athletic teams at PCHS.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	f	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The Green Bank Observatory provides many things to the students and staff of PCHS. It serves as a work site for students during high school, as well as post-graduation employment, an onsite work facility for our forestry and agriculture departments, and a fundraising area. They assist with overnight accommodations for various events. The individuals employed by the Green Bank Observatory serve as advisors, volunteer coaches, committee members, and general supporters of PCHS students. They are willing to donate time and effort to the educational experience and apply their expertise whenever needed. Pocahontas County High School students and staff benefit all around from the Green Bank Observatory as our partner in education.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
2		Mr. and Mrs.	Criss		To Whom it May Concern, We as citizens of West Virginia would like you to immediately give your support to the funding of the Green Bank Observatory. We feel it is of national interest and certainly an economic importance to the citizens of West Virginia. It is critical for you to act upon this immediately.	Against Closure	Email	11/9/2016	
3	a	Cynthia	Pritt	Pocahontas County High School Leadership Team	The student leadership team of Pocahontas County High School would like to express our concerns regarding the future of the Green Bank Observatory. The students of Pocahontas County Schools have had the privilege of participating in several different events and activities at the Observatory. These events include, but are not limited to: The Science Fair, Space Rumpus, tours, and the annual Turkey Trot We are strongly in favor of keeping the Green Bank Observatory, due to the benefits that it not only provides for us, but for the community and its visitors. The Green Bank Observatory has impacted our lives greatly throughout our school careers. We have had many opportunities to visit the Observatory, tour the different telescopes, and participate in the various hand-on scientific demonstrations located in the science center. This site has also served as a recreational area providing opportunities for students to go hiking, biking, swimming, and other various outdoor activities aiding our overall well-being.	Against Closure	Email and Letter - mailed	11/9/2016	201611090841.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
3	b	Cynthia	Pritt	Pocahontas County High School Leadership Team	<p>The Green Bank Observatory has always had an open door policy for students to participate in Science Fairs, Mentorship Projects, Computer Science course, and star gazing activities. The Observatory has also been very supportive of our Forestry and Ag programs. Due to the limited employment opportunities in our area, the Observatory has provided positions for students during the summer months, for which we are very appreciative.</p> <p>Thanks to the Green Bank Observatory, Pocahontas County students have the opportunity to work with scientist that are willing to volunteer in classrooms and within the community. Our Computer Science course currently works with a volunteer from the Observatory a few times a week.</p> <p>As you can see, the Green Bank Observatory has played a large role in our education. We are thankful for the opportunities that we have had and hope to continue these experiences in the future. The Observatory does an outstanding job incorporating us in their activities and studies. We hope that you take this letter and use it as evidence that the work that is being done there is vital to our community and our education.</p>	Against Closure	Email and Letter - mailed	11/9/2016	201611090841.pdf
4		Anne	Adams		Thank you for your notification. Though I can not come in person, I do desire to register my strong hope that the Observatory will be funded. It is important that we in West Virginia keep our treasures, and this one is important.	Against Closure	Email	11/9/2016	
5		Paul	Marganian		I believe that proposals to mothball or shutdown operations at the Green Bank Observatory are ill conceived and detrimental to our nation's status as a leader in science, our state's stake in cutting edge technology and education, and finally, our local economy.	Against Closure	Email	11/9/2016	
6		Paul	Marganian		I would like to give my opinion on the proposed changes to the Green Bank Observatory operations. During the 1950's, my father immigrated to the United States in part for a world-class education. At the time, our country was the center of scientific development, research and education. And so it has continued to be during my life time as well. This time last year I was in China on business. I saw a lot of interesting things on that trip, but what particularly got my attention was the investment they are making in research facilities. One day, while working in the offices of the Xinjiang Astronomy Observatory, I asked what the huge construction site next door was for: "Oh, that's our new lab". Contrast this with the proposal to shutdown or mothball operations at the Green Bank Observatory. Why are we discussing shutting down a world class research instrument like the GBT in the prime of it's life? Why are we abdicating our role as world leaders in scientific development and education? What disturbs me the most is the thought that, if my children decide to purse the best education in science and technology, will they need to immigrate to another country to do so, like my father did?	Against Closure	Email	11/9/2016	
7		Michele	Adams	6th grade science teacher	I am a WV teacher who learned all I know about EM waves at the GreenBank Telescope. I spent the best two weeks of my 25 years of professional development at the GBT and consequently took hundreds of students there over the course of 10 years. I have taken my science club there to speak to scientists about career choices, and I had a student that decided on a career in science after a student program there. She is currently at WVU and was considered for a Rhodes Scholarship. Although my school is three hours away from the GBT, it has played an important role in my education and that of my students. Please continue to fully fund this important endeavor for both science and education-related activities.	Against Closure	Email	11/9/2016	
8		James	Moran		I,James H.Moran am in total support for federal funding of Greenbank . Total support of Senator Joe Manchin in his fight for keeping in Greenbank,	Against Closure	Email	11/9/2016	
9		Jack	Bowers	Captain, U.S. Navy Retired	The National Science Foundation, I fully support the Federal Government continued funding for the Green Bank Observatory. Do not let it be destroyed or removed from West Virginia. I wish to thank Senator Manchin for allowing me the opportunity to show my support for this effort.	Against Closure	Email	11/10/2016	
10	a	Russell	Cronquist		I am a WV tax payer and advocate for the Greenbank Observatory. The reasons are manifold. • The infrastructure has immense value for a host of civil and social scientific reasons. I wish I could be at the public forum to personally articulate these benefits.	Against Closure	Email	11/10/2016	
10	b	Russell	Cronquist		• Perpetuation of the national radio quiet zone is a national security priority. This asset must be maintained and further developed. We need redundancy and diversity in our ability to monitor space-to-ground communications. Sometimes what is old is new.	Against Closure	Email	11/10/2016	
10	c	Russell	Cronquist		• The asset has huge educational value to West Virginia's youth. We should be bussing hordes of youngsters to an educational center here to inspire scientific wonderment and curiosity. The facility could be a center for science advocacy, natural history education and ecological awareness. I am an example of one who was inspired by the history of radio astronomy that is on exhibit at GBO. My 35 year carrier as a satellite engineer was in part inspired by a visit to Green Bank many years ago.	Against Closure	Email	11/10/2016	
10	d	Russell	Cronquist		• WV's coal predicament. We must join the 21st century. Developing this asset is but one element of our challenge. Why not make the GBO a demonstration project for wind, solar and energy storage technology? We need VISION here.	Against Closure	Email	11/10/2016	
11		Charlotte	Grimmett		<p>The Greenback Observatory has been a boon to W.Va as a state, and I believe to the local community as well. I am told that it has been used by many scientists to study the heavens by even other nationalities.</p> <p>It would be unfortunate for it to be discarded like an old toy. Quite possibly, it could garner income to support the site by continuing tours at a more accelerated pace.</p> <p>While I live at a bit of a distance from the observatory, I have visited the grounds and find it quite inspiring. Good wishes for continued progress.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
12	a	Emery	Grimes	President, Pocahontas County Schools Board of Education	<p>We, the Pocahontas County Board of Education Members are writing in regards to the environment impact study of the Green Bank Observatory (GBO). We encourage the National Science Foundation (NSF) to continue with the investment support for the science-focused operations of the GBO.</p> <p>The Green Bank Observatory is an educational partner of Pocahontas County Schools in many ways. Pocahontas County Schools for over the fifty years have seen our high school graduates make their employer the GBO in some facet.</p>	Against Closure	Email	11/9/2016	SKMBT_75116110909350.pdf
12	b	Emery	Grimes	President, Pocahontas County Schools Board of Education	<p>Here are some of the reason the Pocahontas County Board Members support the GBO:</p> <ul style="list-style-type: none"> • GBO provides over \$11.5 million annual in job security to Pocahontas County. • Over 50,000 tourists visit the GBO each year. That in itself provides a high volume of tourism dollars to Pocahontas County-economic stability to a rural county. • The financial loss of not having the GBO in Pocahontas County would have a huge negative impact of Pocahontas County Schools, including loss of tax dollars and students attendance in the school system because of employees moving to find other jobs. This in turn would likely create employee reduction of Pocahontas Schools. 	Against Closure	Email	11/9/2016	SKMBT_75116110909350.pdf
12	c	Emery	Grimes	President, Pocahontas County Schools Board of Education	<ul style="list-style-type: none"> • Pocahontas County students collaborate with GBO during science and math projects. • Pocahontas students and residents take pride that the GBO is part of their county. • GBO employers for many years have been viable volunteers of Pocahontas County School projects, such as sports, band, forestry program, and science competitions. <p>We would like to provide our sincere appreciation for National Science Foundation's support of the GBO in the past and we enthusiastically ask for the continued support of the Green Bank Observatory.</p>	Against Closure	Email	11/9/2016	SKMBT_75116110909350.pdf
13	a	Ray and Mary	Ratliff		<p>The Green Bank Observatory is both a vital contributor to science and a tremendously important part of the community of northern Pocahontas County and the surrounding area.</p>	Against Closure	Email	11/9/2016	
13	b	Ray and Mary	Ratliff		<p>In this very rural and somewhat remote part of West Virginia, the community of talented scientists and the associated jobs the Observatory provides to the area are essential. West Virginia has lost many once-productive areas to the changing economy, and we cannot afford to lose what is a continuing valuable partner.</p> <p>Please do not cut funding to the Green Bank Observatory. Thank you for your consideration.</p>	Against Closure	Email	11/9/2016	
14	a	Jeanette	Wagner	Itinerant Teacher of Special Education Pocahontas County High School	<p>It is extremely difficult and heart wrenching to even begin to think of the negative impact of NOT having the Green Bank Observatory open and operating. I cannot tell you the countless times I have accompanied children to the facility and the pride I witnessed by their actions as they experienced the various aspects, or the number of family members I have had come stay with me from as far as New Mexico just to take a tour.</p>	Against Closure	Email	11/9/2016	LETTER TO GREENBANK.docx
14	b	Jeanette	Wagner	Itinerant Teacher of Special Education Pocahontas County High School	<p>Other than job loss and astrological exploration, the greatest economic loss is the benefits of having a "quiet zone". My previous employment as a Real Estate Broker allowed me the opportunity to work with folks whose primary appeal to the area was the Observatory. Without the facility being operational, Pocahontas County would no longer offer this luxury.</p> <p>To sum it up, the economic devastation to our county is immeasurable and I, personally, do not want to find out what it would mean to our county if we did not have the Green Bank Observatory. Thank you for this opportunity to express how I feel on the matter.</p>	Against Closure	Email	11/9/2016	LETTER TO GREENBANK.docx
15		Steve	Malcomb		<p>Joe,</p> <p>I am in support of any financial support you would be able to obtain for the observatory.</p> <p>Although I now live in Greenbrier County, I was born and raised in Pocahontas before taking employment on the Washington DC Police Department. My wife worked in Correspondence at the White House.</p> <p>It was good to see you last night at Jim's Victory Celebration.</p>	Against Closure	Email	11/9/2016	
16		Melinda	Gabe	SENECA Health Services, Inc. County Director of Pocahontas County	<p>Please keep the observatory open and funded. I enjoy going there to visit with my family and hope to see this remain open for many years to come.</p>	Against Closure	Email	11/9/2016	
17	a	Lori	Wayne		<p>I am writing in response to the possible closing of the Green Bank Observatory and the impact this action would have on our community. The following is just a few areas that this closure would have an effect on: The Observatory provides employment for many local families.</p> <p>Green Bank, as well as all of Pocahontas County, has very few job opportunities for men and women seeking employment. Many young people in our county are forced to move after graduation in order to find jobs.</p> <p>Closing the Observatory will have a sever ripple down effect for our community. Loss of jobs and families moving to find work will mean loss of students for our local schools. This will cause the loss of jobs for people that are working in our school system, professionals as well as service personnel. Less people means less support for our local businesses.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
17	b	Lori	Wayne		<p>I am writing in response to the possible closing of the Green Bank Observatory and the impact this action would have on our community. The following is just a few areas that this closure would have an effect on: Green Bank School Business Partner and Emergency Shelter.</p> <p>The staff and their families are actively involved with school activities, afterschool activities, local Fire Department, sports, and are board members of many different county committees.</p> <p>Green Bank, as you know, is a very rural, beautiful, special place to live. Many people cannot imagine living here without cell phone service. To the locals, this is a beautiful asset. It is a great place to raise a family, generation after generation.</p> <p>Thank you for hearing my concerns, and as I mentioned above, this only touches on a few of them. Please consider fully funding the Green Bank Observatory as this business is vital to our community in so many ways.</p>	Against Closure	Email	11/9/2016	
17	c	Lori	Wayne		<p>I am writing in response to the possible closing of the Green Bank Observatory and the impact this action would have on our community. The following is just a few areas that this closure would have an effect on:</p> <p>Employees of the Observatory provides academic instruction/opportunities for Green Bank students in their different fields of expertise.</p>	Against Closure	Email	11/9/2016	
18		Jo	Weisbrod		<p>I totally support the continuance of the observatory. When relatives visit, that is the FIRST place we take them and their opinion of WV triples. It is a great source of pride and hopefully money.</p> <p>West Virginians CANNOT let this valuable asset go down.</p>	Against Closure	Email	11/9/2016	
19		John	Francis		<p>As a resident of Greenbrier County, WV, I am well aware of the importance of the observatory for the State of WV.</p> <p>I have visited there several times and have also met some of the staff and am aware of the excellence of the work that is done there. They have much to contribute to the education of our residents and students from all around the world. In times when science and learning are frequent targets for politicians looking for low-hanging fruit to prune in their scramble to balance the state budget, I support all those who would fight to preserve this great state asset.</p>	Against Closure	Email	11/9/2016	
20	a	Frank	DeBerry	President & COO Snowshoe Mountain Resort	<p>My name is Frank DeBerry and I serve as President and COO of Snowshoe Mountain Resort; a mountain resort just a few miles from the Green Bank Observatory. It is difficult to overstate the importance of the Green Bank Observatory to Pocahontas County because that importance itself is so great. As an employer, the Observatory's impact is obvious as it serves as the life's blood of the Greenbank / Edray economy. From service to science, business to education, the jobs of the Observatory are performed by the many people of Pocahontas county who very proudly fulfill their duties and who appreciate the chance to put their skills to work in a mountain community that most couldn't imagine having to leave in search of work.</p> <p>Further still is the Observatory's impact on tourism for an area that has become increasingly dependent upon, and has fully embraced its role as a year-round regional tourism destination. The Observatory's 50,000 annual visitors stimulate and support the entire tourism economy of the County. It's worth noting that the tourism impact itself does science good. My own nine-year-old daughter's trips to the Observatory have ignited an interest in science and has led us to share many conversations around cosmology, physics, and philosophy.</p> <p>As the State desperately seeks to diversify from its economic dependency on the coal and gas extraction industries that have literally fueled the US for decades, West Virginia needs and deserves more opportunities for science based education and employment. In this spirit, I truly hope that the NSF will continue to support the operation of the Observatory, and to apply the truly unique remote mountain setting towards new and expanding forms of research in all areas of science. In exchange, I'm certain that you'll not find a more loyally committed community to help you achieve your ever-changing goals.</p>	Against Closure	Email	11/9/2016	
20	b	Frank	DeBerry	President & COO Snowshoe Mountain Resort	<p>Beyond the direct impacts of employment is the otherwise irreplaceable gateway to science and learning that the Observatory provides to a community with few such outlets. Rural West Virginia's students and teachers simply don't have easy access to facilities that can ignite a love for science and research. The Observatory provides what is a truly unique opportunity for just that through the programs offered to a student population who might otherwise never have practical exposure to these advanced sciences.</p>	Against Closure	Email	11/9/2016	
21		Nancy	Gillespie		<p>The observatory is a valuable learning tool for all students in West Virginia. Please consider keeping the funding going for this resource for all of us in the area and the state. We pride ourselves in having such a fine scientific research facility. It would be devastating to lose it.</p>	Against Closure	Email	11/9/2016	
22	a	Sarah	Guyette	Pocahontas County resident	<p>Letter: I am writing to urge you to continue investment in the Green Bank Observatory in Pocahontas County, WV. The facility is an asset to our community and local economy as well as the scientific community.</p> <p>The Green Bank Observatory generates nearly \$30 million per year for the local economy. With approximately 40,000 visitors to the campus each year, it provides resources for educational programs and scientific research for people across the country.</p> <p>It contributes greatly to the county's tourism industry, which is depended upon by the people. According to research conducted by the West Virginia Division of Tourism, the impact of travel and tourism is greater to Pocahontas County than to any other county in the state. One out of every four jobs is generated by travel and tourism. That is the largest percentage state-wide.</p>	Against Closure	Email	11/9/2016	Green Bank Observatory Scoping Comments.pdf
22	b	Sarah	Guyette	Pocahontas County resident	<p>For over half a century, the Green Bank Observatory has been an active contributor to the scientific community. I hope that the National Science Foundation sees the value in continuing support for this facility.</p>	Against Closure	Email	11/9/2016	Green Bank Observatory Scoping Comments.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
23	a	David	Rose		<p>I'm writing this letter in support of the Green Bank Observatory, hereafter referred to as GBO. There are a number of reasons I believe this facility should remain open at or near its current level of operations. These I will address below:</p> <p>1. Economics. From an economic standpoint, the observatory plays a major role in supporting the local economy as well as small businesses in neighboring counties and the state of Virginia. Local businesses are very dependent on the spending by individuals employed by the GBO and by the GBO organization itself. Given the remote location and distances to other major shopping areas, personnel working for GBO do much of their spending locally for everything from fuels to food items and durable goods. What can't be found locally is frequently ordered and shipped here via USPS, FedEx, and/or UPS. In that respect, even global corporations and federal services benefit from the dollars generated by GBO. Some GBO employees live in Virginia. While these individuals may not spend as much in the local economies of Green Bank, Arbovale, and Marlinton, etc., they do contribute to a small extent and help support the communities of Monterey, Va. And Highland County. The last economic aspect I would like to mention comes from outside visitors. Since the completion of the Green Bank Telescope, and most recently the Robert C. Byrd Science Center, tourism to this county and this locality has increased significantly. The GBO routinely receives visitors from across the country. Many foreign tourists make a trip to the GBO as well. Tourist dollars are a significant factor in supporting many small businesses here.</p> <p>3. Tourism Suffice it to say that when your town is the home of the world's largest fully moving telescope, you become a tourist hot spot. That we are. While the Snowshoe Resort plays a significant role in the local community, the GBO attracts a lion's share of visitors as well. With tourism comes the obvious benefits of tourist dollars, but it also presents an opportunity to expose visitors to the importance of science and engineering. The GBO frequently hosts star parties to include major regional events focused on astronomy. The GBO also hosts sporting events, bike-a-thons, and cultural activities relevant to Appalachian history and the arts. The GBO is a lot more than just a collection of telescopes looking at the sky as tourists visiting the area soon find out.</p>	Against Closure	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
23	b	David	Rose		<p>2. Education The GBO is the go-to source for science and mathematics in this county and in many respects this region. The GBO frequently hosts math and science fairs for the county schools. Many GBO employees volunteer their personal time supporting these events. The GBO has many times been a host of the Governor's School of Math and Science. The GBO opens its facility to STEM activities organized by schools and higher education institutions from neighboring counties and states. GBO employees frequently serve as mentors to local school students and state universities. The GBO is a major partner in these same schools and the West Virginia University. While the sciences are the bread and butter so to speak in what's provided, trade crafts and similar skills play a role as well. School mentorship programs in the industrial arts such as welding, machining, construction, and engineering are also supported by GBO. Students wishing to focus their careers in these areas frequently seek out mentors on the GBO staff and complete their mentorship requirements at the observatory. STEM is very important to this country's future. The GBO is doing its part in supporting that.</p>	Against Closure	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
23	c	David	Rose		<p>4. Wildlife Management Given the acreage managed by the GBO, a diverse range of plant and animal life calls this their home. I believe the GBO does an outstanding job in protecting their habitat. The GBO contributes to the activities of the West Virginia Division of Natural Resources (WVDNR) through its controlled hunts program, assisting the WVDNR to manage the deer population in this area. Migratory fowl frequently make the GBO site a stopping point. Ornithology groups frequent this county and given the openness of the facility to foot traffic, make the GBO a stopping point on their trips.</p> <p>5. Agriculture Given the GBO site was originally farmland within this farming region, it was an obvious choice for a site to host a West Virginia Department of Agriculture project to promote the potato as a crop suitable for this region. That project was a major success and a step forward in helping to diversify the county and states agrarian economy.</p>	Resource Considerations	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
23	d	David	Rose		<p>6. Science Last but not least, the GBO does science. I will leave it to the trained astronomers, research scientists, and engineering specialists to make the case for maintaining the GBO as the world renowned facility for radio astronomy that it is. Suffice it to say that the GBO hosts the world's largest, most sensitive radio telescope. It's service life is far from over. Its contributions to science and technology have only begun. It's a telescope and facility that's usefulness to this country goes far beyond scientific study. Thank you for the opportunity to make my personal case for the continued operation of the Green Bank Observatory.</p>	Against Closure	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
24		Michael	Sweeney		<p>My opinion is that the Greenbank Observatory is a "Too Big To Fail" organization for this region in West Virginia. The Socio-Economic value and specific scientific applications this facility provides is an advantage for at the very least, a Self-Sustainability Action Plan that would enable an opportunity to prove the portion of marketable services and community outreach in education this facility provides to the whole state of West Virginia, as well as the indirect benefits provided through commerce brought on by GBO's presence.</p>	Against Closure	Email	11/9/2016	
25		Francis	Hughes		<p>I have had an association with the Green Bank Observatory for the last 45 years with professional and amateur communications. The personnel at the Observatory have always been very competent, knowledgeable, helpful and always extremely gracious. I have worked on a variety of projects, such as licensing for 2-way radio systems thru my employment with West Virginia Wesleyan College and the West Virginia Department of Highways. I am aware of the very advanced technology that Green Bank uses and the very sensitive issues they have to deal with on a daily basis. The Green Bank Facility is a shining star in the field of technology, educational and scientific studies performed there. The continuation of funding for this facility is greatly needed to continue the studies and preserve the observatory for future generations.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
26		Louis	Hart		Deconstruction and restoration of the great and historic observatory would be a painful and tragic course of action. One of my concerns is that the 'radio quiet' zone itself would be lost. My understanding is that it is the only one on Earth.	Against Closure	Email	11/9/2016	
27		Mary	Dailey		I would like to express my support for the continuation of Green Bank Observatory which is of vital educational, cultural, and economic value to West Virginia. This is an example of the kind of project we need to grow in our state to replace coal (which is on the decline) as an employer, tourist attraction and important educational resource for our children.	Against Closure	Email	11/9/2016	
28	a	Jared	Keown	Graduate Student	Growing up in a rural town in western Kentucky, my exposure to science and technology was limited as a child. By the time I graduated high school, I knew little about careers in the STEM fields (science, technology, engineering, and mathematics) and had no interest in pursuing them due to my lack of awareness. It wasn't until I enrolled in an introductory astronomy course during my first semester at university that I discovered astrophysics was my true passion. That passion motivated me to obtain my bachelor's degree in physics and begin my PhD in astronomy. Unfortunately, my path into STEM is undoubtedly the exception for students growing up in rural towns similar to mine. Many young adults in those areas never consider a career in science because it seems distant and out-of-reach from their remote communities. Facilities like the Green Bank Observatory provide a beacon of opportunity to the students of Appalachia by bringing world-class scientific research and education to their doorstep. For this reason, it is imperative the Green Bank Observatory remains in operation. It is no secret that rural states and commonwealths, such as West Virginia and Kentucky, must adapt to changing trends in global energy consumption and manufacturing to prevent future economic hardships. To do so requires a well-trained workforce that is adept in the STEM fields. In order for this change to occur, we must start with the education and inspiration of our youth. We must show children from rural regions that careers in science and technology are exciting and urge them to think outside the confines of their sheltered environments. When children from my home state are asked what they want to be when they grow up, we should be hearing a higher fraction provide responses such as: "Computer Programmer," "Chemist," "Environmental Engineer," or "Astrophysicist." The Green Bank Observatory serves as a stimulus that helps promote that message to our youth.	Against Closure	Email	11/9/2016	
28	b	Jared	Keown	Graduate Student	In addition to the Observatory's positive impact upon the future of its surrounding communities, it is also host to some of the most cutting-edge scientific instruments being used in modern radio astronomy. The 100-meter collecting dish of the Green Bank Telescope, combined with its advanced array cameras, allow it to be one of the best facilities in the world for quickly mapping faint high frequency radio emission sources both within and outside our Galaxy. The telescope is also poised to remain a world-class research facility in the future since new instruments can be readily added to it at minimal costs. Investment in the Green Bank Observatory is an investment in both the youth of Appalachia and the forefront of scientific discovery. Therefore, I strongly urge the National Science Foundation to continue its funding of the Observatory for both scientific research and educational outreach. It would be a shame to allow such a productive facility, and source of scientific pride for Appalachia, to be left by the wayside.	Against Closure	Email	11/9/2016	
29		Steve	Issenberg		The observatory is an important economic asset for the region. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy	Against Closure	Email	11/9/2016	
30	a	Art	Glick		I am writing as both a citizen scientist and a West Virginian about NSF's plans for the Greenbank observatory I have heard that decommissioning is a possibility, and it boggles my mind that people that call themselves scientists could possibly be so short-sighted. I have to assume that such a foolish alternative is only offered to make the others look better. The GBT is a unique key asset to the astronomical community. We need more such facilities, not less, and if the NSF is really about science, it should restore its fullest funding. The fact that roughly 3-4 hours are requested for each hour of time available for science on the GBT is evidence enough of its need and importance.	Against Closure	Email	11/9/2016	
30	b	Art	Glick		And you won't find an area of the country more in need of the economic support that such a facility provides, either, so there's a double benefit.	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
31	a	James	Shuman	Associate Professor of Education, Emeritus	<p>My Credentials to Comment</p> <p>I first came to the NRAO 53 years ago, as a delegate from the State of Iowa to the first annual National Youth Science Camp in 1963. The annual camp, held just up the road from Green Bank, is one of the nation's premier honors programs for just-graduated high school seniors with potential for entering careers in science, technology, engineering, and mathematics, and it has maintained an active partnership with the NRAO every year since then. In fact, one of the big reasons it was held there was to highlight the NRAO as a scientific research facility in this very special region of the State of West Virginia. As a graduating high school senior from Iowa, I had expressed an interest in astronomy since I was a youngster, and I was headed to college in major in Astronomy. Two things stood out to me upon visiting the NRAO for the first time: 1) the facility itself inspired ideas about entirely new types of discoveries to be made about the universe (things most of us had never even considered before), and 2) we were given opportunities to hear and talk with some of NRAO's most highly regarded astronomers and technologists at the time (people like Frank Drake, David Hogg, and Sebastian von Hoerner, all of whom were downright inspirational to us at the camp in 1963).</p> <p>But for me, it didn't end there. I returned to the Science Camp as a counselor each summer during my four years in college, visiting the observatory again and again. In 1966, I even lived at the NRAO for three months while serving as a summer intern there, one of three former Science Campers to do so that year. I interned with T. K. Menon, assisting him and Ken Kellerman on their initial research on quasars, which at the time were entirely new and quite unknown. While at NRAO that summer, I met other astronomers, especially Gart Westerhout and Frank Kerr from the University of Maryland as they worked on mapping the Milky Way on the 21 cm wavelength using the old 300-foot telescope. They encouraged me to come to Maryland for graduate work with them after college, which I did. It was only after my time there that I went into school teaching, and eventually on to a doctoral degree in education at West Virginia University and a career in science education and teacher education.</p> <p>However, even all this didn't end my time with the National Youth Science Camp, nor with the NRAO. I returned to the staff of the Science Camp in the 1970s and 1980s, becoming the camp's fourth Director in 1986 and 1987. NRAO continued to partner with the Science Camp throughout those years, providing lectures, tours, and even research and observing sessions - all predecessors to what is now called informal STEM education. And the partnership continues today, as over 5,000 Science Camp alumni have now visited NRAO and been inspired by it. Many of these people have become well-known scientists themselves; and many of them can recall the influence that NRAO had on their subsequent learning, careers, and dreams. The value of the NRAO can't be underestimated for its contribution to their progression into the top levels of the STEM pipeline. Research on our alumni has shown that the Science Camp was a significant factor in reinforcing their progression into further STEM education and STEM careers, and the NRAO has played an important role in this, and it continues to do so today.</p>	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx
31	b	James	Shuman	Associate Professor of Education, Emeritus	<p>NRAO's Expanded Partnership with the NYSF in the 21st Century</p> <p>In the past decade, the National Youth Science Foundation not only continues to operate the annual National Youth Science Camp and partner with the NRAO for that program, but the foundation has also operated other informal STEM education programs with NRAO for younger high school students. In particular, from 2005-2014, the NRAO and the foundation together operated the West Virginia Governor's School for Mathematics and Science each summer. The program was held in Green Bank, where students from across the state lived in the bunkhouse and interacted with the NRAO professional staff in the same kinds of ways that happened for the National Youth Science Campers each summer. Validated and reliable research on the Governor's School has showed that the Governor's School at NRAO was highly effective for the scores of high school students lucky enough to attend throughout all those years.</p> <p>And now these days, the National Youth Science Foundation continues to operate the Science Camp for some of the nation's top high school graduating seniors, and it also has new plans to operate camps both for high school students and for middle-school students, not only from West Virginia school districts but also from nearby states. GBO continues to fit right into the foundation's plans, and mothballing or deconstruction of the facility would deprive literally hundreds and hundreds of students each year the opportunity to be inspired about science and to learn about astronomy at Green Bank.</p> <ul style="list-style-type: none"> • As an educational facility, GBO already has a solid reputation among college professors, high school teachers, and their students throughout the secondary and post-secondary levels. At a time when the nation's STEM pipeline is still so restricted, decommissioning GBO runs entirely counter to the nation's needs for STEM education. • GBO has effective educational partnerships, not only with the National Youth Science Foundation but with many other educational organizations and agencies. Many of these entities would suffer with GBO's mothballing or decommissioning. 	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx
31	c	James	Shuman	Associate Professor of Education, Emeritus	<p>Five Reasons to Continue Operating the GBO</p> <p>Beyond the importance of NRAO's long partnership with the National Youth Science Foundation in STEM education, there are other important reasons to continue to operate the GBO due to its unique qualities as a center for research and for education:</p> <ul style="list-style-type: none"> • Unlike any other radio astronomy facility, GBO is situated within 500 miles of most major cities in the eastern United States. Travel here is much more possible for more than one half of the entire U.S. population of researchers, students, and teachers. It is situated just a few hours' drive from the nation's capital in Washington, DC, far closer than any other radio astronomy facility of its scope or promise. In short, the Green Bank Observatory has logistic potential as a unique research center and as a unique education center for much of the US population. • The Green Bank Telescope itself has unique capabilities in terms of wavelength and accuracy that few other radio telescopes in the world possess. These capabilities promise types of research that cannot be accomplished elsewhere easily. Much of the telescope's promise isn't even realized yet. 	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
31	d	James	Shuman	Associate Professor of Education, Emeritus	<p>• The establishment of the NRAO radio-quiet zone almost 60 years ago has created a unique and endangered kind of place, unlike any other in the eastern U.S. Its influence goes far beyond simply meeting the research needs of radio astronomers. And this isn't just for the EMF-phobic individuals who have discovered it to be a haven for their needs. The zone has created and maintained a region of exceptional peacefulness, natural abundance, pastoral beauty, and recreational opportunity that is difficult to match throughout any of the states east of the Rocky Mountains. To abandon the quiet-zone designation it would be to deny a major segment of the U.S. population the opportunity to experience the area's particular charm and appeal, thereby impacting the region's potential for tourism and economic stability. Removing the designation would be akin to taking a protected species off the list. Not only could it endanger a place that currently has unique characteristics, but would it would also inflict one more affront to our community psyche about the protection of special places in an increasingly hectic world. It shouldn't happen. As a person who has lived and worked with the NRAO for decades, and for all the additional STEM-related reasons stated above, I urge the committee to recommend the "no action" alternative of continued investment in science-focused operations at the Green Bank Observatory. Any other decision would be an irreparable mistake.</p>	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx
32		Mike	Snyder	Retired teacher and USMCR veteran	<p>As a retired educator I strongly urge that Green Bank be left open. It represents the best efforts of the scientific exploration of outer space not only for our nation, but for the state of West Virginia as well. It is also an important economic asset to the rural Appalachian county in which it is located.</p> <p>The observatory is a neighbor to the National Youth Science camp where the top science scholars from each of the 50 states come together each summer for a week to share their visions into the future of scientific pursuit by the United States. Their proximity in this beautiful mountain setting enhances both of these important entities.</p> <p>The returns for the comparatively small operating budget of the observatory are major accomplishments by any yardstick.</p>	Against Closure	Email	11/9/2016	
33	a	Ricky	Sharp	Principal, Green Bank Elementary/Middle School	<p>As Principal of Green Bank Elementary Middle School, I would formally like to express my concerns over the removal of funding for the GBO by the National Science Foundation. It is my understanding that the NSF is completing an environmental impact study to determine the impact of the proposed changes to the GBO operations. The proposed changes will greatly impact my school as a whole, as our relationship with the GBO goes well beyond our long-term educational partnership. The following is a list of duties and responsibilities that the GBO completes for our school:</p> <ul style="list-style-type: none"> • The GBO staff instructs STEM classes for the student body. <p>As you can see, the GBO is very active in the education of our students and within our community as a whole. Please strongly consider your actions, before removing your funding. Through my personal experience with this organization, I know how deep their roots run within this community. I have realistic fears that your proposed actions, may very well destroy the foundation that this community has built upon since the construction of GBO. Without this well built foundation, I fear that our community, as a whole, will eventually cease to exist.</p>	Against Closure	Email	11/9/2016	letter for the GBO.doc
33	b	Ricky	Sharp	Principal, Green Bank Elementary/Middle School	<ul style="list-style-type: none"> • With the remote location of our school and the size of our student body, the GBO facilities are the only logical location for our emergency evacuation location. • The GBO assisted with the purchase of our emergency radios and assists with any repairs of these devices. 	Against Closure	Email	11/9/2016	letter for the GBO.doc
33	c	Ricky	Sharp	Principal, Green Bank Elementary/Middle School	<ul style="list-style-type: none"> • 16 students (about 6%) of the student body are the sons or daughters of GBO staff. • Members of the GBO staff are active members in the local school board, Local School Improvement Councils, School Calendar Committee, Title I Committee, and serve on the 5yr Strategic Planning Committee. • The GBO staff serves as judges for all of our school fairs; science, social studies, and literacy. • GBO staff has served as tutors for struggling students. • They allow the use of their facilities for county competitions (Math Field Day, Science Fair, and Social Studies Fairs). • The GBO allows use of the facilities for recreation and support of school fundraisers. • The GBO supports the school by offering student incentives at their facilities. This is a huge cost savings to the school due to not having to travel to distant locations that charge fees for use of their facilities. • The GBO staff supports outdoor education and has allowed the creation of a wetland on GBO property. • The GBO supports staff recognition and allow use of the facilities for staff functions. • A large number of the staff use the StarLight Café for lunch. • In addition to the repairs of the emergency equipment the GBO staff also donates their time to complete repairs to PE equipment, electronic equipment, and even school furniture. 	Against Closure	Email	11/9/2016	letter for the GBO.doc
34	a	Greg	Morgan	Local School Improvement Council of Green Bank Elementary Middle School , Co-Chairman	<p>The Local School Improvement Counsel of Green Bank Elementary Middle School, would like to express our concerns over the removal of funding for the GBO, by the National Science Foundation. It is our understanding that the NSF is completing an environmental impact study to determine the impact of the proposed changes to the GBO operations. The proposed changes will greatly impact GBEMS. Mr. Sharp, the Principal of our school, has shared the following concerns with the committee and is worried about the impact that the proposed actions would force upon the school. We too share his concerns and worry about how we would fill the void without the continued assistance from the GBO.</p> <ul style="list-style-type: none"> • The GBO staff instructs STEM classes for the student body. <p>The GBO is very active in the education of our students and within our community as a whole. Please strongly consider your actions, before removing your funding. We as the LSIC committee are worried about the fallout from your actions. We ask that an alternative long term solution be proposed that adequately addresses the issues.</p>	Against Closure	Email and Letter - mailed	11/9/2016	letter for the GBO LSIC.doc

Green Bank Observatory -Written NSF Public Scoping Comments

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34	b	Greg	Morgan	Local School Improvement Council of Green Bank Elementary Middle School , Co-Chairman	<ul style="list-style-type: none"> • With the remote location of our school and the size of our student body, the GBO facilities are the only logical location for our emergency evacuation location. • The GBO assisted with the purchase of our emergency radios and assists with any repairs of these devices. 	Against Closure	Email and Letter - mailed	11/9/2016	letter for the GBO LSIC.doc
34	c	Greg	Morgan	Local School Improvement Council of Green Bank Elementary Middle School , Co-Chairman	<ul style="list-style-type: none"> • 16 students (about 16%) of the student body are the sons or daughters of GBO staff. • Members of the GBO staff are active members in the local school board, Local School Improvement Councils, School Calendar Committee, Title I Committee, and serve on the 5yr Strategic Planning Committee. • The GBO staff serves as judges for all of our school fairs; science, social studies, and literacy. • GBO staff has served as tutors for struggling students. • They allow the use of their facilities for county competitions (Math Field Day, Science Fair, and Social Studies Fairs). • The GBO allows use of the facilities for recreation and support of school fundraisers. • The GBO supports the school by offering student incentives at their facilities. This is a huge cost savings to the school due to not having to travel to distant locations that charge fees for use of their facilities. • The GBO staff supports outdoor education and has allowed the creation of a wetland on GBO property. • The GBO supports staff recognition and allow use of the facilities for staff functions. • A large number of the staff use the StarLight Café for lunch. • In addition to the repairs of the emergency equipment the GBO staff also donates their time to complete repairs to PE equipment, electronic equipment, and even school furniture. 	Against Closure	Email and Letter - mailed	11/9/2016	letter for the GBO LSIC.doc
35		Patricia	Lally	Physician	<p>I, among others in our state, am proud of the world renown scientific research that occurs at Green Bank Observatory. The contributions to the scientific and educational communities are great. "For over half a century, the observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in our state and an important economic engine in the region. The observatory is an important economic asset for the region. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy."</p> <p>In the 28 years that I have lived in WV, I have visited the Observatory many, many times -- trying to tour most summers myself and always to showcase for out of town guests. I care about Green Bank.</p> <p>Please find continued scientific and educational partnerships for the Observatory. Help create and sustain a community respectful and desirous of learning & science, research and achievement for our citizens especially our youth. This is paramount now more than ever given the great hopelessness and lack of educational & employment opportunities that face our young West Virginian's and their families.</p>	Against Closure	Email	11/9/2016	
36	a	Susan	Herold		<p>I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in the areas of education, socioeconomic, health and safety.</p> <p>In addition to all of the above items, loss or even continued funding reduction to the Green Bank Observatory would also have a significant impact on the local school system in two ways – loss of student population could greatly reduce the relevancy of the Green Bank Elementary Middle School, and partners and spouses of Observatory employees make up a significant percentage of educators within the county school system.</p>	Against Closure	Email	11/9/2016	
36	b	Susan	Herold		<p>Contributions from the Green Bank Observatory to this community include:</p> <ul style="list-style-type: none"> • Internships for local high school students, my own son participated in this program a number of years ago. • Teaching and tutoring in advanced mathematics and programming class • Annual support and volunteers (GBEMS and PCHS Career Days; Read Aloud; Literacy Fair judges 	Against Closure	Email	11/9/2016	
37		Phyllis			<p>After spending sooooo much money on the observatory, why close it down NOW? It seems such a waste. AND, was there sufficient information obtained over the past many years to warrant its continued use? It seems such a waste of time, money and effort to close it. IF there was NO information obtained then why has it been used for the past many years?? Someone somewhere surely has correct information as to Greenbanks use and livelihood? And, if I recall the information, it was situated where it is so as to have a low noise environment, yes? Think of the waste of THAT and probably more than I can think of???</p>	Against Closure	Email	11/9/2016	
38	a	Susan	Herold	Library Media Specialist, Green Bank School	<p>I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in the areas of education, socioeconomic, health and safety.</p> <p>In addition to all of the above items, loss or even continued funding reduction to the Green Bank Observatory would also have a significant impact on the local school system in two ways – loss of student population could greatly reduce the relevancy of the Green Bank Elementary Middle School, and partners and spouses of Observatory employees make up a significant percentage of educators within the county school system.</p>	Against Closure	Email	11/9/2016	
38	b	Susan	Herold	Library Media Specialist, Green Bank School	<p>Contributions from the Green Bank Observatory to this community include: Serving on school and school board committees (10 year planning committee; 5 year strategic planning committee; Superintendent's Advisory Committee; Local School Improvement Council (GBEMS, PCHS); Title IV Committee (GBEMS))</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
39	a	Elizabeth	Brown Lockman	Resident	<p>I am a resident of Pocahontas County, West Virginia, a taxpayer, and, perhaps most importantly, a person who is deeply concerned about the United States' future as an intellectual presence on the world stage. As such, I am dumbfounded by the wastefulness and myopia evidenced by what I see as the National Science Foundation's determination to close down the Green Bank Telescope and Observatory.</p> <p>As an astronomer's spouse, I have spent enough time in the company of scientists and other academics to recognize the disingenuousness of alternative Number Two. Exactly how "reduced" is the "reduced NSF funded scope" projected to be? If the reduction is substantial, as I suspect it is, the Green Bank Observatory might as well hold bake sales as bleed itself dry through the endless pursuit of the funding alternative Number Two represents. It might take five years, it might take more, but realistically speaking, the inevitable outcome of alternative Number Two is the annihilation of the Green Bank Observatory.</p> <p>Money is always an issue. Fiscal restraints are a reality. Apparently, so is profligate waste. The Green Bank Telescope is a state-of-the-art instrument currently served by a fully functional Observatory staffed by talented and experienced people. To discard a world-class instrument, to dismiss the potential of the countless scientific discoveries for which the GBT might well be either the best or the only instrument, is so wasteful, so blind to the interests of this country and its scientific community that it seems unworthy of NSF and its mission. That's why I can't help but wonder if other considerations, perhaps of a personal or political rather than an academic nature, were in play when the proposals were made. If there is a chance that I may be right in this, I trust that appropriate steps will be taken.</p> <p>I strongly support Number One, "continued NSF investment for science-focused, no- action alternative," which I understand to mean full funding of the Green Bank Observatory by the National Science Foundation.</p>	Against Closure	Letter - mail	11/9/2016	
39	b	Elizabeth	Brown Lockman	Resident	<p>In reference to the "five preliminary proposed alternatives for the GBT" as cited in the November 3, 2016 edition of The Pocahontas Times, alternatives Numbers Four and Five speak for themselves. Number Three, "operation as a technology and education park," is a travesty of and an affront to the Observatory's unique educational outreach program and its well-documented success.</p> <p>The students who come to the Observatory find the experience intellectually stimulating because it gives them the opportunity to see, and even work alongside, professional scientists, engineers, and computer specialists actually doing their jobs in real time at an active, internationally respected scientific facility. In this, the Green Bank Observatory is of inestimable value. It's also a very far cry from "a technology and education park." My eyes glaze over with boredom at the very thought. Yours probably do, too.</p>	Against Closure	Letter - mail	11/9/2016	
40		Andrew	Morgan		I feel this project should continue to do this work as intended for space exploration	Against Closure	Email	11/9/2016	
41		Unnamed		West Virginia Citizen	After listening for ET for 60 years and no results! Isn't Green Bank Observatory pointless?	For Closure	Letter - mail	UNK	
42	a	Charles	Herr		<p>This is my response to the loss of funding from the National Science Foundation for the Green Bank Observatory. I am a resident of West Virginia. I for one feel that this loss of funding and possible closure of GBO, is a big mistake!! There is more at stake then just the funding of GBO. If funding is lost and the Observatory closes it will have profound effect on those that are employed at GBO plus those that receive income from the tourism business in Pocahontas County. Including the economic impact to the tax base of the County and West Virginia Tourism.</p> <p>It would also be fiscally irresponsible to close or dismantle the Observatory after all of the funds that of been spent on building and rebuilding the Observatory since it's beginning.</p> <p>I do not know all of the science that has occurred or the discoveries that have been made at the Observatory but I do know that it has been beneficial to humanity in some way.</p>	Against Closure	Email	11/9/2016	
42	b	Charles	Herr		<p>As for educational opportunities. By having a facility as the Observatory in eastern West Virginia that is close to Colleges, Universities and secondary schools that are in driving distance of many these schools in Eastern states. It gives these students a real chance to observe and learn a form of astronomy directly. What they learn can spark a students interest in Astronomy or other sciences and engineering.</p> <p>The only thing left I can say please fund the Green Bank Observatory and do not close the Observatory.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
43	a	Majid	Jaridi	Director, NASA West Virginia Space Grant Consortium	<p>At the fall meeting of the Board of Directors of the NASA West Virginia Space Grant Consortium, composed of representatives from 12 colleges and universities and several high tech companies in West Virginia, the Board authorized and approved the submission of this letter of support for the Green Bank Observatory. List of our academic and non-academic affiliates may be found at the bottom of this page.</p> <p>The importance of this facility to science and the state of West Virginia simply cannot be overstated. The science is fascinating and cutting-edge. The Green Bank facility has the world's largest fully steerable radio telescope which is used to detect faint signals from celestial sources. As you know, the Green Bank Telescope (GBT) is one of NSF's newest large telescopes and remains at the cutting edge of astronomy, making ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond Earth. Recently the Russian billionaire Yuri Milner, who was joined on-stage for the announcement by Stephen Hawking, gave \$100 million to UC Berkeley to search for alien life - whether one "believes in aliens or not" this is an incredible private investment in science and the telescopes at Green Bank Observatory are one of only two facilities in the world that can be employed to search for these long range communications. News articles on the gift cite the fact that monetary resources such as this were needed by researchers because the telescopes are in such high demand, that previously they could only get on them 1.5 days per year.</p> <p>We humbly request that you continue to provide the maximum support possible to Green Bank Observatory and remove the untenable and truly unthinkable options of mothballing or deconstruction off the table. Instead of discussing these options, we should be discussing how to elevate the facility back to a national lab status. Green Bank Observatory is truly a national treasure and the best in the entire world.</p>	Against Closure	Email and Letter - mail	11/1/2016	letter of support for Green Bank Observatory.pdf
43	b	Majid	Jaridi	Director, NASA West Virginia Space Grant Consortium	<p>On a more traditional front, the telescopes are the best in the world at detecting fast radio bursts which enable one to find pulsars. Recently several high school students who are part of the Pulsar Search Collaboratory, discovered 6 new pulsars. One student described this experience as "a once in a lifetime experience"; another student got the opportunity to explain pulsars to President Obama at the White House. One can imagine the sense of accomplishment and affinity to science that these students felt - to have made such an amazing discovery as only high schoolers. Their find was recently immortalized in a documentary film called "little green men" (http://lgmfilm.com/). One of our Board members directed a summer science academy for high school students for 15 years in another state and said " If I had easy access to such an amazing scientific resource, I am confident I could have kept 98% of my students as STEM majors and the 2% I did not would have become fans of science for their whole lives."</p>	Against Closure	Email and Letter - mail	11/1/2016	letter of support for Green Bank Observatory.pdf
43	c	Majid	Jaridi	Director, NASA West Virginia Space Grant Consortium	<p>Every year, over 50,000 visitors and 3,500 students get a chance to experience the scientific wonder that is Green Bank Observatory. In addition to needing this facility for the science, the economic impact of Green Bank Observatory on the state is immense -30 million dollars per year. As you are aware, WV is a state in desperate need of economic diversity and development -Green Bank Observatory is a perfect example of the type of opportunity that changes lives. It is also an example of the best America can be - not only does it contribute to innovation and economic prosperity - it has built a community; one that sacrifices modern conveniences like garage doors openers and cell phones for the good of everyone.</p>	Against Closure	Email and Letter - mail	11/1/2016	letter of support for Green Bank Observatory.pdf
44		David	Romine		<p>For over half a century, the Greenbank observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in our state and an important economic engine in the region. Please consider this when you plan to change it status for a place and people who so much depend on this fact , for their livelihood.</p>	Against Closure	Email	11/9/2016	
45	a	Jan	Taylor	Director, Division of Science and Research, West Virginia Higher Education Policy Commission	<p>This letter is to express the support of the West Virginia EPSCoR office and its administrative agency, the West Virginia Higher Education Policy Commission's Division of Science and Research, for the Green Bank Observatory (GBO). In fact, I urge funding at the highest possible level.</p> <p>First and foremost, research conducted at Green Bank could quite plausibly transform our understanding of the universe. In addition, the Green Bank Telescope (GBT) is one of National Science Foundation's (NSF) newest large telescopes and remains at the cutting edge of astronomy, making groundbreaking discoveries in fields as broad as quantum mechanics, the study of gravity and the search for life beyond earth.</p> <p>It is our opinion that it would be fiscally irresponsible to shut down the GBO because it is the focus of several current projects - funded directly by the NSF. In fact, just last year, the NSF awarded West Virginia EPSCoR a highly-competitive \$20 million Research Infrastructure Improvement (RII) grant which supports basic and applied research in gravitational wave astrophysics focusing on early universe cosmology and galaxies.</p> <p>The GBO is integral to the Nanohertz Observatory for Gravitational Waves, or NANOGrav, founded in 2007. As you may be aware, NANOGrav is a consortium of more than 50 researchers at 12 institutions and international liaisons in 11 countries. In 2015, NANOGrav received a five-year, \$14.5 million grant from the NSF. As part of this grant, NANOGrav was designated a Physics Frontier Center. The mission of the Physics Frontier Center is to "enable transformative advances in the most promising research areas. "I believe the GBO remains one of the world's most promising research facilities.</p> <p>Cutting edge research happens at Green Bank which puts West Virginia and the United States at the forefront of international, collaborative, trailblazing science. In fact, the GBT is just as cutting edge as it was when it first began operating in 2001 because it has been continuously updated and improved by the scientists and engineers who work there. As you may recall, in December 2015 scientists at WVU used the GBT to help uncover the most detailed record ever of a Fast Radio Burst (FRB) - the results of which were published in the prestigious journal, Nature.</p> <p>In addition, ceasing science operations at the GBO will directly impact the careers of more than 900 astronomers in the United States, including many who are just entering the field. This number is based on the number of scientists in the nation who submitted formal requests for research time on the GBT in the last year alone.</p>	Against Closure	Letter - mail	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
45	b	Jan	Taylor	Director, Division of Science and Research, West Virginia Higher Education Policy Commission	The GBO is a highly-critical component of this research, which will bolster the Science, Technology, Engineering and Math (STEM) workforce in our nation by providing specialized training in signal processing and electronics design techniques. In addition, just this year, West Virginia University (WVU) received a \$578,000 grant from NSF to provide high school teachers with research experiences using the radio telescopes at the facility.	Against Closure	Letter - mail	11/9/2016	
45	c	Jan	Taylor	Director, Division of Science and Research, West Virginia Higher Education Policy Commission	GBO is also a unique source of distinction for this region of the country. Not only does it bring in an estimated \$30 million annually in economic benefit to West Virginia, it also is the home of the National Radio Quiet Zone which makes the GBT one of the most sensitive radio telescopes in the world. The National Radio Quiet Zone was established by the Federal Communications Commission in 1958 to minimize possible harmful electromagnetic interference to the National Radio Astronomy Observatory. It encloses a land area of approximately 13,000 square miles near the state border between Virginia and West Virginia. Should you have any questions regarding this endorsement of the Green Bank Observatory, please do not hesitate to contact me.	Against Closure	Letter - mail	11/9/2016	
46	a	Rhonda	Hamm	Board Certified Psychiatrist	I wanted to express my strong concerns about the need to keep the Greenbank Observatory operational in Greenbank, West Virginia. This is a very impoverished area. West Virginian's need to have more opportunities to see science and technology than probably any other state. This facility gives children of the region many opportunities to see science in action. The facility's technology, the dedication of staff there to their science, and, most importantly, the incredible educational opportunities for students across the state make this invaluable to our state. Our state takes enormous pride in the scientific research of the observatory and I want us to preserve the observatory for future generations. For over half a century, the observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in our precious state and we need its positive impacts on our state for years to come. I want to help save this important facility. West Virginia strongly cares about Green Bank.	Against Closure	Email	11/9/2016	
46	b	Rhonda	Hamm	Board Certified Psychiatrist	In addition, the observatory is an important economic asset for the region. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy. In this extremely poor state, we need this opportunity.	Against Closure	Email	11/9/2016	
47		Joe	Tekel		My name is Joe Tekel from Elkins, WV and I feel very strongly about supporting the mission of the Green Bank Observatory. This facility is an outstanding feature having national significance. Anyone in or out of WV interested in outer space science realizes the value of the observatory in promoting a better understanding of the universe. I am in favor of the following alternative: Continued National Science Foundation investment for science-focused operations.(No-Action Alternative)	Against Closure	Email	11/9/2016	
48	a	Carolyn	Postelwait		To Whom it May Concern: It was brought to my attention by Senator Joe Manchin that the Green Bank Observatory is in danger of having its funding cut. This is completely unacceptable. West Virginia already trails in education and revenue. We can't afford to fall any further behind! Our children are the future and if we aren't willing to invest in them, then we are in a sad state. I have personally visited the Green Bank Observatory and I was VERY impressed with all that I learned. The staff there do a fantastic job at educating and answering any questions that visitors may have. They are all very friendly and skilled in their jobs.	Against Closure	Email	11/9/2016	
48	b	Carolyn	Postelwait		With all the recent loss of revenue in our state due to the coal mines being shut down, do we honestly need to put any more hard working Americans out of a job??? I think not!!! Thank you for taking the time to read my letter. Please don't hesitate to contact me if I can offer anymore input on this situation. I can be reached at cpostelwait@yahoo.com, Carolyn Postelwait HC 73 Box 3 Valley Head, WV 26294, or (304) 339-3322.	Against Closure	Email	11/9/2016	
49	a	Adam	Taylor	Community Member/Small Business Owner	I am concerned that the socioeconomic impacts of alternative 3-5 will not be taken seriously due to the low population in this area. The amount of GBO employees living in our area has a very extreme direct impact on all of our small businesses. The tourism that GBO currently provides for Pocahontas County is tremendous. This tourism brings money from outside our community and enhance the reach for small businesses like mine. I also have concerns that NSF pulling funding from this site and using that to fund the construction of new facilities is an economic catastrophe. I too work for the Federal Government and tightening funding is not an option now it is a must. So saving eight to eleven million dollars per year and allowing a multi-billion dollar site to fall to the wayside is fiscal irresponsibility.	Against Closure	Letter - mail	11/9/2016	
49	b	Adam	Taylor	Community Member/Small Business Owner	I also feel that the historic value of the numerous telescopes is significant to mankind. Many break throughs in modern science were derived right here in Greenbank, West Virginia and with options 3-5 that history could be lost and/or forgotten.	Against Closure	Letter - mail	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
50		Janet	Ghigo		The history of the development of Emergency Medical Services (EMS) in Pocahontas Co, WV, is closely tied to the presence of the National Radio Astronomy Observatory in Green Bank. ... Early EMTs included NRAO employees Harriet "Harry" Waddell and Zula Taylor as well as NRAO spouses Ann Coe, JoAnn Smith, and Kathy Norrod. Advanced Life Support by the BFD was expanded beyond the services of Medic Theresa Weimer when Ron Weimer, Jr., completed MICP training along with Dwayne Barker, NRAO employee, and Dwayne's wife Rose Mary Barker, who became a paramedic. Ron Weimer, Jr., was instrumental in working with the Observatory to help the BFD in the early days of EMS to run their own dispatch tower on Cheat Mountain before the county had 911. The Observatory had their own fire trucks and an ambulance, but only employees could serve as EMTs. ... Weimer taught a paramedic class in Pocahontas County. This course in 1993-94 allowed squads other than the BFD to offer Advanced Life Services. In 1997, Theresa's last EMT class coincided with the training of NRAO spouse, Janet Ghigo, as an EMT instructor. Since 1998, Janet has taught 20 EMT classes, providing an additional 200-300 EMTs to the county. ...The Authority members include representatives from each of the county EMS squads. Tom Dunbrack, an NRAO employee, represented the Marlinton squad on the first Authority and was its Treasurer.The present Secretary and Treasurer of the Authority is NRAO spouse, Janet Ghigo, representing the BFD. Although the present director of EMS service for Pocahontas Memorial Hospital is from out of county, many of the EMTs and medics employed there started with either Theresa or Janet. Ron Weimer, Jr, and Helen Clark, NRAO spouse, have served and presently serve as the county representative to the state regional EMS organization. In the past 25 years the county Authority has collaborated to bring e-911 to the county, to promote collaboration among the EMS services in the county, and to work to assure the best service possible to all county residents. This past year county squads responded to over 1600 calls, traveling close to 100,000 miles.Paid paramedic service is now available from four of the county's six squads, along with continued volunteer service. A majority of these squad leaders and active members can trace their training back to NRAO spouses and employees. At present the Assistant Fire Chief, Rescue Chief, and Assistant Rescue Chief for the BFD are all NRAO employees or spouses. It is not the main role of NSF to provide community services, but closing the Green Bank Observatory, with the necessary movement of these employees and spouses out of the county, would be a devastating blow to the network built over the past 40 years.	Against Closure	Letter - mail	UNK	
51	a	Samuel	Felton, Jr.	Mayor	I am writing in support of continued full operations at The Green Bank Observatory and in support of the National Science Foundation operations program, as it relates to Section 106 proposed changes. As a citizen of Pocahontas County, I have personally observed the valuable contributions of The Green Bank Observatory. The payroll deposited in the County coffers is a stabilizing factor in an already shaky economy. The support provided by GBO to the Pocahontas County educational programs cannot be overstated. Our school system and social fabric have benefited from the GBO being here. The facility is a tremendous asset to our State, the Green Bank community and Pocahontas County. Tourism is a huge part of the Pocahontas County economy. Literally, thousands of tourists visit each year. Many of our county businesses have grown to depend upon the traffic that we receive, because, of GBO. The loss of this facility would be devastating to these businesses.	Against Closure	Letter - mail	11/9/2016	
51	b	Samuel	Felton, Jr.	Mayor	The Green Bank Observatory has provided opportunities for employees and visiting scientists. The NSF science camps, student mentorships, and teacher work-study programs are unique in their own right. GBO has provided technology support and other assistance to our overall educational system.	Against Closure	Letter - mail	11/9/2016	
51	c	Samuel	Felton, Jr.	Mayor	As GBO has given to us - our people have given of themselves. A long list of residents from my community and personal friends have provided loyal service to NRAO & GBO for up to 49 years.	Against Closure	Letter - mail	11/9/2016	
51	d	Samuel	Felton, Jr.	Mayor	In summary, Pocahontas County is one of the most sparsely populated counties east of the Mississippi River, with an area of nearly 1,000 sq. miles. While the community has welcomed and embraced The Green Bank Observatory, it must be considered, the quiet zone that surrounds the GBO, has also limited other opportunities these last fifty years. If this facility were to cease operations - The quiet zone would be all we had left.	Against Closure	Letter - mail	11/9/2016	
52	a	Kenneth	Woods	Secretary, Rotary Club of Marlinton	The Rotary Club of Marlinton, without any reservations, recommends the full operation of the Green Bank Observatory [GBO] with support from NSF for science focused operations and capitalizing upon additional support through collaboration with interested parties for science and education-focused operations. This Rotary Club believes these viable efforts will be most beneficial for GBO, Pocahontas County and the State of West Virginia. The Rotary Club of Marlinton recognizes the invaluable contributions that the GBO contributes to Pocahontas County and West Virginia's economic and educational well-being. The GBO has 100 full-time employees and approximately 40 part-time summer employees. Additionally, the GBO has approximately 50,000 tourists visiting the facility annually. With a payroll over \$14 million and tourist spending over \$7.5 million, Pocahontas County and West Virginia receive millions of dollars to support education, health, human services, public safety, highways and other public services.	Against Closure	Letter - mail	11/7/2016	
52	b	Kenneth	Woods	Secretary, Rotary Club of Marlinton	The GBO offers numerous educational opportunities for education K-12, post-secondary and post-graduate levels for local, state, national and international institutions and students. As a result, all West Virginia school systems have opportunities to participate through field trips, teacher training programs, science camps and other hands-on educational activities. In closing, The Rotary Club of Marlinton endorses the full operation of GBO through NSF and collaborating parties. The GBO is an invaluable facility for Pocahontas County, State of West Virginia and the Nation. In fact, the GBO is represented as this Rotary Club's banner, being presented to visiting Rotarians from various locations.	Against Closure	Letter - mail	11/7/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
53	a	Rachel	Taylor	Community Member	I have lived my whole life here in Pocahontas Co. except for my time away at collage. After school, I was able to return as a Physician Assistant in the local clinics. If the GBO was to close, I would be impacted in many ways. Below are a few: 1. I would lose patients. I work in a family practice office and provide services to many GBO employees and family members.	Against Closure	Letter - mail	11/8/2016	
53	b	Rachel	Taylor	Community Member	2. I recommend many of my patients exercise. The GBO offers year-round free exercise classes that are open to the public. 3. We utilize the pool and rec area for exercise-based community events in the summer months. U.S Masters Swim Team, the Green Bank Turtles, swims multiple times per week. The Northern Pocahontas Community Wellness Center has hosted multiple triathlons at the rec area site. On a personal nostalgic note, the NRAO was my first employer. When I was 15-17 I life guarded at the pool. Not only did this provide me with money to help support myself, it helped shape my decision to go into healthcare.	Against Closure	Letter - mail	11/8/2016	
53	c	Rachel	Taylor	Community Member	Also, many employees of the NRAO would come to Green Bank School when I was a student there. In particular, in the late 90s there was a program called "Hands on Science" started by many NRAO scientists. One told me "you have such potential, you'll shine like a star". I never forgot those words. I know that regularly the people of GBO are touching lives like they did mine!	Against Closure	Letter - mail	11/8/2016	
54	a	Erica	Engquist	Community Member	I am here today, as a tourism professional, a Pocahontas County, WV resident, a Citizen of the USA, and a human on this planet. Please understand that this is the National Quiet Zone, a rural community (8k people), and a place where galactic science has flourished.	Against Closure	Letter - mail	11/9/2016	
54	b	Erica	Engquist	Community Member	The economic and educational value of GBO, its operations, tours, and science center must be considered during the NSF's environmental impact statement. This facility is a tourist attraction and economic driver for our community. Handwritten notes on letter: - 50k visitors is a lot for our county of 8k residents. - Loss of jobs = loss of tax base	Against Closure	Letter - mail	11/9/2016	
54	c	Erica	Engquist	Community Member	The facility also plays a major role in helping our fellow humans think outside of our galaxy. These telescopes are important, and although thought to be outdated, still show one the advancement in time and landmarks in human knowledge. I highly oppose "mothballing" and/or "deconstruction and site restoration" of this facility due to the severity of impact it will have on me, my community, the State of West Virginia, and our World. Please continue investment for the Green Bank Observatory and its science-focused operations. Handwritten notes on letter: - Teach the masses about the heavens	Against Closure	Letter - mail	11/9/2016	
54	d	Erica	Engquist	Community Member	Handwritten notes on letter: - Deer Creek Valley = Fort Warwick 1774 site	Against Closure	Letter - mail	11/9/2016	
55		Larry and Paula	Garretson	Community Members	Paula and I have been here in northern Pocahontas County for 10 years and have been operating a bed and breakfast the entire time we have been here. We settled on this area because of the importance of tourism, with the GBO being one of the primary destinations for our guests. We have seen a steady increase of visitors, bo tourists staying with us who want to visit the GBO and see for themselves the science and technology that is on display here, and also scientists and engineers who come here to work and stay with us during their visit. Our business depends on the continuation of the GBO's existence and enjoys a good relationship with the GBO and the employees that work here, both at the facility and in the community which we all live. We enjoy 10-15% of our business coming from the existence of the GBO and expect that to grow each year, primarily tourism. We respectfully request that you consider the economic impact on small businesses like ours in our ability to continue to grow and to draw visitors to our beautiful county. We have to say that guests walk in the door, those that are not aware of the GBO existence, to ask about this giant telescope here and must say they are awed and inspired by technology that is located here. Your careful consideration of the personal and economic impact of the GBO on our small community is of utmost importance.	Against Closure	Letter - mail	11/9/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
56	a	Roger	Trusler		<p>This letter is written to strongly encourage the full operation of Green Bank Observatory with continued support from NSF for science focused operations, including further support through collaboration with interested parties for science and education-focused operations. This is the best method for the enhancement of the Green Bank Observatory [GBO] and the Pocahontas County Community.</p> <p>As a citizen of Pocahontas County since 1973, I have personally experienced and observed the valuable contributions that the GBO has contributed to the County's school system, business community and social fabric. Over the years, the GBO has been a valued supporter of Pocahontas County educational initiatives involving math, science and technology. GBO employees and visiting scientists have been actively providing: 1]. opportunities for science camp hands-on experiences, School-to-Work mentorships for high school students, teacher work-study programs; 2]. technology support for computer installation, networking, programming; and 3]. consultations for system-wide troubleshooting regarding technical issues.</p>	Against Closure	Letter - mail	11/3/2016	
56	b	Roger	Trusler		<p>County-wide, the GBO continues to contribute significantly to the Pocahontas County business community. Millions of dollars of employees' payroll flow through the local banks and business community. This influx of dollars plays a critical role in sustaining and creating business and job development. Payroll and sales tax revenue from the circulation of these dollars contribute millions of dollars to support governmental entities locally and within West Virginia. Additionally, thousands of tourists visit GBO each year, spending approximately 7.5 million dollars in the local and State economies.</p>	Against Closure	Letter - mail	11/3/2016	
56	c	Roger	Trusler		<p>The employees and visiting scientist contribute greatly to the social fabric of Pocahontas County. These individuals become involved in community service activities/projects that have positive impact upon adult and youth activities.serving with fire and rescue; coaching little league, soccer, midget football and/or varsity sport; participating in civic, religious, senior citizen and/or school organizations/functions; and devoting volunteers on local boards and/or committees involving education, recreation, health-safety, scouting, 4-H, etc.</p> <p>Illustrating one of many examples involving a major project that GBO provided technical support, Pocahontas County Schools needed assistance with an initiative entitled "Careers in Broadcasting", a vocational project for developing a radio station at Pocahontas County High School. Mr. Omar Boyer, GBO Engineer, worked with Superintendent of Schools, Dr. James Lannan and I for the initial ground-work for FCC and Quiet Zone approval. Due to his dedicated interest, Dr. Gibbs Kinderman, a Doctorate in Communication student at Virginia Tech, approached us about taking over the project. Approval was given and through Dr. Kinderman's dedication and the continued technical assistance of GBO employees, WVMR Public Radio was born and has matured into Allegheny Mountain Radio, serving a Pocahontas Community that previously had no radio station to communicate emergencies, special announcements, community affairs and entertainment for youth and adults, especially senior citizens who are unable to attend social functions.</p> <p>In summary, Pocahontas County is the most sparsely populated county East of the Mississippi River, with an area of approximately 1,000 sq. mi. GBO is a critical component of the educational, economic and social fabric of this rural County and the State of West Virginia. A viable means must be determined for the continued science and education-focused operations of GBO.</p>	Against Closure	Letter - mail	11/3/2016	
57	a	Amy	Haden	Teacher, Charleston, WV	<p>My name is Amy Haden, a teacher from Charleston, West Virginia.</p> <p>I am writing in support on continued funding for the Green Bank facility. Its has played and can continue to play a contributing role in the advancement of scientific knowledge. A great educational facility, like Green Bank, should be repurposed, not scrapped, as such action would be wasteful.</p> <p>Please consider the educational benefits of the facility, for high school, college, and graduate students, and continued value of the facility for research.</p>	Against Closure	Email	11/23/2016	
57	b	Amy	Haden	Teacher, Charleston, WV	<p>As a West Virginia, I want to keep the facility for the direct and indirect benefits it provides to this State which so needs a boost, as the economy continues to decline in our State.</p>	Against Closure	Email	11/23/2016	
58		Dom	Pesce	Student, Department of Astronomy, University of Virginia	<p>My name is Dom Pesce, and I am a graduate student in the astronomy department at the University of Virginia. I am writing to lend my support to the "no-action" option for proposed changes to operations at the Green Bank Telescope (GBT).</p> <p>Even in just the few years that I've been involved in astronomical research, the GBT has proven to be an invaluable resource. As a member of the Megamaser Cosmology Project I've regularly used the GBT for the monitoring and survey components of the project, as well as a critical component of the High Sensitivity Array for very long baseline interferometry (the GBT alone provides nearly half the sensitivity of the combined array). I've also led a couple of related projects, which have made use of the GBT to (1) study the recoil motion of a supermassive black hole in a distant galaxy and (2) study the chemical environment around another supermassive black hole. For this second project in particular, the high-frequency capabilities of the GBT (which are unmatched by any other available telescope) make it the only option for these sorts of "chemical inventory" studies.</p> <p>The efficient dynamic scheduling capabilities of the GBT have also allowed me to use it to make near-simultaneous observations of objects that I've targeted with other (rigidly-scheduled) telescopes. For certain types of highly-variable objects, like the ones I study, waiting a long time in between observations can really hurt the science goals (or even eliminate them completely). These kinds of studies are only possible thanks to the scheduling flexibility afforded by the GBT.</p> <p>Ultimately, the GBT provides a large number of unique science capabilities that have enabled much of my research. Many of these projects would simply not have been possible without it, and the future of my field in the absence of the GBT would be depressingly bleak.</p>	Against Closure	Email	11/23/2016	GBT_support_letter.docx

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
59		Charles	Sheets	Resident	<p>I am a native and resident of Green Bank, WV, and was a Green Bank HS student when word came out in our small rural community about a large project coming that would employ folks. Many rumors were circulating until our High School principal, (1956) called an assembly of students with an official government spokesman to announce that an observatory would be established in Green Bank under the direction of the National Science Foundation. This was welcomed news and was quickly embraced by the community and State.</p> <ul style="list-style-type: none"> For the past 60 years NRAO, now GBO, has been an integral part of our community, providing educational opportunities for young aspiring students from elementary school through graduate school. November 9, 2016, at public scoping meetings, State & Federal Congressional Representatives, concerned citizens, and students, spoke of the importance of the education and scientific future value of continuing support of the GBO. During the October open house dedication and renaming of NRAO to GBO, Scientifics from around the world spoke of the cutting edge technology of the GBT as well as the value of the other radio telescopes and all the discoveries about the universe the past 60 years which have been uncovered at Green Bank. On CBS Morning America November 22, 2016, Neil Degross Tyson, noted Astronomer was interviewed about his new book, A Guided Tour of the Universe and quoted the Frank Drake's theory for search of extra-terrestrial life in the universe. <p>The NSF Mission Statement is as follows:</p> <ul style="list-style-type: none"> To advance the progress of science, a mission accomplished by funding proposals for research and education made by scientists, ... <p>If this is your agency's Mission Statement, the final Environmental Impact Statement (EIS) must make the following finding: Continue NSF investment for science –focus operation. (No Action Alternative)</p> <p>There are many reasons to continue NSF funding. I, as a tax paying citizen am appalled that NSF can turn its back and walk away from the world's largest and most accurate \$95 million radio telescope, the only one of its kind. Instead NSF would rather spend billions of dollars on a project in Chile while turning its back on it US tax paying citizens.</p> <p>Thanks for the opportunity to write in support of the GBO.</p>	Against Closure	Email	11/23/2016	GBO-NSF Support Ltr 11-23-2016.docx
60		Steve	Hard	Software Systems Engineer NASA IV&V Facility Capability Development	<p>In my opinion, mothballing the GBT seems silly and considering the deconstruction of the GBT is just absurd. Would you really want to inhibit another high school student from discovering another pulsar? The observatory is world renowned and the value/benefits it provides to the scientific community and to STEM education should be very obvious. If the telescope needs repairs, it should be fix without question. However, the management of the program may require more than routine maintenance if the future of the observatory is really in question. Please consider the future of the green bank observatory very closely and really look at what you have before making any rash decisions.</p>	Against Closure	Email	11/23/2016	
61		Justin	Spradling		<p>I am writing in support of the Green Bank Telescope. As a native West Virginian, as well as someone with degrees in both science and international affairs, I have unique insight on the growing skepticism and contempt that an alarming and growing number of West Virginians (and Americans across the country) feel toward science. Relative to the rest of the country, West Virginia is greatly impaired in its ability to progress at any significant rate, and relative to the rest of the world West Virginia is essentially unknown. By dismantling the Green Bank Telescope, science literacy in the area will become virtually nonexistent, dying along with the current generation that is literate in scientific fields.</p> <p>The unique abilities of the Green Bank Telescope not only further the interests of West Virginia by bringing federal funds and highly intelligent individuals into our borders, but through these very same principles further the interests of the country at large. International cooperation and education achieved via the Green Bank Telescope should be a shining beacon that we should strive for, and implement more opportunities for, rather than dismantle and de-fund.</p> <p>I urge whoever is responsible understand that the loss of this scientific community in West Virginia will be a drain on both West Virginia and the United States for the foreseeable future. With anti-science information being mandated in school textbooks an extremely alarming frequency, the Green Bank Observatory can remain as a shining symbol of truth and an instrument of knowledge in an area of scientific darkness. Putting out this light, so to speak, will engulf this state in near-permanent darkness. To gain pace in science and math literacy in West Virginia and, by extension, the United States, the Green Bank Telescope must remain operational. Otherwise, the United States will lose yet another battle in the struggle to close the gap between math and science literacy here versus other developed countries.</p>	Against Closure	Email	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
62	a	Rhett	Herman	Professor of Physics, College of Science and Technology Department of Physics, Radford University	<p>Email: I am sending this email to let you know how great the Green Bank NRAO is as an educational resource for my students and our faculty members. I had so much to say that I had to include it as the attached pdf (although I did try to keep it as short as possible). We have visited Green Bank since 2002, with our students benefitting tremendously from the amazing hands-on experience they receive. This is a laboratory experience that our campus –and frankly almost no other – has the resources to replicate. Not by a long shot. The resources at Green Bank NRAO are part of the broader educational and scientific community and that must be taken into consideration with this decision.</p> <p>We have had a number of students throughout the years who have specifically been inspired by the Green Bank trips. One even went on to get her PhD studying interstellar molecules using radio astronomy at the U. of Arizona, taking a position at NRAO in Charlottesville after completing her studies. Our undergraduates have used our data after these trips in a number of Independent Study projects, learning how to use the raw data we obtained ourselves to reconstruct powerful ideas such as the spiral structure of our own galaxy. Several in fact have been so inspired that they have pursued their graduate degrees in not only astronomy in general, but radio astronomy in particular.</p> <p>This is a truly valuable resource for our students, one that simply cannot be allowed to lapse.</p>	Against Closure	Email	11/23/2016	2016-Nov22-NRAO Green Bank letter.pdf
62	b	Rhett	Herman	Professor of Physics, College of Science and Technology Department of Physics, Radford University	<p>I am writing this letter to let you know how the National Radio Astronomy Observatory at Green Bank has positively impacted our students for well over a decade of hands-on learning at this facility. The Radford University Society of Physics Students has been visiting Green Bank for nearly 15 years. We have spent many weekends there touring the facility and – most importantly – using the educationally tasked 40-foot radio dish. Our students have not only enjoyed using this dish, but they have also learned a tremendous amount from that use. For example, we have replicated the observations that showed the spiral structure of our galaxy, mapping out the angular distribution of the great hydrogen gas clouds as seen from Earth’s location. We have observed supernova remnants, interstellar nebulae, and the radio emissions from planets in our own solar system. Ironically enough our students have said throughout the years that they even prefer this altitude-only telescope since it really does give them the chance to delve into the original type of work that led to so many facts that we now take for granted. When asked if they would prefer to have the 40-foot teaching dish updated to a fully-steerable dish, and have the data acquisition automated, their answer is invariably a resounding “No!” From the first moments we arrive for our weekends (yes, during the regular semesters) on Friday evenings to right before we leave on Sunday afternoons our students spend nearly every minute of the 40+ hours that we are there in the 40-foot control “bunker” recording the radio emissions of our universe. As a physics professor I can tell you that it’s a wonderful opportunity for yet another hands-on laboratory experience for my students, one that I simply do not have the resources on our campus to reproduce. In fact, so few campuses have such capabilities that this is truly a broader resource that belong to the greater whole in education in our country. We have been told throughout the years that the current trend in education is towards “collaborative efforts.” The Green Bank NRAO is just that type of broad educational collaboration. I know that many student groups visit Green Bank and experience this amazing resource. I know the reality that budgets are tight and continue to tighten. However, just as with our own Science Day educational outreach to the broader community outside of Radford University, I feel that the Green Bank NRAO serves a greater community and is an irreplaceable resource. I am including images that show our times visiting Green Bank.Our trips to Green Bank have also inspired our students to further their careers in radio astronomy. One of our students went further and obtained her PhD studying radio astronomy, and even worked at the NRAO in Charlottesville for several years. One student received his PhD in solar physics from Montana State University, also having been inspired at Green Bank. Another student is currently in graduate school at Clemson in astronomy/astrophysics after completing a number of independent study projects in radio astronomy while at Radford, including one involving Green Bank data. I am encouraging you in the strongest terms to maintain the funding for the Green Bank NRAO at the current levels such that they can continue their current level of operations. This is the “No-Action Alternative” in the EIS of the NSF. Or at the very least to maintain sufficient funding so that, if necessary, perhaps we could pay a small fee to support their educational work. This resource is too valuable to the broader educational community to let lapse. My students and I would be greatly diminished without it.</p>	Against Closure	Email	11/23/2016	2016-Nov22-NRAO Green Bank letter.pdf
63	a	Duncan	Lorimer	Professor of Physics and Astronomy West Virginia University	<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory (GBO) published in the Federal Register on October 19, 2016. As a Professor of Astronomy based at the Department of Physics and Astronomy at West Virginia University for the past decade, I would like to impress upon you the unique and iconic status of GBO here in the state of West Virginia, and on both the national and international astronomical and science communities in general. Since its construction in 2000, the Robert C. Byrd Green Bank Telescope (GBT) has been at the forefront of many areas of modern astrophysics. In my own research, which is centered around Radio Pulsars, the GBT has made a number of far-reaching contributions which are well documented in the literature. For example, the measurement of a two solar mass neutron star (Demorest et al. 2010, Nature, 367, 1081) has amassed over 1300 citations to date and has profound implications for our understanding of the nature of matter at high densities which are impossible to constrain elsewhere. More recently, the GBT has for the first time detected one of the enigmatic Fast Radio Bursts (FRBs; Masui et al. 2015, 528, 523) and places important constraints on the origin and distance scale of these radio sources.</p>	Against Closure	Email	11/23/2016	GBT.pdf
63	b	Duncan	Lorimer	Professor of Physics and Astronomy West Virginia University	<p>My relationship with GBO dates back 15 years, and in particular over the last decade I have worked very closely with observatory staff since being a faculty member at WVU. Motivated by the promise of finding new pulsars, and my experience at engaging students in understanding the exotic properties of pulsars,... The PSC is now in its 10th year and has been incredibly successful in engaging high-school students in STEM fields and is currently funded by an NSF Advancing Informal STEM Learning (AISL) grant as well as a five-year NSF Track I EPSCoR award. Each year, the PSC has grown by reaching more students, training more teachers, and making more scientific discoveries. So far, the PSC has engaged over 2000 students and 100 teachers in 20 states. The PSC has achieved notable educational goals including reaching first time college-goers and seeing gains in self-efficacy and interest in scientific careers, especially in girls. The GBT is one of the best telescopes for pulsar searching. During the summer of 2007, while the GBT track was being refurbished, the PSC received 300 hours of telescope time, totaling approximately 30 TB of data. Since the initial survey observations, further GBT data sets have been acquired. All these data belong solely to the PSC students. While the PSC is part of a larger collaboration of professional astronomers, it is important to note that the PSC data have not been analyzed by astronomers.</p>	Against Closure	Email	11/23/2016	GBT.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
63	c	Duncan	Lorimer	Professor of Physics and Astronomy West Virginia University	<p>The ownership of the data, complexity of the plots for pulsar searching, and the interactive nature of the science make the PSC unique among student research programs. In our initial model of the PSC, teachers and students came to NRAO Green Bank each summer for periods of between one and three weeks to learn the fundamentals of radio astronomy and pulsars. During the academic year, teachers recruited new students to participate in the PSC through whole-class activities, then student leaders and teachers form teams at their schools to participate in the PSC throughout the year. ... In data analyzed so far, PSC students have discovered seven new pulsars, including one millisecond pulsar and one pulsar in a binary system. The millisecond pulsar, and others that we expect the students to find, are potentially very useful additions to pulsar timing arrays which aim to detect low-frequency gravitational waves. The letter written on behalf of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) addresses specifically the GBT's importance to this project. Over the years, the PSC has received a significant amount of press coverage. One of the original student discoveries, Lucas Bolyard, was featured as a guest at one of President Obama's star parties at the Whitehouse in 2009..... In surveys that we have carried out with PSC participants, over 90% of all respondents said that the PSC had changed them in some way. The strongest motivating factors reported were being involved in scientific research, working with their friends and team-mates, and enjoyment. Students reported gains in knowledge, research skills, leadership and friends from participating in the project. When reporting ways in which participating in the PSC had changed them, students listed changes in career path, appreciation for how science is done, confidence and motivation. We found statistically significant increases in interest in three careers as scientists and engineers a result of participating in the PSC. I hope that this letter has described the critical role that the GBT and GBO in general is playing in developing STEM careers on both a state and National level. The PSC is a unique experience for the students and teachers. Students and teachers work hand-in hand with world-renowned scientists. They gain real-world experience as to what it truly is to be part of a scientific team. In these troubled times, where the political landscape of our country and the world needs, more than ever, the next generation of scientists and engineers, I cannot stress how devastating it would be to these efforts if the GBO site were to be decommissioned.</p>	Against Closure	Email	11/23/2016	GBT.pdf
64		Josh	Smith		<p>I have recently learned from my former astrophysics professor that the NSF is reviewing the current funding of the Green Bank Observatory and is interested in hearing from those who have had experiences at the site.</p> <p>In April of 2013 I had the pleasure of participating in an educational experience as part of my course curriculum for a 400 level radio astronomy lab at Rutgers University. My professor, my classmates, and myself all happily made the 8 hour commute for 2 days of observations using one of the radio telescopes built in the 60's. Learning the history behind the field and engaging with period specific equipment was an indelible moment for me. It was one of the first moments I could actively see myself as a professional scientist, and I can confidently say my peers felt the same.</p> <p>Touring the facilities was also exciting; after using a radio telescope from the 60's there was a newfound appreciation for the control room at Green Bank, as well as the equipment we all took for granted on the roof of the physics building back home in New Jersey. The excitement stuck with me through the years, and as a physics teacher it is a trip that I share with my current students whenever they ask me about the exciting things they'll experience in college.</p> <p>Continued funding of the Green Bank Observatory is an investment in America's future scientists. The team at the observatory did an amazing job of making two dozen 20-something year old students from New Jersey feel like they had the ability to work in a field they love at a professional level, and that is a feeling I try to instill in my students every day. The experiences I had at Green Bank are part of the reason I am a physicist today, and I truly believe every budding physicist deserves the opportunity to see exactly what American ingenuity can produce.</p> <p>I hope my words can help influence the NSF's decision, and I sincerely hope the Observatory can continue its mission with the full support of the US government.</p>	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
65		Marc	Eimers		The day was May 25th, 2008. It was my first day as a "summer student" at the National Radio Astronomy Observatory in Green Bank, WV. .. Before me lay the type of scene that is often portrayed in movies. Scientists, engineers, and technicians sat in front of banks of computers and sophisticated monitoring equipment calling out technical commands to one another. ... For a kid fascinated with math and science, and who had once dreamed of becoming an astronaut, it was the experience of a lifetime. But it was just the beginning. My summer at the Green Bank Observatory would prove to be a significant period of professional and personal growth for me, and it was the observatory and its people that made it possible. Working in concert, the physical capital and human resources at the Green Bank Observatory provided invaluable opportunities for immersive educational experiences. During my time at Green Bank, I learned about the history, theory, and practice of radio astronomy. I learned about the early days of radio astronomy by actually using the 1960's era 40' telescope to observe hydrogen emission lines in the galactic plane. I learned about instrumentation by seeing the inner workings of the backend spectrometers in the control rooms. I learned about programming by creating a graphical user interface to send commands to the 43 meter telescope for my summer observation project. I learned about telescope optics by climbing to the top of the GBT feed arm to see the massive sub-reflector. I learned about cutting edge observational astronomy by participating in a study using the GBT to measure OH emission from a comet. There were countless opportunities for me to apply myself. At the Green Bank Observatory, I learned by doing. While the observatory's facilities provided a unique environment for learning, it was the observatory's staff that created the immersive, hands-on educational experiences that came to define my summer in Green Bank. My direct advisors created a challenging summer project for me to help develop and test a system to observe pulsars with the 43 meter telescope. There also seemed to be a genuine desire among staff members to share the wonders of the observatory with me in meaningful ways to help advance my understanding of radio astronomy...And even as a young undergrad with limited work experience in an office, I always felt comfortable around other staff members as I developed my professional skill set. If I had to sum up in one word the staff and work culture at the Green Bank Observatory, it would be "inclusive." It was the incredible hands-on experiences and the welcoming environment that made the lessons I learned that summer stick with me all of these years. I definitely advanced my education and grew professionally at Green Bank, but I also grew personally. I attribute that growth to my interactions both with the community and with the place itself. As an introvert, I feel perfectly at ease spending time alone by myself. In the secluded, radio-quiet expanse of the Green Bank Observatory and surrounding properties, I enjoyed many a day contemplating the larger questions in life. The GBT, always visible in the distance above the trees, inspires one to look not only up toward the skies, but also to look inside oneself...I heard so many stories about the Observatory from community members who had grown up in the area (my favorite story being about the creative tactics employed one year by staff members in their attempt to remove a larger than normal snowfall from the dish of the old 300' telescope). ...When I left the Green Bank Observatory to return to school, I immediately landed a research assistant position in the astronomy department at my university. It's safe to say that after my time at the Green Bank Observatory, I was more mature, better educated, and better off financially. I know that this is the case for many other individuals whom the Observatory has impacted as well. For all of these reasons, and for so many more that I have not captured here, I urge the National Science Foundation to continue to invest in science-focused operations at the Green Bank Observatory. Thank you for your time and consideration.	Against Closure	Email	11/23/2016	
66	a	Steven	Spangler		I am writing to encourage you to continue the status of the Green Bank Observatory and choose "no action" on the change of the environmental impact of the observatory. I am a professional astronomer with a primary research interest in radio astronomy. Although most of my research in the last few decades has been with radio interferometers like the Very Large Array, I consider it crucial for the science of radio astronomy in the United States to have a large, modern single dish radio telescope with state of the art receivers. To make a specific point, in my opinion most physicists consider gravitational radiation of more fundamental importance than most of what we do in astronomy. The recent detection of gravitational wave bursts by the LIGO observatory has begun the era of gravitational wave astronomy. Precision pulsar timing provides the best way to investigate gravitational waves at much lower frequencies than those accessible to LIGO. I agree with the statement of Dr. Lockman and colleagues that the GBT, with its pulsar receivers, is the pre-eminent instrument for pulsar studies in the world at the present time, and can plan an important role in the exciting future of gravitational wave science. The location of the GBT and the Green Bank Observatory in the National Radio Quiet Zone, a unique resource, strengthens this argument. I believe it should also be emphasized that the GBT was only dedicated 15 years ago, and even more recently has received the instrumentation to permit it to observe at its full potential. I think actions that would close the observatory or change its direction from a basic research installation, and end the career of the GBT would send a message that astronomers are profligate with public funds, and will quickly abandon large and expensive instruments for new ones on a wish list. In summary, I encourage the NSF to continue the current environmental use statement for the Green Bank Observatory, and to continue operation of the Observatory and the Green Bank Telescope.	Against Closure	Email	11/23/2016	
66	b	Steven	Spangler		In my opinion, Dr. Jay Lockman and colleagues have made a convincing argument for continued operation and support of the Green Bank Telescope (GBT) in their article arXiv:1610.02329, stating the case that the NSF "portfolio review" is no longer applicable to the GBT. I read and agree with the points made there that recent improvements to the GBT position it to make important contributions to astronomy such as study of molecular transitions in star formation regions.	Against Closure	Email	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
67		Andrew	Seymour		I think I might hold one of the most unique stances on the Greenbank Observatory (GBO) and its role to the local and scientific community. See I grew up only a county over from the GBO, and maybe because I was a kid the world only seemed 30 miles wide. All your friends, most of your family, and your future seemed to be within that radius. If you were born into a farming family, like most of us were, it was expected that you would continue that tradition. Perhaps you could get a second job "plucking chickens" at the poultry plant at the edge of that radius. It was not until junior high that this radius would be expanded. That is when we took a field trip to the Greenbank Observatory. There we learned about other worlds and the great science that occurs all the way to the edges of the universe. Not only that, there was wonderful and mysterious engineering that made all of this possible. I did not have my own "great expansion" until I saw what was only the base of the newly built Greenbank telescope. Then I realized that science was not just for academics, it was happening just beyond my radius, and would be for many years to come. From thereon the future seemed bright and felt that anything was possible. This sent me down to the road of science, but growing up in an utilitarian world engineering seemed like the only choice, and it was. There were no options to go into any astronomy programs. Even the largest university in the state, West Virginia University (WVU), did not have an astronomy program. This was until 2012, when I was in graduate school, that WVU hired new faculty. Once that opportunity arose, I jumped on it. Now I am currently graduated with a Ph.D. in Astronomy from WVU and working at the Arecibo Observatory as a postdoctoral scientist. Instead of "plucking chickens", I am plucking radio signals from distant stars and galaxies. Yet I find myself back in a 30-mile world, where the NSF has budget constraints and is investigating the uncertain futures of both GBO and AO. Not since my childhood have I felt that my future rest with someone else's decision. These facilities have much greater impact than one can measure. I think it is short sighted to close these facilities for a budget constraints, considering that the Arlington Libraries have a larger operational budget than either one of these sites (https://budget.arlingtonva.us/fy-2017-proposed-budget-2/). If we are willing to spend 13 million to preserve knowledge in one city, why are we not willing to spend that much in the pursuit of it, and with in some of the most economically disadvantaged areas of our country? Even by switching to a partnership model, this creates a "pay-to-play" atmosphere, where only those with the money will be able to use the telescope. I strongly believe this will close opportunities for people in these areas to expand their world, much as I was able to. Therefore, I ask the NSF and those who are writing this report, to expand their own horizons and to look beyond our politics and short-term budget constraints. It is only the power of the government that can ensure equal opportunity, to have the sites open to all, and to explore the ideas that will help all of mankind. Failing under these pressures will cause longer-term effects. I fear that all of these comments will fall on to deaf ears with a predetermined "non-decision" with an "only a 30 mile" view. If we must go down this road, please take these comments with an open scientific mind. "Science is much more than a body of knowledge. It is a way of thinking. This is central to its success. Science invites us to let the facts in, even when they don't conform to our preconceptions." Carl Sagan	Against Closure	Email	11/23/2016	
68	a	Philip	Engelke		I am a graduate student at Johns Hopkins University writing to describe what an important instrument the Green Bank Telescope is and how it has contributed greatly to my research in astrophysics. My research group has been using the Green Bank Telescope to study OH 18-cm emission from the Galaxy, as a new tracer to map the quantity and location of molecular gas. We are finding with this new method that there is in fact much more mass of molecular gas in the Galaxy than is assumed using the traditional methods for tracing it--perhaps twice as much! Our work contributes to an understanding of the total mass of the Galaxy, which is a question of much importance when theories of dark matter are being proposed and tried out, and is also important for better understanding processes such as star-formation that are not currently well understood. Our work is powerful and far-reaching in its applications, but is only possible because of the high sensitivity and low noise levels of the Green Bank Telescope. The Very Large Array in New Mexico, while a powerful radio telescope in its own right, is not ideal for the same purposes, as it has a higher resolution, meaning that longer exposure times are needed to observe our signals, and our work becomes less feasible. The Green Bank Telescope is essential to our exciting research work, and I hope to see it continue to be available for the science community in the future.	Against Closure	Email	11/23/2016	
68	b	Philip	Engelke		I will also add that the Green Bank Telescope has provided me with a great training as an astronomer during my time in graduate school. Unlike some telescopes, where the scientist simply prepares a list of targets for observation and submits it to the telescope operators, who decide when they have time to do the observations, scientists using the Green Bank Telescope have control of what they observe in real-time. It is a more hands-on, involved, decision-making experience, and far better I think for budding new astronomers learning how observing works. As such a powerful tool for groundbreaking research, as well as a resource for educational purposes, I greatly appreciate the funding that the NSF has provided for the Green Bank Telescope thus far, and hope to see it functioning and open to proposals from the scientific community for years into the future. And keeping the top-notch radio astronomy facilities in the United States would be beneficial for the future of American science.	Against Closure	Email	11/23/2016	
69		Shea	Garrison-Kimmel	astronomer	I'm writing to register my support for the continued operation of the Green Bank Telescope (GBT). As an astronomer who grew up in the state of West Virginia, GBT has a very special meaning to me -- it has both served as an early inspiration and glimpse into the field of astronomy, and as a valuable instrument for HI astronomy. GBT serves a vital role in the West Virginia community as one of the places that young schoolchildren can receive exposure to modern science, and particularly astronomy. The impact of their outreach is only strengthened by their location in one of the most impoverished states in the country. Losing GBT would be a huge blow to the astronomy community, as it is able to provide increasingly useful data for near-field cosmology. It would also be an enormous loss to the state of West Virginia, and as a former resident of that state, I wholeheartedly support funding GBT.	Against Closure	Email	11/23/2016	
70	a	Golnoosh	Golpayegani	student	I am a PhD astronomy student at West Virginia University and I'm writing to share how Green Bank Observatory made a huge impact in my life. I'm from Iran and I chose to study at WVU two years ago because of the collaborations with GBO. I never forget the very first moment that I saw this unique telescope on my first trip to Green Bank. I had a chance to get trained on how to observe with the GBT, I participated in a summer school there, and very recently, I proudly took my high school astronomy teacher who is now a science communicator and astrophotographer, collaborating with National Geographic and other organizations there so that he can take pictures of the Green Bank Telescope with the night sky in the background. Every time I visited GBO, I met wonderful staff and scientists there working from the cafeteria to the Jansky Lab, and made so many good friends and memories. I'm impressed with the fact that the community in Green Bank are so connected to each other.	Against Closure	Email	11/23/2016	

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70	b	Golnoosh	Golpayegani	student	<p>Right now, my advisor and I are trying to detect Fast Radio Bursts (FRBs) using the GBT. There is still so much we don't know about FRBs, and the fact that GBT is located in the National Radio Quiet Zone makes this a one of a kind facility we can use to detect these mysterious objects.</p> <p>I really hope NSF considers the amount of science and culture contributed because of GBO, and keeps funding it. I'm sure this investment pays back with wonderful results and accomplishments.</p>	Against Closure	Email	11/23/2016	
71		Nancy	Laroche	visitor	<p>We visited Green Bank a couple of years ago with our entire family and had a personal tour by our niece, Kathryn Williamson, who worked there at the time. Our three young granddaughters were fascinated with the fun aspects of the tour and seeing the observatory. It was great to see them so excited about science and to experience some hands-on astronomy. Perhaps we have a future astronomer in the family! Thanks Green Bank for an educational and fun experience. We hope the observatory continues to be funded.</p>	Against Closure	Email	11/23/2016	
72		Cree	Lahti	resident	<p>As I write this letter I can hear a telescope at the Green Bank Observatory turn from my home office window. How cool is that? That I can live in the mountains, incredibly rural, yet have state of the art technology next door. The opportunities that the GBO brings to the community, to my family, and to me are unique and valued.</p> <p>The Pocahontas County Free Libraries were established fifty years ago this year, and the Green Bank Observatory was incremental in the establishment of the original four libraries, including donating the land on which the Green Bank Library Branch is located. The Observatory provided and continues to provide support, both financially and in-kind, in the form of technical expertise, materials, and helping hands. Additionally, the libraries have benefited tremendously with the resource of people that have moved to the area and stayed because of the GBO. They become our patrons, our volunteers, our board members, and our librarians.</p> <p>Our libraries are centers of information; offering cultural, literary, and historical programming. They are business centers; for sending faxes, making copies, using computers. They offer a social outlet in the mountains; space to hold a meeting, or take an art class, or have a potluck. Not to mention finding the New York Times bestsellers, for free. But our success relies on the success of the communities in which we are located, and with fewer than 8,700 residents in the entire county, the patrons that are affiliated with the GBO in some way (whether directly working at the GBO, or family members, or visitors of the GBO) are one of the reasons we exist. Without the influx of ideas of folks coming from different places, with different experiences, we risk becoming stagnant. We risk becoming obsolete. We risk becoming just another struggling community in rural America.</p> <p>Personally, I feel the GBO is one of the best parts of living in Green Bank. I have chosen to raise my family here, and I selfishly want my son (a thirteen year old, that goes to school in the shadow of the GBT) to be well-rounded. To realize there is a whole wide world out there to explore, to dream, and even if he winds up back where he started, he will have a solid foundation that began in a community that is influenced by astronomy, space, and science. A community that is not afraid to dream big. Thus, as a representative of the Pocahontas County Free Libraries, and as a concerned citizen, I strongly urge the NSF to support option one or option two in future planning regarding the GBO. Thank you for your consideration.</p>	Against Closure	Email	11/23/2016	PCFL letter to NSF.docx
73	a	Bob	Lindner		<p>I'm writing to express my opinion about the fate of the Green Bank Observatory. I spent time at the observatory as a teaching assistant supporting my advisor Prof Andrew Baker (Rutgers). He brought students to site to collect and analyze data every time he taught the Rutgers Observational Radio Astronomy course. I visited the site twice, and finished by PhD in astrophysics in 2008. I currently work in industry as a data scientist in Madison WI.</p> <p>My personal experience visiting the site was an empowering, formative experience, and absolutely one for the students I was helping supervise.</p>	Against Closure	Email	11/23/2016	
73	b	Bob	Lindner		<p>As well as functioning as a world class observatory, the telescope has serves as an important testing bed for new receiver technologies and should be maintained as a site of scientific innovation. I appreciate this because I analyzed data from new experimental receivers like these. They are the pathfinders that allow us to see the farthest into our Universe and break open entirely new fields of astronomy. The pathfinders are possible because of flexible, available, platforms like the GBT.</p> <p>I'd like to see either:</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) or 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 	Against Closure	Email	11/23/2016	
74		Dave	Bruton		<p>I disagree with any option that reduces funding for the Green Bank Observatory. I hope the NSF will continue investing. I also hope to see a collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope and a collaboration with interested parties for operation as a technology and education park.</p>	Against Closure	Email	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
75		Yvonne	Shepard		<p>I strongly urge you to not shut down the Greenbank Observatory in West Virginia.</p> <p>One major justification for no longer funding the Green Bank Observatory was that many of its capabilities were duplicated by the stationary Arecibo Telescope; however, this is not a valid justification. The GBT has unique capabilities not available at other observatories in operation or planned. The GBT is both very large and fully steerable. With its large 110-meter dish, GBT is able to “hear” incredibly faint radio waves emitted from the universe that smaller radio dishes wouldn’t be able to capture. With its ability to move its large dish, GBT can cover 80 percent of the sky. In contrast, the Arecibo Telescope can observe about 33 percent of the sky. Furthermore, stationary telescopes like Arecibo can’t collect the same types or amounts of data as the GBT because of the restricted portion of the sky they cover.</p> <p>Recent discoveries show that GBT is necessary and important. The discovery of gravitational waves has put pulsar research, an area where GBT is well-known, at the forefront of modern astronomy.</p>	Against Closure	Email	11/23/2016	
76	a	Nicolas	Lehner	Dept. of Physics, Univ. of Notre Dame	<p>I am a research associate professor at the University of Notre Dame and I urge you to keep the GBT funded for research. I’ve been using the GBT for constraining the properties of the diffuse gas around galaxies. It has been revealed via GBT and UV observations how important this halo gas is to understand the evolution of galaxies. For example, the ability of the galaxies to form stars depends sensitively on the content and physical conditions of their gas. A galaxy may gain mass from its circumgalactic environment through the infall of intergalactic matter or of remnants resulting from galaxy interactions and lose mass through outflows driven by stellar and AGN feedback. While we do not fully understand this exchange of baryons between galaxies and their environments, we do know that it must result in a net gain of mass if galaxies are to form stars over many billions of years.</p> <p>The GBT has been unique for undertaking this research. It is the sole radio instrument that has a stable baseline and the dish area to detect extremely weak emission of HI 21 cm with a small beam. Typically most of the HI surveys (or even deep HI observations) with current and future instruments other than the GBT have a sensitivity of $2-5 \times 10^{18} \text{ cm}^{-2}$. The GBT can routinely reach a factor >10 better in sensitivity. It can probe a regime in HI column density that is similar to the QSO absorption line surveys, the so-called Lyman limit systems (i.e., with HI column density of $10^{17}-10^{18.5} \text{ cm}^{-2}$), providing a direct comparison between the local and higher redshift universe.</p> <p>While my area of expertise is HI 21 cm emission, the GBT has clearly been always in forefront of technology and science as these two white papers arXiv:1610.02329 and arXiv:1610.09014 show that very well. I therefore urge you to continue sustainably funding the GBT.</p>	Against Closure	Email	11/23/2016	
76	b	Nicolas	Lehner	Dept. of Physics, Univ. of Notre Dame	<p>The GBT has not only been critical for my research, but also for the continuing formation of my postdocs and grad students. With its easy access, hands-on on the observation, the GBT has provide a unique experience to my students in this generation of queue mode observations.</p>	Against Closure	Email	11/23/2016	
77	a	Lewis and Rose Ann	Harvey	Resident	<p>My wife and I are writing to express our feelings about keeping the Greenbank Observatory open. My wife is a school teacher and has taken several groups of children on field trips to the observatory. Not only is it educational, it is also encouraging to youth of our state to expand their knowledge of this wonderful facility and it opens their minds to the world of science.</p> <p>I am a native West Virginian that has visited the observatory many times over my lifetime. It never ceases to amaze me as to how much knowledge is readily available to the visitor. I also believe that it would be detrimental to the science community, as well because our future explorations of space and beyond wouldn’t have the advantages of what knowledge the observatory can provide. I cannot emphasize enough on how much the educational aspects would be taken away from our children and adults as well, if the facility was to close.</p> <p>I was wondering if any research has been done to check on grants or to see if money is available from outside sources? In closing I hope that every effort will be made to keep the observatory open.</p>	Against Closure	Email	11/23/2016	
77	b	Lewis and Rose Ann	Harvey	Resident	<p>With tourism being a large factor in West Virginia and with the downturn of our economy, to lose the observatory would be devastating to this region.</p>	Against Closure	Email	11/23/2016	
78	a	David	Hogg		<p>I write to recommend that upon completion of the NSF EIS for the Green Bank Observatory the alternative “Continued NSF investment for science-focused operations (No-Action Alternative)” be selected. I make this recommendation based on a number of considerations.</p> <p>First, the Green Bank Telescope (GBT) is highly productive, and is recognized as a world-class research instrument. It is central in the quest to evaluate the Hubble Constant by independent means; it is central in the effort to measure gravitational waves at wavelengths different from those being detected by LIGO; it is an important tool in the study of forming stars and their associated debris disks; and it offers the opportunity to explore the manner in which planets might form.</p>	Against Closure	Email	11/23/2016	
78	b	David	Hogg		<p>Second, the Green Bank Observatory (GBO) has been an outstanding place for the furtherance of science education. It has numerous programs, a few of which I cite here. These include the enrichment programs for teachers of science at the public school level; the support provided annually to the National Youth Science Camp, support which began with the founding of the Camp in 1963; support for the science programs offered by others, such as Chautauqua; and the continuing program of science education provided to the thousands of visitors who come to the GBO each year.</p>	Against Closure	Email	11/23/2016	

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78	c	David	Hogg		<p>Third, the GBO has been of great importance to the local community. When the Observatory first came to Pocahontas County there were a number of other major employers, but with the passage of time most have closed. That the work force at the Observatory continues has provided important stability to the County. In addition, many of the staff have contributed personal effort to the betterment of the County, be it by serving in County government, or by initiating and then supporting the widely-recognized County library system, or by providing guidance in science and sports programs. As an interesting historical note, it was an Observatory employee who worked with others in the County to persuade the State to take over the Cass lumber works and lumber railroad and turn it into the hugely successful state park.</p> <p>I believe that when the contributions of the GBO in science, STEM educations, and community support are evaluated, it will be obvious that the continued NSF support of the GBO is both necessary and wise.</p>	Against Closure	Email	11/23/2016	
79	a	Charles	Kerton	Associate Professor Department of Physics & Astronomy Iowa State University	<p>The 2017 version of the Green Bank Telescope provides US-based astronomers an important, and unique, capability at millimeter wavelengths that should not be lost. In the interest of brevity, I will not reiterate the excellent points made regarding the changes in the GBT's capability at high-frequencies (millimeter wavelengths) since 2012, and the resulting science that this has enabled: see Lockman et al. (arXiv 1610.02329) and Bally et al. (arXiv 1610.09014) respectively. To their points I will simply add that, as an observational astronomer interested in the area of massive star formation, the capability of the GBT to examine the large-scale environment surrounding regions of massive star formation is very exciting, and I think will lead to an understanding of what allows massive stars to form.</p>	Against Closure	Email	11/23/2016	
79	b	Charles	Kerton	Associate Professor Department of Physics & Astronomy Iowa State University	<p>The GBT will also play a crucial role in providing low-spatial frequency information for many ALMA observations. The importance of short-spacing information in radio astronomy is sometimes treated as an afterthought, but it can be crucial for the correct astrophysical interpretation of objects. My personal research has involved radio observations of HII regions (the ionized gas surrounding massive stars). Without short-spacing information, these regions can look completely different, and it is very easy to draw incorrect conclusions regarding the astrophysics involved.</p> <p>Shutting down the GBT (options 3, 4, and 5 of the EIS) would completely snuff out the potential of GBT in the area of mm astrophysics just as it is starting to gather momentum. Option 2, while preferable to option 3, 4, or 5, is of concern to me since it will clearly limit access to the GBT. As a researcher based in a small astronomy group, I need competitive open access to national research facilities in order to work effectively. I strongly encourage NSF to look at the 2017 version of the GBT when considering options for the Green Bank Observatory, and I hope they will support option 1 – continued NSF investment for science-focused operations.</p>	Against Closure	Email	11/23/2016	
80		Trupti	Ranka		<p>I interned at GBO as a graduate student during summer of 2012, 2013 and 2014. Now I work as an engineer at Giant Magellan Telescope, one of the next generation ELTs. The opportunities provided to me by GBO during graduate school, has directly resulted me in getting an opportunity to work at an ELT.</p> <p>I am one of many examples as to how exceptional facilities like GBO can train astronomers and engineers for the next generation. No other experience in my academic career would have prepared me for my current job as much as my work at GBO.</p> <p>Though the cost of 10 million dollars/year is a large sum needed to operate GBO, it is a very vital and relatively small cost if it helps train engineers and astronomers to lead billion dollar astronomy projects of the future. Hence it is my sincere request to NSF-AST to try its best to continue to fully fund GBT which will allow its open access to engineers and astronomers around the world.</p>	Against Closure	Email	11/23/2016	
81		Jim	Braatz	astronomer	<p>I am writing to express my strong support for maintaining the Green Bank Telescope as a general-purpose, NSF-funded research facility. The GBT is doing cutting-edge research, and I would like to particularly emphasize in this letter the unique and essential contributions that the GBT is making and will continue to make in the fields of cosmology and galaxy evolution. The GBT is helping us understand Dark Energy, and it is unique in its ability to measure masses of extragalactic black holes with the highest precision. With regard to the Environmental Impact study being conducted by the NSF, I would like to voice support for "Continued NSF investment for science-focused operations", the No-Action Alternative. I am an astronomer at NRAO in Charlottesville, Virginia. Here I lead the Megamaser Cosmology Project (MCP), which is a multi-year, international effort to measure the Hubble Constant, H₀. The MCP uses observations of nuclear water vapor megamasers to measure galaxy distances and thereby determine H₀, leading to a powerful test of cosmological models. ... Current measurements using standard candles disagree with the value of H₀ predicted from exquisite observations of the Cosmic Microwave Background in the context of the standard cosmological model. Either the cosmological model is wrong or there are unrecognized errors in the observations. We are addressing this controversy by measuring H₀ independently from all other observations and assumptions. Ours is a straightforward, geometric method that determines H₀ in one step, with no "distance ladder" or uncertainty related to standard candles. So far our observations are in agreement with the prediction of the standard cosmological model, but we must push the observations to improve our scientific conclusions. With ongoing observations, we will test whether Einstein's Cosmological Constant is the "dark energy" that explains the accelerating expansion of the universe. Besides this fundamental contribution to cosmology and physics, the MCP is also measuring gold-standard masses of supermassive black holes as a critical secondary science objective. These measurements are being used to understand galaxy formation and the role of the central supermassive black hole in galaxy evolution. With the GBT as the critical element of a VLBI array, we map gas directly in the sphere of influence of the central black holes. No other technique measures extragalactic black hole masses as precisely. Our observations are being used to demonstrate critical difference in the role of the supermassive black holes in disk galaxies, as compared to massive ellipticals. These are two examples of the cutting-edge research enabled by the GBT. I would like to emphasize that these studies were *revolutionized* by the GBT because at the critical water maser frequency, 22 GHz, the GBT is by far the most sensitive single-dish telescope on Earth. In the past decade, nearly all new megamasers have been discovered with the GBT. Because of its sensitivity and location, the GBT is the most critical antenna for VLBI follow-up studies. The MCP was made possible by the GBT. Future studies of megamasers rely on the GBT remaining available as a general-purpose science instrument. The MCP is an international project with critical contributions from senior astronomers as well as students and postdocs. ... In summary, I would like to express my wholehearted support for keeping the GBT available for open science. I strongly advocate continued NSF investment for science-focused operations. Studies of megamasers represent one example where the GBT is revolutionizing a field at the forefront of research. Continued involvement by the NSF is essential to push these investigations forward. Please don't hesitate to contact me for more information.</p>	Against Closure	Email	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
82	a	Edward	Murphy	Associate Professor of Astronomy University of Virginia	<p>I am writing to urge the NSF Division of Astronomical Sciences to continue funding and support for the Green Bank Observatory (the No-Action Alternative). In particular, I believe it is a mistake for the NSF to divest itself of the Green Bank Observatory, and I believe full divestiture will do serious harm to astronomical research and STEM education in the United States.</p> <p>First, as a scientist, I believe that the Green Bank Telescope is a unique, world class facility. The GBT has capabilities that are found in no other telescope in the world. For example, in my area of work, neutral hydrogen studies of the Milky Way, the unblocked aperture of the GBT is essential to providing spectra free from contaminating stray radiation. In terms of ability to survey low column density gas in the Milky Way, the GBT is unsurpassed. In addition, the GBT is the only single-dish radio telescope available to the general community in the United States that can observe the majority of the Galaxy. Eliminating, or even significantly reducing, the available observing time for basic research will negatively impact many research programs.</p> <p>I know that they all left with a greater appreciation of the research conducted there and the agency that made the research possible.</p> <p>In closing, I strongly urge the NSF to continue investing in the science and education focused operations of the Green Bank Observatory.</p>	Against Closure	Email	11/23/2016	
82	b	Edward	Murphy	Associate Professor of Astronomy University of Virginia	<p>Second, as an educator, I believe that reducing support for the Green Bank Observatory will significantly harm science education and outreach efforts in astronomy. The Green Bank Science Center provides an array of education and public outreach programs that are important not only to the local community, but to the nation as a whole. I have personally participated in teacher professional development programs, research experiences for undergraduates, programs for visiting educational groups including school groups and scout troops, and informal visits by the general public. In the case of teacher professional development programs, I have acted as the astronomy instructor for a few of the NSF funded RARE-CATS programs. The teachers, from across the East Coast, found the program to be a life changing experience. In addition to their gains in content knowledge, the teachers left with increased skills and improved attitudes toward science teaching. Most of them told me it was the best professional development they had ever had. The other education and outreach programs in Green Bank have had similar impacts on other groups.</p> <p>Finally, let me point out that the education and public outreach programs are an excellent venue for promoting the work of the National Science Foundation. Over the last 25 years, I have brought a few dozen Boy Scouts, their parents and adult leaders, and other adults, to visit the Green Bank Observatory. For the vast majority of these visitors, it was their first experience with a facility funded by the NSF and the first time they have connected the NSF to specific scientific research.</p>	Against Closure	Email	11/23/2016	
83		Anna Belle	Sheets Gillespie		<p>I taught sixth grade at Green Bank Elementary School in 1959-1962, and the Green Bank Observatory was in operation then. Scientists and their families lived on the observatory campus; their children attended our local elementary and high school. The Green Bank area was primarily an agricultural and forestry community. However, the students from the observatory brought diversity and fresh interest to the classrooms. Their presence was (and continues to be) a valuable boost to the intellectual climate of the school, and to discontinue the observatory would have a negative impact to the school system in Pocahontas County.</p> <p>Much money and knowledge have been invested in the functions of the observatory, and to ditch this unique operation that has the possibility of augmenting mankind's understanding of space seems to me to be not only wasteful but also short sighted. What is to be gained by abandoning the observatory? Isn't everything in place to make discoveries that will have great impact on human survival in the future?</p> <p>I hope the NSF will continue to support the important research underway at the Green Bank Observatory in West Virginia.</p>	Against Closure	Email	11/23/2016	
84	a	Preston	Ozmar, III	Adjunct Science Professor Wave Leadership College	<p>I just wanted to send you a note about the Green Bank Observatory. I know that others have sent you messages also.</p> <p>Each year when I visit the Green Bank Observatory I am greatly inspired and I bring that inspiration back with me and inspire others, especially my students, to learn how to use science to understand the amazing universe surrounding us.</p> <p>I have seen classes of middle or high school students learning in classrooms at the Observatory and I read an amazing paper written by middle school students (I do not recall the name of the paper but I am sure I can obtain a copy if you would like to have one).</p>	Against Closure	Email	11/23/2016	
84	b	Preston	Ozmar, III	Adjunct Science Professor Wave Leadership College	<p>I read the paper entitled "The Case For a Publically Available, Well Instrumented GBT Operating at 20 - 115 GHz.". It is well written and illustrates some of the many scientific applications of the GBT.</p> <p>I see success at Green Bank in both the scientific and the educational missions and I recommend that full funding be established for them. It is an investment that has paid off in the past and I believe it will continue to pay off in the future.</p>	Against Closure	Email	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
85	a	Jeremy	Darling	Associate Professor of Astrophysics Astrophysical and Planetary Sciences University of Colorado, Boulder	<p>I write this letter to express strong support for the No-Action Alternative for continued NSF investment for science-focused operations.</p> <p>The NSF AST portfolio review measured the GBT against the metrics and goals detailed in the New Worlds New Horizons (NWNH) decadal survey, which was beyond the scope of the survey. The 2010 survey was explicitly tasked to address future facilities, taking current facilities *as given*. The NSF portfolio review deliberately misused NWNH and the review's findings should be regarded as invalid and unsupportable.</p> <p>As the NSF AST portfolio review itself said, "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm". Since these words were written, the GBT has become the world's most sensitive single-dish radio telescope at millimeter wavelengths and provides a crucial multiplier for NSF-supported ALMA science.</p>	Against Closure	Email	11/23/2016	
85	b	Jeremy	Darling	Associate Professor of Astrophysics Astrophysical and Planetary Sciences University of Colorado, Boulder	<p>The GBT is a best-in-the-world facility, enabling unique and crucial scientific capabilities (as outlined in recent white papers). Ending or curtailing NSF support for science-focused operations will significantly negatively impact U.S. competitiveness in STEM fields. I personally have trained many students (undergraduate and graduate) and a postdoc on the GBT --- nearly all members of traditionally under-represented groups in astrophysics -- and their access to the facility enabled them to continue on their career paths. Several undergraduates are now in PhD programs in astrophysics, and the postdoc now works at NASA JPL.</p>	Against Closure	Email	11/23/2016	
85	c	Jeremy	Darling	Associate Professor of Astrophysics Astrophysical and Planetary Sciences University of Colorado, Boulder	<p>The science the GBT enables is forefront, ground-breaking, and is crucial to the scientific endeavor. It is a testbed for innovation: scientific, technical, and educational. There is no alternative to the GBT for many of its scientific constituencies, and choosing any option other than continued NSF support for science will be a deliberate truncation of many exceptional careers, particularly in the area of gravitational wave detection in the epoch of LIGO and multi-messenger astronomy. One of the NSF's new "big ideas" initiatives is "Windows on the Universe: the Era of Multi-Messenger Astrophysics." If this is indeed a goal of the NSF, then ending scientific support of the GBT is a contradictory action.</p> <p>The GBT, unlike most of the other facilities recommended for divestment, is unique, is still in its scientific prime, and multiplies the NSF's modest investment, supporting the guiding principles of the NSF as a federal agency.</p>	Against Closure	Email	11/23/2016	
86		David	Buchner		<p>I wouldn't have realized that The Green Bank facility was endangered — or, frankly, that it was in West Virginia, to be honest — had I not read it on Homer Hickam's Facebook page. The name was familiar, but I confess I didn't know where it was.</p> <p>In these weird times, we need to be safeguarding our scientific and technological assets. Not pruning or retiring them.</p> <p>I'm nobody special: just an American taxpayer and space fan. But I hate to see it when resources and iconic structures like this are brushed aside. Were it up to me, we'd keep the telescope.</p>	Against Closure	Email	11/23/2016	
87		Ali	Printz		<p>As a life long West Virginian, it has always been a struggle for us to break out of the stereotype that others states and the nation as a whole seem to pin on us. It is important that we break out of this mold continuously and show the rest of the country and world that we are educated, nature conscious, and can be an important part of scientific research. The Green Bank Observatory is an amazing place and has contributed enormously to astronomy and should continue to do so indefinitely. It would be a terrible loss that we might never be able to recover from to see such an amazing place go inactive.</p>	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
88		Bill	Mullin		<p>From letter: Thank you for the opportunity to provide my comments regarding the 19 October 2016 Federal Register Notice regarding the National Science Foundation's Intent to Prepare a Public Impact Statement regarding the operation of the Green Bank Observatory in West Virginia.</p> <p>I retired from Merck and Co., Inc. after 37 years as the Vice President of Global Vaccines and Sterile Quality Operations and currently volunteer at the American Museum of Natural History in NY as an Explainer in the Rose Center for Earth and Space and a Tour guide and Docent hosting in part the five million visitors annually from all over the world. I have had a great interest in Science throughout my life and obtained a M.S. Degree in Astronomy as part of fostering a greater understanding of science in people of all ages in my retirement.</p> <p>I have visited the Radio Astronomy Operations in Green Bank, WV largely through a professional development program for college teachers that has been coordinated through the University of Dayton (Chautauqua) multiple times over the last 10 years. In my opinion the NRAO Green Bank Facility, now the Green Bank Observatory, remains a vital and premier scientific research facility with the largest steerable radio telescope in the world (GBT). Because of its unique capabilities, the Green Bank Observatory is well suited to complement the ALMA facilities in Chile for the US Scientific Community in pioneering research and I believe given the pioneering research at LIGO, where gravitational waves were discovered; the GBT is at the forefront of modern astrophysics with its research focus and capability in pulsar observations using nano-HZ gravitational radiation.</p> <p>In carefully reviewing the five options provided in the Environmental Impact Statement, I fear that as presented, two options create the immediate or short term destruction of the facility. Two options re-purpose the facility as a technology park which does not reflect the scientific research capability that would be sacrificed for modern astrophysics, or one option provides an over-reliance on future partnerships that will create a very uncertain outcome/sustainability. It is my deep hope that our Country will take a longer view on the need for this historic and scientifically advanced facility and provide for a modified Alternative #1 providing budgeting at 100% levels by NSF while actively pursuing partnerships with other partners to create new areas of interest while offsetting costs of operation.</p> <p>It saddens me to realize the NRAO Facility created in Green Bank West Virginia in the 1950's was executed to ensure the United States role in Radio Astronomy research would narrow the gap that existed in the US vs other countries. Indeed, the leaders at that time took a long view with respect to pioneering scientific research and the benefits that follow. For 60 years, the team at Green Bank and their pioneering spirit has made wonderful scientific contributions to increasing our knowledge of the universe and did it in a way that also benefits the local community and state of West Virginia. Because of the importance of this facility to scientific research in the United States, I will be providing copies of my comment to our elected officials from the region and other Congressional representatives on science and appropriations committees.</p>	Against Closure	Email	11/23/2016	NSF EIS Public comment.docx
89		Bill	Mullin		<p>Additionally, the Green Bank Observatory plays a vital outreach role in advancing Science, Technology, Engineering and Math with students of all ages coupled with the thousands of visitors they host annually. Their educational camps, courses, Science museum and staff set the right path and commitment to have a profound impact on all visitors and students at the Green Bank observatory Campus. To risk or compromise the presence of this world class facility in the middle of very rural West Virginia, in my opinion would also be a devastating blow to the local community and region which I cannot quantify.</p> <p>I sincerely hope that we do not close the book on the Green Bank observatory, given the wonderful chapters they have written in modern astrophysics of radio astronomy and the intensity of their outreach in Science, Technology, Engineering and Math for students of all ages.</p>	Against Closure	Email	11/23/2016	NSF EIS Public comment.docx
90		Dan	McCarthy	Director, Boy Scouts of America Summit Group	<p>It recently came to my attention that the future of the Greenbank observatory is being actively discussed. It is my hope that these discussions will lead to continued funding for the facility.</p> <p>As the Boy Scouts of America continues to expand its STEM- related program offerings, the Summit Bechtel Reserve expects to serve as a key component of those offerings. The Greenbank facility has consistently been seen as an attractive asset in supporting those programs as they evolve over the next several years. It would be disappointing were this facility and the potential advantage it provides for educating youth in this important scientific research area to no longer be available in proximity to our reserve here in Southern West Virginia.</p> <p>I hope you will take this into consideration as your discussions proceed.</p>	Against Closure	Email	11/23/2016	
91		Stefanie	Muhle		<p>I was appalled to learn that the future of full scientific operation at the Green Bank Observatory is being questioned. This instrument with its unique sensitivity and suite of receivers has produced numerous valuable results in the past and is expected to continue to do so.</p> <p>Anything else but continued full scientific operation would effectively rob the North American astronomical community of a valuable means to conduct their research and compete on a global scale.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
92		David	Blank		<p>WHY I STRONGLY URGE CONTINUING NSF FUNDING FOR THE ROBERT C. BYRD GREEN BANK TELESCOPE</p> <p>I am writing this letter to express my strong support for continuing NSF funding of the Robert C. Byrd Green Bank Telescope (GBT). As an astronomer affiliated with a university which has no connections to any private astronomical facility, public facilities like the GBT make it possible for scientists like myself to conduct research as the excellence of the project is the only criteria used in granting observing time.</p> <p>The sensitivity and frequency range of the GBT is greater than that of any existing radio telescope making it possible to do research that is harder or impossible to do elsewhere. For example, my research has been on searching for radio emission from exoplanets. Recently my collaborators and I have used the GBT to search for 43 GHz SiO MASER emission from the "disintegrating" exoplanet KIC 12557548 b. KIC 12557548 b orbits its star with an orbital period of only 16 hours. It is also a member of a class of exoplanets discovered from Kepler telescope data that are distinguished both by having periods of under a day and having variable transit profiles which are caused by outflowing material from the planet. The planet is so close to its star, that its surface gets hot enough to be vaporized and with the material expelled from exoplanet by the stellar wind. We used the GBT to search for MASER emission from the SiO molecule as the physical conditions present were very similar to where such emission has been observed elsewhere. Detecting such emission would have been the first direct detection of the composition of a rocky exoplanet and would have given much information about the origin and evolution of such objects.</p> <p>The GBT is the most sensitive telescope anywhere for conducting these observations and the only other telescope that could have been used was the less sensitive JVLA. My colleagues and I are looking forward to the launch of the TESS satellite in 2018. TESS will be searching for transiting exoplanets around bright, nearby stars and it is estimated that it will find 20,000 exoplanets no further away than about 60 parsecs. By comparison KIC 12557548 b, like the majority of the exoplanets found from Kepler data, is at a distance of roughly 500 parsecs. If exoplanets like KIC 12557548 b are as common in TESS data as they are in Kepler data, then a few dozen will be found and their much nearer distance will make any MASER signal stronger by at least a factor of 70 from what they would otherwise be if they were at the distance of KIC 12557548 b thus making a detection more likely.</p> <p>The GBT was commissioned in 2001, eleven years before the surprising discovery of close-in exoplanets like KIC 12557548 b. In the decades to come, I have no doubts that other new and surprising astronomical discoveries will continue to be made. I also have no doubts that the sensitivity and frequency range of the GBT will make it important in understanding such discoveries which is why I urge the NSF to continue to fund the GBT at a level that is at least as great as present.</p>	Against Closure	Email	11/25/2016	GBT_Funding.pst
93		Karen	Masters	Spokesperson for the Sloan Digital Sky Survey Reader in Astronomy and Astrophysics (equiv. to US Associate Prof)	<p>I am writing to express my strong support of continued funding on the Green Bank Telescope as a valuable asset to both US and international science.</p> <p>I first made use of the Green Bank Telescope almost 10 years ago as a postdoctoral researcher at Harvard University. In this project I observed a large sample of nearby galaxies with GBT with the aim of detect their radio 21cm emission to measure the rotation of the galaxies. These data were published as Masters et al. 2014 , and combined with other similar data made an essential contribution to our understanding of the motions of galaxies in the local Universe via Davis et al. 2011 (http://adsabs.harvard.edu/abs/2011MNRAS.413.2906D), Hong et al. 2014 (http://adsabs.harvard.edu/abs/2014MNRAS.445..402H). These data are still being used today by my collaborators in Australia.</p> <p>I currently am making use the Green Bank Telescope to make similar observations of a sample of nearby galaxies which have been selected to be observed with a new resolved spectroscopy instrument in the optical-NIR part of the spectrum by the Sloan Digital Sky Survey. This "MaNGA" survey will be the gold standard for local galaxy observations for years to come, observing the motions and make-up of stars and ionised gas in 10,000 nearby galaxies. However by only observing in the optical we miss vital parts of the ingredients of galaxies. Making use of GBT to followup these galaxies and measure their neutral hydrogen content (via it's 21cm radio emission) is an extremely valuable contribution to add to our understanding of how these galaxies form stars, and process their interstellar medium.</p> <p>My team was granted 200 hours to begin this work at the beginning of this year; we will publicly release those reduced data as a Value Added Catalogue in the SDSS Data Release 14 (planned for July 2017). We heard only just over a week ago that we have been granted a further 700 hours to continue this programme through to the end of 2017. Put together these 900 hours of GBT filler time (when the weather is too poor for higher frequency observing) will allow us to measure neutral hydrogen gas content in over 1500 galaxies in the MaNGA sample which are in parts of the sky inaccessible to any other radio telescope which can make observations of this quality.</p> <p>Green Bank is by far the best northern hemisphere telescope to followup the MaNGA sample, and as such its contribution to the science of understanding how galaxies in the nearby Universe formed, process their gas into stars, and cease star formation to become passive, dead galaxies is essential to our developing picture of the Universe we live in. Making these data public via the widely used SDSS database will ensure they provide a legacy dataset for years to come.</p> <p>I urge you to chose the "no action" option and continue to support the Green Bank Telescope as the cutting edge astronomical facility it is.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
94	a	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I am a scientist at the National Radio Astronomy Observatory, and have worked with the Green Bank Telescope for over 12 years as a student, telescope user, and NRAO staff member. My first involvement with Green Bank was as a graduate student at the University of California, Berkeley; as part of my PhD research, I helped design, install and commission a new instrument to record pulsar data from the Green Bank Telescope. This ended up being used not just by me, but by many other researchers for their own projects. Green Bank is one of only a few US facilities where students can get this experience of being deeply and meaningfully involved in instrumentation research and development. In my case, this experience was directly responsible for my continuing on with a career in astronomy. In addition to the scientific capability of the telescope, Green Bank continues to provide unique opportunities for students in our program – at levels from high school through PhD – to become directly involved in high-profile, exciting scientific research. Several scenarios proposed for review include ending science operations at Green Bank. These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. This would come as other countries around the world are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves (e.g., the FAST telescope under construction in China). Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. This will result in talented young scientists leaving the US to pursue careers in other countries that are expanding rather than reducing their investment in this cutting-edge field of research. Over the long term this will have negative consequences for the entire field of astronomy in the US. The GBT and Arecibo are currently the best telescopes in the world for NANOGrav science and with continued NSF support they will remain so for at least the next decade.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
94	b	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	Furthermore, the National Radio Quiet Zone ensures an environment free of many of the man-made radio emissions that can interfere with these sensitive measurements.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
94	c	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	The research program I became involved with as a student has grown dramatically over the past 10 years into the North American Nanohertz Observatory for GravitationalWaves (NANOGrav), a collaboration of over 100 students, astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are now on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the recent discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by gravitational waves. The Green Bank Telescope is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers this combination of sensitivity and sky coverage.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
94	d	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher-tech areas of the country. The people of Pocahontas County are proud of the observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. The scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. This will result directly in loss of US leadership in one of the most exiting frontiers in modern astronomy and physics, and remove a unique national resource for training the next generation of innovative, highly-skilled scientists and engineers. I urge NSF to continue its investment in science-focused operations at Green Bank (the “no-action alternative”) in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
95	a	Erin	Matheson		It took me longer than it should have to write this, so feel free to take my words. It's much better to say something than nothing: Please keep the Green Bank Observatory open. It has economic importance for West Virginia and Pocahontas County. It gives poor children in the coalfields something to aspire to. More importantly, Central Appalachia is in a state of economic transition. The extraction industries that have been central to the region's economy for the past hundred years are disappearing through automation, globalization, and technological change. This period of transition has been devastating already, causing many people to flee the state and many communities to dissolve.	Against Closure	Email	11/25/2016	
95	b	Erin	Matheson		And if we lost the National Radio Quite Zone, there'll be nothing like it on this side of the Mississippi for years to come. Quiet spaces are important.	Against Closure	Email	11/25/2016	
95	c	Erin	Matheson		Now more than ever, Appalachians, and especially West Virginians, need the hope and inspiration that Green Bank offers -- the hope that there is a future in education, that school matters and that, even in West Virginia, the mysteries of the universe are accessible through these telescopes. Please keep Green Bank open.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
96	a	Ingrid	Stairs	Professor Dept. of Physics and Astronomy	The Green Bank Telescope (GBT) has been an essential instrument throughout most of my research career. I had the good fortune of holding an NRAO Jansky Research Associateship at the Green Bank site from 2000 to 2002, when I obtained my faculty position at UBC. Being on-site at Green Bank for two years was a unique experience that allowed me to focus exclusively on my research and imagine new projects to be undertaken by the GBT, which was then undergoing commissioning. Over the years, I have help fund and install a precision pulsar observing instrument (the Green Bank Astronomical Signal Processor, or GASP) at the GBT, written software for reduction of data from other instruments and carried out numerous research projects involving the rapidly spinning, magnetized neutron stars known as pulsars. In 2007, the long-term timing collaboration that I have been part of since my graduate-student days extended its scope to become the North American Nanohertz Observatory for Gravitational Waves (NANOGrav). This collaboration is on the road to making a direct detection of gravitational waves passing near the Earth; the loss of the GBT, or even a significant reduction in the observing time available to NANOGrav would delay the time to detection and reduce our ability to carry out astrophysical studies of the waves. The GBT is also absolutely essential for studies of the double pulsar: it has a unique combination of high sensitivity and ability to track the system for 3 orbits at a time. This system provides the more precise constraints available on departures from Einstein's theory of general relativity in the strong gravitational-field regime. Losing the ability to time this binary with the GBT would slow down the science dramatically in the near term. The GBT has provided the scientific community with a wealth of new pulsars, including multiple millisecond pulsars in several globular clusters, several new millisecond pulsars that we have included in NANOGrav timing, and exotic systems such as a pulsar in a short-period triple system with two white dwarfs, and the first pulsar known to switch between radio pulsar and X-ray-binary states. I count myself fortunate to have been involved in most of these exciting discoveries. The GBT is still a young and versatile instrument, with years of fundamental and high-impact science ahead of it. The "open skies" policy has been a boon to worldwide radio astronomy and also the means to ensure that the best science is done with the telescope. I advocate strongly for the first option under consideration: Continued NSF investment for science focused operations.	Against Closure	Email	11/25/2016	GBT_EIS_Stairs.pdf
96	b	Ingrid	Stairs	Professor Dept. of Physics and Astronomy	I have trained students and postdocs on searching for new pulsars in the field of our Galaxy and in globular clusters, on timing both young and millisecond pulsars, on understanding the unique double-pulsar system and on deciphering pulsars in triple systems. I have so far mentored 19 trainees ranging from undergraduates to postdoctoral fellows on the use of GBT data and hope to be able to continue doing this for years to come.	Against Closure	Email	11/25/2016	GBT_EIS_Stairs.pdf
97		Josh	Simon		I am writing to support continued scientific operation of the Green Bank Telescope by NSF. Although I am not a radio astronomer, the GBT makes significant contributions relevant to my research. I will give two very recent examples. First, Spekkens et al. (2014) and Crnojevic et al. (2016) used the GBT to search for neutral hydrogen associated with a number of recently discovered dwarf galaxies orbiting the Milky Way. One particularly interesting galaxy they studied is Eridanus II (Eri II), which is the Milky Way's second most distant satellite. They placed tight upper limits on the gas content of Eri II, while my optical spectroscopy of stars in the system and HST imaging shows that Eri II has not formed any stars in many billions of years (Li, Simon et al. 2016). The combination of these results presents a major puzzle: how did Eri II stop forming stars and lose its gas despite being so far away from the Milky Way? It has long been known that all of the dwarf galaxies within 250 kpc of the Galaxy lack gas, while those at larger distances generally have retained some gas, which provides significant clues about how star formation shuts off in small galaxies and about the hot gas halo surrounding the Milky Way. However, the details of quenching and gas stripping in dwarfs are still not understood. As the most sensitive steerable cm-wave telescope, GBT can play an important role in resolving this decades-old mystery. Second, I recently used Kepler imaging to study the long-term photometric behavior of Boyajian's Star, which became famous last year as "the most interesting star in the Galaxy" as a result of its unexplained dimming events observed by Kepler. I showed that in addition to briefly fading by as much as 20% for a few days, the star's brightness also steadily declined over the course of several years (Montet & Simon 2016). Both behaviors are completely unprecedented in stellar astrophysics for main sequence stars, leading to speculation of a non-natural origin. Several members of the Breakthrough Listen project recently used the GBT to search for SETI signals from the star. While detection of a signal is of course unlikely, Boyajian's Star is unquestionably the best SETI target we know of today, and GBT is the most sensitive radio telescope that can observe it. These are just two examples of the importance of the GBT to the US astronomy community (again, not limited to radio astronomers). Because it is the most sensitive facility that can observe outside the declination range accessible to Arecibo, NSF divestment from GBT would result in a major loss of scientific capabilities. I therefore urge you to adopt the No-Action alternative and continue NSF support of the telescope.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
98	a	Edward	Jenkins		I have been made aware of the fact that NSF is undergoing a review of different possibilities for the future of the Green Bank Telescope (GBT), with options that range from a continuation of totally science-focused operations (the No-Action Alternative), to some compromises in support, to complete deconstruction and site restoration. ... I am not a radio astronomer, nor do I work in an academic department that is heavily dependent on radio astronomical research. Thus, I feel that in expressing an opinion on the fate of the GBT I am relatively free of any conflict of interest, other than my enthusiasm for astronomical observations in general. Of course, I must acknowledge that my lack of technical or programmatic expertise in radio astronomy matters puts me at some disadvantage in posing any well informed advice. I understand that the Astronomy Division of the NSF is under severe budget pressure and faces strong fiscal challenges in supporting a new generation of important, highly ambitious new projects that will advance our understanding of the universe. As a result, the agency needs to save on operating costs and decommission old observing facilities that have outlived their usefulness. However, I do not consider the GBT as particularly old: the scientific operations of this unique facility began only 15 years ago. Since that time, there have been significant investments in creating upgrades for tracking, active surface control, and high frequency receivers. Since my research background is in the interstellar medium, it would be tempting (and probably easiest) for me to address the potential benefits from the GBT in its new capabilities to observe at millimeter wavelengths and the ensuing prospects for studying molecular species and supporting ALMA investigations. There is no doubt that this is a valuable enterprise for the GBT. The GBT also offers important contributions to a large number of other astronomical topics, as outlined in a recent white paper (Lockman et al. arXiv 1610.02329). However, I'd like to focus on one particular subject, namely, the potential of using the GBT to detect pulse phase variations caused by gravitational waves of very low frequency for a network of millisecond pulsars distributed across the sky. Over a long period of time, NSF made a very substantial financial investment in gravitational wave astronomy with the building and perfection of the Advanced LIGO facility. That venture paid off with the spectacular detection of gravitational events in the hecto- to kilohertz regime. We now have a start in gravitational wave astronomy in one frequency domain with an excellent promise of future discoveries. However, it is important to recognize that we have the potential to build upon this achievement in an entirely different frequency range. My understanding is that in our country, the only telescope facilities that can contribute effectively to the NANOGrav enterprise are the Green Bank and the Arecibo telescopes, since the pulsars that are useful for this investigation are extremely faint and require large apertures. The fact that the GBT is fully steerable is an important strength since it can access pulsars over broad areas of the sky, which helps to increase the precision of the measurements. I sense that not too long from now, the sensitivity for detecting the low frequency gravitational wave background will penetrate the level of signal amplitudes expected from disturbances produced by binary black holes at their very early stages of inspiral. Moreover, GBT investigations of individual systems containing millisecond pulsars will allow observers to probe such fundamental physics problems as the equivalence principle, the equation of state of extremely dense matter, and general relativistic effects in the strong field approximation.	Against Closure	Email	11/24/2016	GBT.pdf
98	b	Edward	Jenkins		I would like to go beyond simply expressing my support for maintaining operations of the GBT and make a pragmatic suggestion. I understand that LIGO in its various stages of development was funded by the physics division of NSF. I presume that the premise for this support plan was that gravitational wave detections were primarily a basic physics undertaking, even though we recognize that they benefitted astronomy as well. I would like to propose that the same reasoning could be applied to partial support of GBT operations, i.e., use some funds from the physics division to decrease the financial burden on the astronomy division and thus rescue the GBT from any curtailment of its science research. Now I understand that NANOGrav receives some support from the physics division, and it is contributing a modest amount to the operation of the GBT, according to an article that I read in a recent issue of Science (Clery, D., Science, 354, 693). According to this article, NSF will be experiencing an annual savings of 2.5M\$ in operational costs from this and other sources, but it still is supporting a remaining annual budget of 8.2M\$ for GBT operations. In view of the relevance of millisecond pulsar research to fundamental physics that I mentioned in the previous paragraph, does it not seem reasonable that the physics division could provide some additional financial relief to the astronomy division by increasing the contribution to GBT operations at a level of spending that is still substantially less than the support for Advanced LIGO? I think we can recognize that LIGO and Advanced LIGO have established a precedent for funding gravitational wave detection by the physics division. I realize that the proposal that I suggested in the above paragraph may be out of line with the balance of various types of observing, i.e., gravitational wave research versus all of the other kinds of investigations. Thus, my suggestion may be unwarranted in the light of realities in the demands on telescope time. Nevertheless, I thought I should put this idea forward in the hope that we can forestall any curtailment of a full time use of the GBT for astronomical observations. I hope that you find my opinions to be useful in your decision on the fate of the GBT, a telescope that has unique attributes and is a valuable resource for the US and the entire world.	Alternatives Consideration	Email	11/24/2016	GBT.pdf
99	a	Rita	Wilson		I am writing in support of maintaining funding for the Green Bank Telescope. Many things have changed at GBT since 2012 including pulsar timing for gravitational wave research and listening for radio signals from Tabby's Star. NSF Open Skies support is critically important to our country's scientists who need radio telescope access for their research.	Against Closure	Email	11/24/2016	
99	b	Rita	Wilson		The Green Bank Observatory invests about \$30 Million into the local economy annually. Shutting down or mothballing the facilities would have a devastating effect on the area.	Against Closure	Email	11/24/2016	
99	c	Rita	Wilson		Time on the GBT is a key to research by professors and students in the West Virginia University Department of Physics and Astronomy. Shutting down, mothballing or repurposing the GBO would have a chilling effect on that WVU Department.	Against Closure	Email	11/24/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
100	a	Laura	Jensen		<p>I strongly urge NSF to consider either continuing its existing investment for science-focused operations for the Green Bank Observatory or supporting its collaboration with interested parties to establish funding partnerships with proportionally reduced NSF funding.</p> <p>For the past year, I have had the opportunity to manage projects involving the Green Bank Observatory. Previously, I worked with well-known media, technology, and policy organizations in Washington, D.C. The capabilities of the staff at the Green Bank Observatory to deliver on projects rival those of any other major institution I have worked with. Green Bank staff have considerable multi-disciplinary expertise in science, engineering, electronics, software development, and computer sciences. In the last year, Green Bank teams have successfully delivered on several international consulting and engineering projects, as well as domestic and US-university-based instrument development, research, and support initiatives. Green Bank staff are in demand to consult on radio astronomy and engineering initiatives around the world.</p> <p>The Green Bank Observatory represents a significant and valuable US-based resource for the NSF—not only for the scientific and educational value of the GBT and the observatory facilities, but also for the expertise and international reputation of the staff that have been assembled at the site. It's inconceivable that this impressive combination of physical and human resources could not continue to be effectively leveraged by NSF as part of its mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."</p>	Against Closure	Email	11/24/2016	
100	b	Laura	Jensen		<p>Many people spoke eloquently at the public meetings on November 9, 2016, about the socioeconomic impact that a reduction or closure of the Green Bank facility would have on the local community. There is no question that a reduction in the scope of the Green Bank site would require its professional staff to find employment elsewhere. The local community impact would be profound.</p>	Against Closure	Email	11/24/2016	
100	c	Laura	Jensen		<p>The implications of any reduction on the site's ability to continue its established educational and STEM programs would be devastating and far reaching for the next generation of US students.</p>	Against Closure	Email	11/24/2016	
101		J.N.	McDonald		<p>I just want to let you know that I feel the Green Bank Observatory, despite, or perhaps because of, its remote location it has continually contributed to the advancement of our understanding of the vast amount of space beyond our own. In addition to its huge steerable telescope, it serves a vital role educating children and adults alike on the mission of the National Science Foundation and NRAO. While facilities in the southwest and Peru have been constructed with different capacities, they are not nearly as accessible for most Americans.</p> <p>In closing, I ask you to consider Option 1 (no change) or Option 2 for the Green Bank Observatory.</p>	Against Closure	Email	11/24/2016	
102	a	Maura	McLaughlin	Eberly Family Distinguished Professor Department of Physics and Astronomy	<p>I am writing in response to the environmental review being conducted of the Green Bank Observatory (GBO). I have been a user of several telescopes at Green Bank for over 20 years, have worked at West Virginia University (WVU) for over 10 years, and have owned property in Pocahontas County for roughly five years. The closure of the GBO or a severe reduction in the time available for astronomical observations would have serious and far-reaching consequences for not only on the local and international astronomy community, but also for students and residents in the state. In the 10 years since I've been a professor at WVU, the number of faculty in the Department of Physics and Astronomy doing astronomy-related research has grown from one to six. In addition, WVU has hired faculty in Math and Computer Science and Electrical Engineering whose research complements the astronomy research in our Department. We've been able to recruit and retain excellent faculty in large part due to our proximity to the GBO. (Indeed, I wouldn't have accepted a faculty position at WVU were it not for the GBO proximity!) It is an extremely valuable resource for STEM education collaborations. It is also critical for training our undergraduate and graduate students, who can easily visit the GBO and use some of the smaller telescopes on site for independent research projects. It is incredibly useful for faculty and students developing instrumentation, as they can access both world-class facilities and engineers. Just last year, we were named an official university research center (the Center for Gravitational Waves and Cosmology). This would not have happened without the support of our GBO collaborations (and in fact several GBO employees are affiliate members of the Center). If the GBO would close, or cease performing astronomical observations, we would likely lose faculty to other institutions. We would also have a more difficult time recruiting the best graduate students. And, our undergraduate retention rate would certainly decrease as trips to the GBO are a prime motivator for our undergraduate physics majors. This would be accompanied by a decrease in the fraction of female Physics majors, as astronomy is the most diverse of the sub-specialities in the Department. Finally, as the large majority of awards coming into the Center are related to GBT research, teaching, or outreach, our Center would likely cease to exist as it would not satisfy WVU's Center designation criterion. This would negate a large intellectual and financial investment by the state, just before the true scientific potential of many of our GBO programs is realized. (We are likely only five years away from detecting low-frequency gravitational waves in Green Bank Telescope data through the efforts funded by our NSF Physics Frontiers Center award. This will revolutionize our understanding of cosmology, galaxy evolution, and gravity). The impact on STEM education in the state would be equally, or even more, devastating. A visit to and/or research experience at the GBO is often the only exposure to real-world STEM that rural students in WV receive through their entire K-12 education. (The number of freshman at WVU who tell me they are majoring in STEM due to an early experience at the GBO is astounding!)</p>	Against Closure	Email	11/25/2016	gbo2016.doc
102	b	Maura	McLaughlin	Eberly Family Distinguished Professor Department of Physics and Astronomy	<p>) It also provides teachers in the state access to world-class research facilities and enables them to incorporate astronomy research experience into their classes. One program that I am involved in is the Pulsar Search Collaboratory (PSC), in which high-school students are able to analyze data from the Green Bank Telescope to search for pulsars. We have been carrying this program out, in collaboration with the GBO, for eight years and, in that time, have involved over 2000 high-school students and 100 high-school teachers. Roughly 50% of the students are female, and nearly 50% of the students who participate have an ultimate career goal of a PhD in a STEM field. In addition, seven pulsars have been discovered thus far, representing a remarkable scientific achievement. I have co-produced an NSF-funded documentary about the program called little green men that will expand the sphere of influence of the PSC to students world-wide. If the GBO would close, the PSC and other programs using the GBO would be impossible to carry on, having a very negative impact on WV's ability to produce students trained in 21st century skills. This would also have implications for students throughout the country – our current NSF award for the PSC funds the establishment of PSC hubs in nine other states. Note that while the continued operation of the GBT is of course paramount, the smaller telescopes on site are also critical to the education efforts and must remain operational for the GBO to continue its impact.</p>	Against Closure	Email	11/25/2016	gbo2016.doc

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102	c	Maura	McLaughlin	Eberly Family Distinguished Professor Department of Physics and Astronomy	Finally, the impact of the GBO on the economy and culture of the region is significant. Astronomers and students from all over the world visit either to use the telescope or to attend conferences, and these visitors also patronize Cass, Snowshoe, and many state parks in the region. And, of course, there is a large tourism industry built around the GBO, drawing astronomy enthusiasts or simply people who are curious about a quieter way of life without cell phones and wi-fi to the region. We love the area so much that we purchased property there, and visit often. None of our neighbors are astronomers, but all realize the economic benefits of the telescope and are proud and supportive of the facility. If the GBO would close, not only would jobs, but an important source of revenue to the county, would be lost."	Against Closure	Email	11/25/2016	gbo2016.doc
103	a	Loren	Anderson	Assistant Professor of Physics and Astronomy	I am writing in regards to the Environmental Impact Statement of the Green Bank Telescope (GBT). I am an assistant professor of physics and astronomy at West Virginia University (WVU). Removing NSF funding from the GBT, as you have already begun to do, would have severe negative impacts on the people of West Virginia, the faculty of WVU, and on our ability to educate the next generation of scientists. I arrived at WVU in 2011, drawn to the close connection with the GBT and to the growing emphasis on astrophysics in the department. It was one of only two jobs that I applied for. My work centers on single-dish radio observations of massive star formation regions, and the GBT is my primary instrument. To date, I have been the PI of about a dozen projects on the GBT totaling hundreds of telescope hours, published five first-author papers, and written two successful grants (one to NASA and one to the NSF) requiring the use of the GBT. Personally, the GBT is necessary for me to continue my research. No other facility has comparable surface brightness sensitivity. I understand the need to divest from some facilities to make room for others. This is foolish for the GBT, however, as it has just become a mature instrument and has numerous NSF-funded projects related to it. For example, the new ARGUS and MUSTANG-2 receivers, both NSF-funded, are just now being commissioned on the telescope. Its best work is yet to come, since researchers now know its true capabilities at high frequency. While decreasing funding seems like a viable option, this is untenable. The telescope operates ~3600 science hours per year with a shoestring scientific staff. Cutting to 60% funding, as was just done, will further reduce the staff and put ongoing operations, including NSF-funded FLAG, MUSTANG-2, and ARGUS, in jeopardy. Many large projects have already had their hours reduced. Mature instruments like the GBT have a niche in large projects, but these large projects are severely negatively impacted by the current reduction in funds. I implore you to restore funding to this important and vital facility.	Against Closure	Email	11/25/2016	nsf_gbt_letter.pdf
103	b	Loren	Anderson	Assistant Professor of Physics and Astronomy	Our department's connection with the GBT has allowed us to grow tremendously. I was the fourth astronomer hired; 12 years ago there was only one in the department. Since I arrived, we have hired three additional astronomers, two tenure track and one teaching assistant professor. All this growth has been due to our connection with the GBT. There is little other reason for people to move across the country to work at WVU. If the GBT funding were cut, or even if it were reduced to the point that we cannot get the telescope time we need, I have no doubt that our faculty would move elsewhere. I would immediately begin pursuing other options. Our GBT connection has also enabled numerous successful grants, most funded by the NSF. Since 2006, our faculty have been awarded \$14.5M. In the last few years we have been awarded ~\$10M of this amount. Much of this money has been in related to the efforts to use pulsar timing to detect gravitational waves. The GBT is necessary if this effort is to be successful. All of our faculty have been funded by the NSF, and all of our research involves the GBT. These grants have resulted in an enormous influx of dollars in the the West Virginia economy. West Virginia is economically poorly performing, and is hurting badly due to the decrease in revenue from coal.	Against Closure	Email	11/25/2016	nsf_gbt_letter.pdf
103	c	Loren	Anderson	Assistant Professor of Physics and Astronomy	We badly need to re-train the workforce in new industries, most importantly in STEM fields. The grant funds have mostly been used to hire WVU students and postdocs, keeping the money in West Virginia. We now have 15-20 physics and astronomy majors graduate each year, up from 6 a decade ago. We now have ~15 astronomy graduate students in astronomy, up from zero a decade ago. We now have 8 astronomy postdocs, up from zero a decade ago. Unlike most modern facilities, students can be trained on-site at the GBT, and see directly how science is done. This is incredibly powerful for motivating young scientists. We need the GBT to keep this vital industry of radio astronomy in West Virginia. We are an EPSCOR state, and the obvious way to positively impact our state is to maintain funding for its only major scientific research facility. We have so little in the state. It is no stretch to say that the GBT is the focal point of the community in Pocohontus county. It is the meeting place for citizens and the source of extracurricular education in the area. Most of us faculty, together with our students and postdocs, spend weeks to months on-site at the GBT each summer. We talk with the locals. Removing the GBT would be devastating to the community.	Against Closure	Email	11/25/2016	nsf_gbt_letter.pdf
104	a	Carmen	Fragapane		As a science educator, the experiences that I have had the privilege of being a part of at Green Bank have had a tangible and meaningful impact, both personally and professionally. I first had the opportunity to visit Green Bank in 1989 as part of a field trip with the WVU Physics and Astronomy club. Since that initial visit I have taken part in several programs geared towards science education: RARE CATS (Radio Astronomy Research Enhanced Coordinated and Thematic Science); Hands on Universe, Living With a Star, and Quiet Skies. Each of these experiences equipped me with the knowledge and experiences to bring back to the classroom hands-on lessons that not only introduced students to radio astronomy, but got them genuinely excited about science. Each year I share the experiences that I have had at Green Bank over the years with my students during our unit on light and the electromagnetic spectrum. Several have visited me over the years and shared that they were led to make a visit themselves, and the indelible impression that their time in Green Bank had on them; having the opportunity to see the Green Bank Telescope and learn about the cutting edge science made possible by it at the Science Center exhibits. On a personal level, my experiences at Green Bank have instilled a visceral fascination with astronomy that led me not only to my professional position as a science educator, but also to public outreach endeavors. As a member of the NASA Langley Skywatchers, I share the wonders of the night sky with both young and old during telescope viewing sessions throughout the Hampton Roads area. I also serve as an instructor of an introductory astronomy course at The College of William & Mary's Christopher Wren lifelong learning program.	Against Closure	Email	11/25/2016	
104	b	Carmen	Fragapane		It is my fervent hope that the Green Bank Observatory remain a vital part of radio astronomy research. With state of the art instruments, some of which are currently employed and some that are still in development, the GBT is poised to continue to make groundbreaking discoveries in a number of areas. Having such a facility in the United States - and in the optimum radio quiet area of Green Bank - is a vivid testimonial that we as a nation are committed to cutting edge research and science education.	Against Closure	Email	11/25/2016	

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105	a	Martin	Chestnut	GBO employee and resident	<p>I'm writing this as both an employee at the Green Bank Observatory and a lifelong resident of Pocahontas County, Wv where the observatory is located. I'm a second generation employee. My mother worked there when I was a teenager. After graduating from College, I had an opportunity to apply for a position and was hired. Thirty two years later, I'm still an employee and hope very much to be able to retire from the observatory. Recently, my son had an opportunity to apply for an open position and decided not to due to the uncertainty of our future. Obviously, there is no way to say he would have been offered the job but he now continues to work out of state in Ohio while his fiancée continues to teach school at Pocahontas County High School. At some point, they may have to decide if she will seek employment closer to where he works, and leave the County. I am part of a large work force at the Observatory that are in out fifties. many of which are lifetime residents. It would be very difficult for many of to find new jobs in our craft, and we certainly could not find similar positions in this county or even in in surrounding counties, certainly not within driving distance. We would be forced to move our families or work away and come home to our families on weekends. If the observatory could remain funded, many of the jobs that would be vacated due to retirement over the next ten to 15 years could potentially be filled by college graduates from our own County. As has been stated by many in the recent scoping meetings, there are very few job opportunities in our County and our kids are forced to leave to find employment and raise families elsewhere. This impacts our school systems as well businesses where they would by gas, groceries, etc, as well as our county tax income. Again, as stated by others in the meetings, local businesses, including the local bank branch would be devastated by the loss of the observatory work force, and it would be a major blow to the County's tax revenue.</p> <p>I feel I could go on and on with why the Observatory should continue to be funded and remain in operation, including the impact on the Astronomy community and West Virginia University, but those topics were presented very well in the recent meetings.</p>	Against Closure	Email	11/24/2016	
105	b	Martin	Chestnut	GBO employee and resident	<p>As for as other impacts of the the Observatory's closure on the community, many things were mentioned in the meetings. The observatory provides a great deal of services to the local schools to support children's education (mentoring, tutoring, help with science and history fair projects, etc), as well as labor to help keep the aging schools' infrastructure in working order. Many Observatory employees over the years have served as volunteers for youth programs, and still do. This includes coaches, leaders, referees, and so on. I myself have been a cub scout leader, youth baseball and soccer coach, and assisted with middle school basketball. We've also had and currently have an employee that serves on the County Board of Education.</p> <p>The Observatory also opens it doors to county activities. It has hosted High School proms, field trips, science fairs, math field days, annual Eighth grade picnic/play day at our Recreation Area. The Wv Sate Department of Natural Resources holds Hunter Safety courses in our Auditorium. There have been town meetings, Fire and Rescue/CPR training meetings, and many others. The Residence hall has been made available multiple times during States of emergencies or extended power outages. Folks without power that have to use oxygen machines have a place they can come to. Local area residents take advantage of our site just for walking and biking where they can feel safe, and employees have the use of an exercise room. Currently, I believe there is only one exercise gym in the County, which is approximately 25 miles away.</p>	Against Closure	Email	11/24/2016	
105	c	Martin	Chestnut	GBO employee and resident	<p>In reference to the impact of budget cuts to the Observatory, any cuts could affect safety of telescopes and personnel (reduced money for painting, upkeep of facilities). Mothballing the GBT isn't as simple as parking it and leaving it alone. It requires yearly painting to prevent rust and potential structural failure., and the tri-annual contractor structural inspections. A structure this large requires continues painting to assure complete coverage over time, and inspections to find/remedy any possible or potential structural problems.</p> <p>Through all of this, I can't stop remembering that the National Radio Astronomy started in Green Bank. I truly hope and request that that NSF will continue to fund the Green Bank Observatory at the fullest extent possible (option 1).</p> <p>Thank you for the opportunity to give you my thoughts and concerns.</p>	Against Closure	Email	11/24/2016	
105	d	Martin	Chestnut	GBO employee and resident	<p>I do not understand option 1 since a change has already been made. The budget has already been reduced we have become "The Green Bank Observatory". Thus, I assume you mean option 1 would be the current "reduced" funding level?</p>	Alternatives Consideration	Email	11/24/2016	
106		Catherine	Pastor		<p>It has recently come to my attention that you are considering shutting down the Green Bank Observatory. I'm writing to you this Thanksgiving night to ask you to choose options 1 or 2 which would allow students to continue to use educational telescopes. It wasn't so long ago that I was a student visiting Green Bank. I cherish the memories that trip. I know that my experience at Green Bank influenced my decision to pursue a career in STEM. Today I work as a Medical Laboratory Scientist in the Pathology department at the University of Maryland Medical Center. I hope with the current emphasis on STEM education the National Science Foundation will continue its partnership with the Green Bank Observatory.</p>	Against Closure	Email	11/24/2016	
107	a	Ryan	Endsley		<p>My name is Ryan Endsley and I am a current graduate student at the University of Arizona pursuing a PhD in Astronomy. During the summer of 2014, I was an REU student at Green Bank Observatory. As a former REU student of Green Bank and as a young graduate student in astronomy, I write to you with a firm request that the No-Action Alternative be taken for Green Bank Observatory operations.</p>	Against Closure	Email	11/24/2016	
107	b	Ryan	Endsley		<p>After speaking with colleagues, looking through past GBT press releases, and reading through two recent papers on the abilities of the GBT to perform high-interest astronomical science (arXiv:1610.02329 and arXiv:1610.09014), it is very clear to me that the GBT is a highly valuable resource for the astronomical community and should be a high priority target for funding.</p>	Against Closure	Email	11/24/2016	

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107	c	Ryan	Endsley		What may be less clear to the committee is the cultural impact of discontinuing scientific operations at the observatory. After participating in local community events and meeting the residents of Pocohontas County and surrounding areas, I am strongly convinced that cutting astronomical funding for the observatory would lead to undesired cultural effects for these residents. Many of these residents of Green Bank and surrounding towns worked for the observatory or visited frequently. Moreover, it seemed that the observatory was a location where local events for the whole county would take place, including the "Space Race Rumpus". The observatory is seen as the location where rural living individuals in America can go to connect with the extremely high-quality science being performed in their vicinity. Discontinuing scientific operations would, over time, break that connection between the local public and astronomers essential to maintaining public interest in science.	Against Closure	Email	11/24/2016	
107	d	Ryan	Endsley		Lastly, if scientific research terminates for the GBT this will have a lasting impact on the diversity of REU opportunities. Many REU opportunities focus strictly on theory or observation, but the Green Bank Observatory is an excellent location for research in astronomical instrumentation. Instrumentation should be seen as a highly valued avenue for astronomical studies by younger generations so that world-leading telescopes can continue to be planned and constructed by U.S. academics. Moreover, most REU's take place at a university while Green Bank Observatory exposes students to a completely different type of research environment which is critical to maintaining diverse opportunities and research. Thus, I strongly request that the committee take the No-Action alternative for the Green Bank Observatory. Thank you for your time and for your consideration of my opinion on this matter.	Against Closure	Email	11/24/2016	
108	a	Kristine	Spekkens	Associate Professor, RMCC Physics	I am writing in response to NSF's solicitation of input in its preparation of an Environmental Impact Statement (EIS) for changes to operations of the Robert C. Byrd Green Bank Telescope (GBT). As a world expert on cosmological galaxy structure as well as a heavy scientific user of the GBT, I strongly support the "No Action Alternative" of continued NSF investment for science-focused GBT operations. The GBT is a world-class research facility now and will remain so for years to come; any further NSF investment of this important resource will jeopardize the GBT's unparalleled impact on our understanding of the universe. Let me first provide some background information regarding my scientific and technical expertise. The scientific focus of my research is to understand how galaxies form and evolve in the context of the cosmological model that describes the structure and evolution of the universe as a whole. My technical expertise lies in deep radio observations of nearby galaxies to constrain competing models. I have thus used the GBT dozens of times over the past several years to carry out my research program. In the last three years in particular, I have authored or coauthored 8 refereed publications of GBT observations that together have been cited almost 100 times..... In particular, I am heavily involved in Square Kilometre Array (SKA) precursor and Phase 1 scientific design and development, and served on the panel of NSF's FY 2014 AUI/NRAO Program Review. I am therefore eminently qualified to provide an expert opinion on value of the GBT for scientific research. Simply put, the GBT is a world-class instrument for carrying out astronomical research of all kinds, and it is unsurpassed in several important regimes. For these reasons, maintaining current science operations through moderate NSF investment is critical for the US to stay at the forefront of radio astronomical research. Allow me to delve into specifics with an example from my own research on cosmological galaxy structure and evolution. An important piece of this puzzle is how gas cycles in and out of galaxies, regulating star formation and thus galaxy growth. Cosmology predicts that the lowest mass galaxies are the building blocks of all larger structures in the cosmos, and thus the process by which they deliver gas to their parent systems is of profound importance for understanding the role of gas in galaxy evolution. The combination of sensitivity, steerability and directionality (afforded by its unlocked aperture) make the GBT the best instrument in the world for characterizing the gas reservoirs of the faintest known galaxies in the universe, a fact that my research team showcased in 2014 (Spekkens et al. 2014, ApJ, 759, L5) and continues to exploit today. It is important to realize that the GBT will remain unrivalled in carrying out deep searches for gas reservoirs in faint satellites around gas-rich hosts until the SKA era, which may well be decades away. The GBT certainly remains both unique and relevant in the context of the SKA pathfinders in Australia (ASKAP), South Africa (MeerKAT) and the Netherlands (Apertif) that will likely begin full science operations in 2018: the searches that these instruments will carry out for gas-rich nearby dwarf satellites remain shallow by GBT standards, making the latter a fabulous follow-up instrument. To summarize, as a world expert on gas in galaxies and a radio astronomy black belt, the GBT is critical to my research and that of my extensive network of US collaborators. It is making important scientific contributions to several important fields including my own, and will remain an impactful facility in the coming decades. I strongly support the "No Action Alternative" of the EIS. In my opinion, all other options will lead to the cessation of meaningful scientific research at the GBT, representing a huge loss not only for US radio astronomy but also for the international astronomical community as a whole. I strongly recommend that NSF continue to invest in the GBT at its current level (which is modest within the NSF AST portfolio) in order to preserve this precious resource. I hope to have the opportunity to use the GBT for scientific research for years to come.	Against Closure	Email	11/24/2016	GBS_EIS_letter_Spekkens.pdf
108	b	Kristine	Spekkens	Associate Professor, RMCC Physics	It is well documented that the GBT's new and unrivalled capabilities for 3mm operations to complement ALMA, and its unique constraints on the nature of the gravitational waves first detected by LIGO in 2015, make it a fundamentally different instrument than the one considered by the Portfolio Review committee in 2012 (Lockman et al. 2016, arXiv: 1610.02329); it should therefore not be treated as such.	Against Closure	Email	11/24/2016	GBS_EIS_letter_Spekkens.pdf

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109	a	Martin	Bloss		<p>In response to FR Doc. 2016-25213 I am writing today to request that the National Science Foundation continue either full funding of the Green Bank Observatory (GBO) or provide substantial ongoing funding in addition to other Green Bank support partners. These are the first and second alternatives listed in the NSF Environmental Impact Statement dated 13-October 2016. Specific comments follow.</p> <p>Science Capabilities: The Green Bank Telescope at the GBO remains a unique and valuable instrument to the world scientific community.</p> <p>Poor return from this action: In the public meetings on 9 November 2016, Dr Ajhar of the NSF presented a graphic illustrating the future financial challenges that prompted the NSF to look for cost reductions. The amount of savings to the overall NSF AST budget by reduced GBO funding is minuscule compared to the projected cost increases that accompany the new facilities the NSF has chosen to champion. In the current uncertain economic climate and the public's weak support for the sciences in general, there is no assurance that funding for these facilities will become available. It could lead to a future where the only outcome of this action is to reduce the USA's competitiveness and relevance in the international science community and the NSF will have failed in its educational mandate. Budget considerations with this potential to do such harm should be evaluated as a result of actual pressure from approved and funded facility construction, not projections based on a wish list of desired facilities. Expansion of the NSF AST funding is a more prudent and permanent solution to NSF's funding challenges.</p> <p>Thank you for this opportunity to comment on this action which is so critical the scientific, educational, and economic leadership of the nation and NSF's promise to the American people.</p>	Against Closure	Email	11/25/2016	
109	b	Martin	Bloss		<p>Socioeconomic Impacts; The GBO plays a critical role in multiple socioeconomic areas, two of which I will expand on in this letter. The GBO, located in Pocahontas County West Virginia is one of the largest employers in the county and is the only high tech facility in a multi-county radius. The staff of the GBO are prominent members and leaders of the local community, providing a significant percentage of the Health and Safety, educational, and civic volunteers essential for preserving a basic quality of life for a highly underserved population. The loss of the GBO wages, tourism dollars, and subsidiary economic benefits would cause unrecoverable harm to the county's and area's business community.</p>	Against Closure	Email	11/25/2016	
109	c	Martin	Bloss		<p>Secondly the GBO via its world class instruments is one of, if not the last, United States astronomical facilities with a comprehensive education and public outreach portfolio providing unmatched hands-on educational programs for students from elementary to post-graduate levels. Should funding pressures force the GBO to curtail these programs, there is no facility outfitted and positioned to take on this critical aspect of the United States' STEM and astronomy world leadership.</p>	Against Closure	Email	11/25/2016	
109	d	Martin	Bloss		<p>At the point of the scientific capabilities assessment of the 2012, NSF's Division of Astronomical Sciences' (AST's) portfolio review committee, the GBT was just beginning a substantial series of enhancements to actualize the inherent capabilities designed into the GBT. By 2014 the first of a series of 100 GHz high frequency receivers were added to updated surface control and servo algorithms and regular 3mm observations began. NSF grants awarded after the portfolio review committee's report funded two of the three 100 GHz receivers set to begin observations in the 2016/2017 high frequency observing season. Nearly all observable frequencies and in particular the high frequency receivers are heavily oversubscribed. Two recent white papers describing the improved GBT capabilities are published at: arXiv:1610.02329 and arXiv:1610.09014.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

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110		Russell	Kohrs	Environmental Science Teacher - Massanutten Regional Governor's School Adjunct Faculty -- Lord Fairfax Community College VAST - Earth Science Board Chair	The purpose of this letter is to urge the NSF to remain vested, fully or as much as possible, in the operations of the Green Bank Observatory. Over the long years of association between the National Science Foundation, Associated Universities, and the National Radio Astronomy Observatory (NRAO), amazing and groundbreaking science, irreplaceable educational opportunities, and valuable outreach between the federal government and the local communities Green Bank and Arbovale, WV have had a profound effect on the lives of countless people. As a STEM educator who has availed himself of all of this richness offered by the NRAO, I feel that it would be a travesty for the NSF to reduce its involvement in the operations of the Green Bank site any more than it has. For a teacher such as myself, who works in a rural, low-income area, and often lacking opportunities for both my students and myself for growth and education, the loss of the Green Bank Observatory as a refuge for such enrichment would be devastating. For thirteen years, I have journeyed three hours each way by school bus with groups of students to the observatory, typically overnight. I would estimate that, over these years, I brought with me nearly 250 students on these trips. These students were largely of very modest means, many of whom might not have attended college, though certainly some have. And, for those that have, many of them were inspired by their overnight experience at a place which, to them, was larger than life and really made science come alive in a more profound way than I ever could manage in the classroom. It is one thing to visit and admire the grandeur of the largest fully-steerable radio telescope on the planet, located practically in your rural backyard. It is quite another to be able to work at this amazing place, even for a night, collecting data that told them something about the universe beyond their tangible experience. Science, after all, is a tricky thing.... A visit to Green Bank never disappointed. Not really knowing what they were getting into on such a trip, the afterglow of the experience is carried with many of my former students to this day. ... These were always special times for them and also for me. I learned so much - particularly about how to be a better teacher. So, these field trips were not only important to my students, they set my own career as a teacher on a trajectory where the importance of giving all students, not just those who are gifted, the opportunity to reach beyond what they thought was possible for themselves. Green Bank became an extension of my classroom. This annual sojourn and association with NSF and NRAO led to even more opportunities for my students and myself. One such opportunity is the Pulsar Search Collaboratory (PSC), of which I have now been a member for over six years of my fourteen year career. This NSF funded project allowed me to bring the work of the NRAO, NSF, and also new direct associations with astronomers from West Virginia University, into my home classroom and to all of my students. Thus, over my years of involvement, though not all of my students participated fully in the PSC program, over 300 students were exposed to pulsar astronomy, data analysis, and an opportunity to make a solid contribution to science that is very real and important. A critical part of this work was the chance for each PSC team to bring with them to WVU a group of active PSC students, who had conducted research and created a poster, to an annual conference where they could see what college was like, hear astronomy lectures, meet astronomers, share their work, and spend time with peers from other schools from around the region and country. For my students, this was very important to them, as they did a great deal of extra work to make it possible for them to attend. I know for sure that at least two of these students, both young women, are now pursuing astronomy or astrophysics in college and that, if not for this program, this very well may not have been the case. This was, and is, a special program with a powerful reach. And, the partnership between NSF and the NRAO is what made it possible.	Against Closure	Email	11/24/2016	LettertoNSF.pdf
111		Russell	Kohrs	Environmental Science Teacher - Massanutten Regional Governor's School Adjunct Faculty -- Lord Fairfax Community College VAST - Earth Science Board Chair	One final and very personal story is imperative for me to share, and that is something about my experience serving as an NSF-RET (Research Experience for Teachers) for eight weeks at the NRAO site during the summer of 2012. That summer was one of the best of my life, not only because of the chance to live and work in Green Bank and at the NRAO, but because it taught me a great deal about myself as an educator and as a researcher. I hold an MS in Geology, but I completed that in 2003. Secondary teachers really do not have the time to conduct research and, well, much of the time have not had the opportunity to do so. It had been nine years for me. During that summer, I really realized that this drought in my life had been far too long. My time at the observatory was spent helping to bring the 20m telescope back online, literally in fact, via SKYNET. That telescope and I became good friends that summer, and for the four years since, as I have continued to use it with students to ask questions about the universe and conduct our own investigations. During that summer when I lived onsite, made my own food in my rented townhouse, practiced my bagpipes in the pines, soaked in the history of the site from my bicycle, hiked the surrounding woods (even coming to work late one day after getting lost), worked with a team of fabulous undergraduate REU students, worked with amazing professional astronomers, conducted a "Messier Marathon" for a full day on the 20m, ascended the GBT more than once, climbed the dish of the 140ft with Dr. Langston, hosted my family onsite more than once, witnessed the amazing outreach to the community in great need after the derecho that July, and participated in countless other activities, I really grew into a professional. My work there that summer would propel my career in ways I could not have predicted and have made me the educator that I am today and the researcher and research mentor that I am in my current position. Such opportunities for teachers like myself are so very rare. Again, it was the partnership between NSF and the NRAO that made this possible. I have written enough, though I could go on for many more pages about the importance of the observatory in my life and career and the amazing fruits I have experienced as a result of the partnership between the NSF and NRAO. I urge NSF to remain fully vested in the now Green Bank Observatory (GBO). I urge NSF to keep its funding at current levels and even to increase its obligations in the future, not only because of the amazing science that still remains to be attempted there, but because of the importance of the observatory to the lives and academic experiences of so many students and teachers. Few places offer what the NSF and GBO offer as partners.	Against Closure	Email	11/24/2016	LettertoNSF.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
112	a	Justin	Dilley	Business owner	<p>I would first like to thank you for giving our community the opportunity to show the National Science Foundation what the Green Bank Observatory (GBO) means not just to Pocahontas County, but also to West Virginia. We have been very fortunate to have this amazing site in our area for so many years and would be so appreciative to have the GBO open and operating at full capacity for several years to come. I was born in 1989, I witnessed the Green Bank Telescope being constructed, the initial operation of the telescope, and completed my high school senior project for civil engineering at the site. Now, after completing my degree in civil engineering at West Virginia University and my degree in land surveying at Glenville State College, I have returned home and started my own land surveying business. My wife Laurel Dilley teaches math at Pocahontas County High School and in 2015 started one of the first computer science classes in the state with the help of employees from the GBO.</p> <p>West Virginia, as you may well know, is a very poor state and is losing more and more jobs every day. People here are in dire need of something positive to boost morale and give hope that our state is not done yet and I firmly believe that the "Moth Baling" or complete destruction of the GBO site would be a catastrophic loss to our state and another "nail in the coffin" for the spirit of our people. I don't know if you yourself have ever been to West Virginia, but no matter the economic or social status of a person here, they would gladly give you the shirt off their back and help anyone in a time of need, and I think that West Virginians are owed this same show of gratitude in the form of keeping the GBO operational.</p>	Against Closure	Email	11/25/2016	NSF Letter.docx
112	b	Justin	Dilley	Business owner	<p>Thanks in part to the Green Bank Observatory and Snowshoe Mountain, Pocahontas County has a very diverse and rare collection of people for a rural community. This helps to make our county a more well-rounded and open environment for people of all races, colors, and creeds. I attended the recent open forum meeting that the National Science Foundation (NSF) held at the GBO. The one thing that stood out to me, especially during a very intense election year, was not only the number of people who attended, but the diversity of those present. Astronomers, physicists, teachers, and engineers sat side by side with farmers, fireman, loggers, and local business owners all in favor of the same end goal, to see the GBO succeed. Not to mention Democrats and Republicans coming together to support and agree on the same cause? If that doesn't show how important it is to keep the site open, I don't know what does!</p>	Against Closure	Email	11/25/2016	NSF Letter.docx
112	c	Justin	Dilley	Business owner	<p>My wife fought a hard battle to initiate one of the first computer science classes in the state of West Virginia and in 2015 she was granted the opportunity to start the course. Having had only a few computer science courses herself, she was worried that she would not be able to provide the students with all the knowledge that they might need. Three employees from the GBO volunteered their time to come to the high school and help the kids learn coding languages such as Python, C++, and Java. The first year was a huge success. In 2016 West Virginia mandated that all high schools in West Virginia offer computer science. Thanks to Laurel and the employees from the GBO, Pocahontas County High School was ahead of the curve. More and more students, boys and girls, want to take computer science. Many students, from Pocahontas County High School, have stated that they now want to go into computer science, engineering or other STEM fields because they have enjoyed the class so much. Former students from the first year the class was offered, who are now in college, have told my wife that they have found their first computer science classes in college very easy thanks to the initial experiences they had in high school.</p> <p>There are many other reasons why the GBO should remain open. I have not even begun to touch on the hardships a closure would cause to local businesses, West Virginia University and their physics and astronomy department, or the Green Bank community itself. I ask you to please keep the GBO open, for the people of Pocahontas County and the State of West Virginia, for the coal miners who helped to keep the lights on and no longer have jobs, and for our future youth, to help inspire them and show them that even though you grow up and live in a rural and poor area you can still become anything you want to be, and hopefully return to West Virginia to peruse your goals. Also, for Robert C. Byrd who helped to grow funding for the Green Bank Telescope in the first place and always had the best interest of the people of West Virginia and the United States in mind until the day he passed. I beg you, please, continue to fund and keep open the GBO for all of us.</p> <p>Thank you again for the opportunity to express our heartfelt opinions on the matter.</p>	Against Closure	Email	11/25/2016	NSF Letter.docx
113		Chuck	Haden		<p>Please save the observatory we all value the science and West Virginia needs the jobs WVU uses the information daily and will have to cut classes or source the info from other places that will be more expensive and less informing.</p>	Against Closure	Email	11/24/2016	
114		Joe	Halstead		<p>Fund the Green Bank Observatory</p> <p>By cutting funding at the Green Bank Observatory, the National Science Foundation is trying to convince the public incorrectly that the Green Bank Observatory is outdated and no longer necessary. We must take action, not out of love for an observatory but because of a sense of duty to science.</p> <p>The Green Bank Observatory is a remarkable tool for astronomers to collect very precise and sensitive data from outer space. In 2002, the observatory discovered a windfall of three previously undetected millisecond pulsars in a dense cluster of stars in the Milky Way Galaxy. In 2006, it was discovered a "superbubble" of hydrogen gas above the Milky Way Galaxy by combining numerous smaller images made with the GBT into one large image. It's in the unique position of being extraordinarily sensitive to faint radio-emitting signals and other phenomenon in space since it exists within a 13,000 square mile "bubble" of radio silence. In fact, the number of discoveries made by the Green Bank Observatory has increased greatly since its inception in 2000. This is, in itself, compelling evidence for the value of continued funding.</p> <p>Knowing that there are abundant scientific possibilities out there, we ask for continued science-based operations at the Green Bank Observatory, as well as call for NSF funding to develop major long range research goals. More specifically, the research should focus on gaining a deep understanding of radio signals possibly emitted by alien lifeforms in a universe literally bursting at the seams with the ingredients of life.</p> <p>Filter out the noise. Fund the Green Bank Observatory.</p>	Against Closure	Email	11/24/2016	

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115	a	Aaron "Ernie"	Williams		To the fellow inhabitants of our collective future, My name is Aaron Williams and I am a current graduate student in Art + Technology at the University of Florida. I am from French Creek, WV and an alumn of West Virginia University's sculpture and printmaking programs. Over the summer I was selected as a participant in a Science + Art residency at WVU called CESTA (Community Engagement in Science Through Art) along with another sculptor, two engineers, and two chemists. During my time there, I took one of the chemists with me on a road trip around West Virginia to see all its great wonders. In a single day we saw the Mummies of Philippi, Seneca Rock, the Dolly Sods, Spruce Knob, and did a tour at the Green Bank Observatory. Our visit there was by far the most incredible thing I witnessed on that day, but in fact in my lifetime.	Against Closure	Email	11/24/2016	
115	b	Aaron "Ernie"	Williams		Anytime that I close my eyes and imagine the future of West Virginia, I see its sky so untainted by light that the molecules of sugar seen by the GBO actually shine over the valleys. Where mountaintops were once removed now sit radio arrays to coordinate with findings in the valleys below. People from all over the world come there to see how dark it is and to hear how quiet it is. They see and hear things not of this earth while enveloped in the embrace of Appalachia which is almost alien in its worldliness. West Virginia's pride is that of the coal miner; they sacrificed everything to give power to the world. And now, with that same conviction, they protected those same mountains with laws which suspended the proliferation of light and the tide of electromagnetic waves in the hills and hollers. In this new West Virginia they saw the world, as they always have, from a very different perspective. And it was the sum of all of these things that made every discovery henceforth possible. Stories of the Mothman and of the Flatwoods Monster were true! The Quiet Zone shudders when a barn owl shrieks or a blue heron calls. These familiar bird calls, once mistaken for alien cryptids, helped to identify a far flung radio signal as a signature of an alien organism. There was a turning point, though, and it almost didn't happen. That time is right now.	Against Closure	Email	11/24/2016	
115	c	Aaron "Ernie"	Williams		When I heard the news of the National Science Foundation's review of the Green Bank Observatory and that deconstruction was on the table my head filled with fear. Fear that West Virginia would lose brilliant minds, economies, and technologies that are essential to the future of not only our state but ultimately the planet. Our history has played out time and again, and it's very tired. What we need, more than ever, is something to believe in. We need the educational opportunities given to our children, our communities, and the world by radio astronomy. We need the Green Bank Observatory.	Against Closure	Email	11/24/2016	
116	a	Michael	Holstine		Please accept this email as comment to the EIS statement being prepared by the NSF with regards to the Green Bank Observatory. As I am certain that you have been inundated with emails concerning the socio-economic impact of the Observatory to the local community, County and State, it is important to also note the historic factors existing at the site. The Observatory houses a replica and display of the original Jansky antenna used to first detect and quantify radio waves coming from the Milky Way galaxy. Across the road from the Jansky antenna exists the actual and original Reber Telescope, donated to the site by Grote Reber and registered on the National Registry of Historic Places. Both of these antennae have been utilized to recreate their original discoveries. Remember, these represent the birth of radio astronomy. Further down the site exist telescopes used for original interferometry and correlator experiments, the 40' telescope (the first fully computer-controlled radio telescope in the world, and now refitted as a fully manually-controlled telescope for education purposes), the 40m telescope (a polar-mount telescope with the largest spherical bearing ever produced at its tolerances), and the GBT (the largest fully steerable telescope in the world). It is amazing that all of these telescopes, varied and precisely built, all exist in one unique location - Green Bank. It is inestimable the value that can be placed on such a unique suite of instruments all in one place.	Against Closure	Email	11/24/2016	
116	b	Michael	Holstine		Another unique aspect of the facility is the existence of the National Radio Quiet Zone and the West Virginia Radio Astronomy Zone. These unique areas provide to the Green Bank site protections for radio astronomy that exist nowhere else in the world. Beyond that, however, are the protections that these zones provide to a wide contingent of contractors and other governmental departments that need to test and refine operational projects requiring radio quiet. Many of these contractors come from DOD, military and other agencies to the Green Bank site to work through the problems associated with their projects and available nowhere else in the world.	Against Closure	Email	11/24/2016	
116	c	Michael	Holstine		Land management has been a focus of the management of the site, as well, and is therefore utilized by various State agencies to develop model programs not available elsewhere. Two of these programs have been instituted by the WV Department of Natural Resources and by the WV Department of Agriculture. The WVDNR worked with the site to develop and maintain a controlled hunt program on the site to benefit wildlife diversity. Instituting this program at a facility where controlled conditions exist allowed testing of herd health, development of statistics through the Southern States Wildlife cooperative, and the opportunity for under- and graduate students to refine their education. Additionally, the techniques used in this controlled hunt allowed the State of WV to expand their experience gained to municipal and State Park hunts, for the first time in State history. Several firsts were accomplished through this program, including the first controlled program, the first early-season hunt, the first early season firearm hunt, and the model hunt for every future controlled program in WV. The WV Department of Agriculture utilized the site to resume a farming operation to develop a potato project for the purposes of modeling statistics for Pocahontas County soil yields of potatoes. This is the first year of the project and will be used to further refine planting and treatment methods for farming in the eastern part of the State.	Against Closure	Email	11/24/2016	

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116	d	Michael	Holstine		<p>Lastly, but nowhere near least, is the value of the social connections garnered by the employees of the Observatory with the local and broader community. This is a place of living and purpose. People here interact with each other like those of years past. We help each other in every aspect of our lives. When our neighbor needs help, we help. When the Observatory needs help, our neighbors help us. We are the only Red Cross-certified emergency shelter in the northern end of Pocahontas County. When people need heat when it's cold, or cooling when it's hot, or electric power for personal oxygen production, we provide it. We are integral to the community, in every stitch of the community fabric, in ways that cannot be replaced. Much like the effects of losing the QZ's, loss of parts of this community will have a devastating and irreplaceable effect on what remains. Tearing asunder the fabric of this community will never be repairable, and I hope that you have been able to witness this worry in even the smallest amount. When you consider every facet of life in Green Bank, no matter how small, that life is held together by all members of the community - Observatory and non-Observatory. Gratitude is hard-won among the people here and not easily regained. I stand in force with those that want to see the Observatory continue, not only for the irreplaceable scientific merit of the site but for the irreplaceable love and kinship of the Green Bank community. I beg you to consider Options 1 and 2 only. No other options are in the least bit tenable.</p> <p>As a final thought, please consider entering the book ""But It Was Fun"" in the record of the effect this site has had in regards to everything from science to personal relations, good or bad.</p>	Against Closure	Email	11/24/2016	
117	a	Jeffrey	Marganian		<p>Hello. To whom it may concern, I am writing in support of the continued financial and administrative maintenance of the Green Bank Observatory in West Virginia. Green Bank Observatory provides jobs and livelihoods for many people in a rural area of West Virginia that suffers from poverty, underdevelopment, and lack of economic opportunity. A closure of the Observatory would result in unnecessary economic hardship and privation for numerous families and individuals. There would simply be no recourse but financial crisis for hundreds of people dependent on the work offered by the telescope(s) and its various functions.</p>	Against Closure	Email	11/24/2016	
117	b	Jeffrey	Marganian		<p>Additionally the Observatory is of course the home of a myriad number of dedicated scientists, engineers and technicians doing invaluable scientific research. This research should be allowed to continue in the interests of scientific inquiry and discovery.</p>	Against Closure	Email	11/24/2016	
117	c	Jeffrey	Marganian		<p>It is my understanding that the Observatory also functions as an instrument of national security and intelligence gathering. For all these reasons the Observatory is a vital part of the economy and culture of the Green Bank area and should be allowed to be maintained and well administrated into the foreseeable future.</p>	Against Closure	Email	11/24/2016	
118	a	Nichol	Cunningham		<p>I strongly urge the National Science Foundation (NSF) to support Option 1: ""Continued NSF investment for science-focused operations"" for the Green Bank Telescope and the Green Bank Observatory (note: specific references supporting the matters discussed here can be found in the two attached documents, available at https://arxiv.org/abs/1610.02329 and https://arxiv.org/abs/1610.09014). The No-Action Alternative is the only option that will not lead to detrimental, long term negative socioeconomic, cultural, ducational and scientific impacts on not only the local community, that heavily depend on the infrastructure of the telescope and support of the staff, but to the global scientific community as a whole.Impacts of the Green Bank Observatory Impacts on the Scientific EnvironmentAs discussed in both https://arxiv.org/abs/1610.02329 and https://arxiv.org/abs/1610.09014 "The National Science Foundation (NSF) Astronomy Division's Portfolio Review of 2012 is no longer relevant to the Green Bank Telescope (GBT) of 2017".That committee recommended that AST divest from the GBT because of its ""lower scientific impact"". This assessment was not justified in 2012 and is not justified now. As an early career, female postdoctoral fellow, specializing in the formation of massive stars I can fully attest to those statements. Massive stars are the nuclear powerhouses that drive the chemical evolution within galaxies, without which the complex molecules and elements we need to live would not exist. In spite of this, we still do not have a comprehensive understanding of how these progenitors of our existence actually form. The scientific merit of the GBT in understanding these very early stages in the birth of a star, particularly in the vitally important high mass regime, is stronger than ever. This is due to a myriad of new instruments on the GBT that were not in existence or still being commissioned during the 2012 review. Examples include University of California Berkeley development of the VEGAS spectrometer, University of Pennsylvania development of the MUSTANG family of bolometers, and the Stanford University development of the Argus 3mm camera.These new NSF funded instruments open up a frequency range that is deeply beneficial to the star formation community, allowing us peer into the cold, dense environments as stars are being born and will greatly add to our understanding of these initial stages. These new instruments have also captured the interest of a slew of new users to the GBT.</p>	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Co mments.pdf
118	b	Nichol	Cunningham		<p>More importantly, the GBT offers merit-based access to a world-class facility. The NSF-funded open skies time is allocated on merit. What this means, is early researchers such as myself have the opportunity to develop our own scientific research projects. Forge new collaborations and networks and become the future leaders of radio astronomy. It means the GBT is not only for the rich, or only for scientists from wealthy institutions, but is accessible to early PhD, postdoctoral and even undergraduate level researchers with a strong science project. The loss of open skies time, in my opinion, would be one of the most damaging and detrimental things to the success of the Green Bank Observatory as a functioning world class research facility and to the future of radio astronomy in the US.</p>	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Co mments.pdf
118	c	Nichol	Cunningham		<p>Impacts on the Socioeconomic, Cultural and Educational environment Aside from the scientific impact, there is a deeper, more insidious impact any cut in funding would result in to the local community, to the thousands of visitors and the hundreds of students that are inspired by the GBT each year. I have had the honor of talking with, mentoring, teaching, and presenting to countless students of all ages about science, and about my own research in the year I have been working in Green Bank. A place I would not currently be if it were not a world class leading facility in radio astronomy. I believe the students interaction with an actual astronomer, and the ability to do actual research on a radio telescope is something incredibly wonderful and unfortunately becoming more and more rare. I am always humbled by their enthusiasm, excitement and joy at being here. Moreover, the fact that I am an early career female is something that, while should no longer be an issue, is a very valuable aspect for female students to see firsthand. In addition, the staff at GBO have a strong connection with the local schools and community. I myself have gone into the local school and talked with the elementary classes about radio astronomy as I know countless other staff have. Staff that would likely not be here if anything other than the No-Action Alternative is implemented. Furthermore, I have participated in science fairs, Hour of Code, open days, and career days, again along with countless other staff. I also recently participated on the Space Race Rumpus committee (http://www.spaceracerumpus.org/) a fundraising event that directly benefits the local community, but more than that serves as a wonderful outreach event with hundreds of families coming each year to Green Bank and participating in Star Parties, enjoying the wonderful science center and interacting with the scientists here (all of which volunteer their own personal time to participate in the weekend long event).</p>	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Co mments.pdf

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118	d	Nichol	Cunningham		This telescope is a wonderful educational tool, but without the world class researchers that work here or come here to observe it would not be able to function in the same manner and would not have the same impact on the students that come to learn astronomy and what it means to be an astronomer or a scientist. Any loss of open skies time would completely change the functionality of the telescope as an educational tool doing real research. For all of the reasons cited here, I hope that NSF will choose the No-Action Alternative. I ask you to ensure that the EIS fully account for the impacts of all the proposed scenarios. The GBO is a shining example of the many positive impacts of investment in basic research.	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Comments.pdf
119	a	Linda Lee	Jones Marganian		I am a well educated person with a B.S. in Biology and an M.A. in Chemistry and a certified secondary level educator and would like to say something about the work of the Green Bank observatory. I have visited several times over the years that my son and daughter-in-law have worked there. It is a tremendous resource for our nation and the region in understanding our universe and other nations on our planet. Without Green Bank I think we would take a giant step backward and become victims once again of impoverished thinking and fear of the unknown where there are no principles based on fact to guide us in the right direction. Progress in not guaranteed in a world where science and instrumentation such as we have in Green Bank are shut down for whatever reason.	Against Closure	Email	11/24/2016	
119	b	Linda Lee	Jones Marganian		In the case of National Defense I think it would be foolish to cut the measures we have in Green Bank Observatory to secure our country against enemy activities .	Against Closure	Email	11/24/2016	
120	a	Violette	Impellizzeri		I am a radio astronomer working at ALMA. I have been using world-class radio instruments since I was an undergraduate at the Max Planck Institute for Radioastronomy in Bonn. During my PhD, I had the privilege to use 100-m telescope in Effelsberg, the VLBI, Arecibo, and the VLA. After finishing my PhD, I moved to NRAO for my first postdoc - which was for me the 'mecca' of radio astronomy. There I had the opportunity to observe with the GBT regularly for full three years (which extended into many more years). There is no doubt in my mind today that the Green Bank Telescope it is the best single dish telescope in the world. No other instrument in the world today that can replace the GBT. After spending many hundred hours observing both with Effelsberg and the GBT - the two biggest fully steerable telescopes in the world - I feel strongly that losing the GBT would be a great loss to the whole astronomical community. While Effelsberg is still doing great work in the lower frequency bands and pulsar work, the GBT is irreplaceable at both low frequency but also at the higher frequencies where it operates. Beside being a relatively "new" telescope itself (construction only finished in 2003), it has been continually evolving and new further instruments were only recently commissioned. With an un-obstructed surface it displays an incredibly flat and stable spectrum, the active surface makes it one of the best surfaces to observe at the higher frequencies in both single dish mode and with the focal plane array. The wide bands and flexibility of the GBT have allowed for surveys to be carried out accurately at both low and high redshifts. The GBT has been involved in a number of discoveries, and a witness of its popularity is its oversubscription. The GBT is truly a jewel, to all astronomers world-wide. I can imagine the budgetary stress the NSF and funding agencies find themselves under, with so many new telescopes coming on the horizon and older ones still running. However, the GBT is not an older telescope, it is all ways possible a new, state-of-the-art machine. I hope that the NSF will consider continuing support of the GBT operations into the future. Beside being a great instrument for all astronomers in the world, I think that it should be a matter of national pride for both West Virginia and the United States science as a whole.	Against Closure	Email	11/24/2016	
121	a	Ryan	Lynch		I urge the National Science Foundation (NSF) in the strongest possible terms to select the No-Action Alternative (continued NSF investment for science-focused operations) for the future of the Green Bank Observatory (GBO). The No-Action Alternative is the only option that will not have severe, long-term negative impacts on the socioeconomic, cultural, educational, and scientific environments of the local community of Green Bank, the State of West Virginia, the surrounding region, the entirety of the United States, and the global community. The No-Action Alternative is also the only option that will not have severe, long-term negative impacts on NSF's mission to broaden the impacts of its activities and facilities. Scope of the Environmental Impact Statement Areas of Study The environmental impact statement (EIS) should formally include the educational and scientific environment as independent areas of study within the scope of the EIS. The EIS should also include broader impacts as an independent area of study in the scope of the EIS; NSF defines1 broader impacts as those that: Advance discovery and understanding while promoting teaching, training, and learning Broaden participation of under-represented groups Enhance infrastructure for research and education Broaden dissemination to enhance scientific and technological understanding Benefit society I understand that the scope of the EIS as defined by the National Environmental Policy Act of 1969, as amended (42 USC x4321-4347), does not explicitly call for assessing the educational and scientific environments, or agency-level considerations such as NSF's broader impacts. However, nothing in the statute prevents the EIS from expanding its scope. Furthermore, the purpose of the EIS scoping period is, in part, to "determine relevant issues that will influence the scope of the environmental analysis"2. A full assessment of the impact of the GBO must consider educational, scientific, and broader impacts. After all, the primary purpose of the GBO is to be a scientific research facility with a strong educational component, in keeping with NSF's mission.	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	b	Ryan	Lynch		Region of Impact The region of impact (ROI) for the GBO as it relates to cultural, socioeconomic, educational, scientific, and broader impacts should be defined as encompassing the entire global community, and should especially focus on the United States. The GBO serves users around the world, and to limit the ROI for any area of study to just the local community or State of West Virginia will necessarily underestimate the impacts of proposed alternatives for the GBO.	Resource Considerations	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf

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121	c	Ryan	Lynch		<p>Context of the EIS</p> <p>The true impact of the proposed alternatives for the GBO cannot be measured without considering the broader national and global context in which the GBO operates, and in which the EIS is being conducted. The Arecibo Observatory is undergoing its own EIS and is facing possible divestment by NSF. If science-focused operations at the Arecibo Observatory are substantially reduced, it will compound any similar reductions at GBO because astronomers in the United States will have no single-dish radio telescopes to turn to as an alternative. The Five Hundred-meter Aperture Spherical Telescope (FAST) under construction in China cannot be viewed as a viable alternative to the GBO for several reasons: 1) it has not yet started full science operations, 2) its performance and sensitivity have yet to actually be demonstrated, 3) it is not fully steerable and cannot access the same parts of the sky as the Green Bank Telescope (GBT), 4) it does not benefit from an extensive radio quiet zone like the one that protects the GBO, and 5) it is not yet known under what conditions astronomers in the United States will be able to access FAST. Similarly, the Square Kilometer Array (SKA) and its predecessors 1) have not yet begun full science operations, 2) are located in the Southern Hemisphere and so will not be able to access the same regions of the sky as the GBT, and 3) currently have no support or involvement from the NSF or the United States. The EIS should take this context into consideration when assessing the impacts of the proposed alternatives for the GBO.</p> <p>For all of the reasons cited here, I expect that NSF will choose the No-Action Alternative. I ask you to ensure that the EIS fully account for the impacts of all the proposed scenarios. The GBO is a shining example of the many positive impacts of investment in basic research.</p> <p>Please do not hesitate to contact me if you have any questions about the issues I have raised or would like more information.</p>	Resource Considerations	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	d	Ryan	Lynch		<p>...That committee recommended that AST divest from the GBT because of its "lower scientific impact". This assessment was not justified in 2012 and is not justified now. The PRC report contained some incorrect assumptions that impacted its decision to classify the GBT as having lower scientific impact. Three telescopes were cited as potential replacements for the GBT: The Jansky Very Large Array (VLA), Arecibo Observatory, and the Effelsberg Telescope in Germany. However, the VLA has reduced sensitivity at the lowest frequencies when compared to the GBT, no capabilities at the highest frequencies at which the GBT operates, is already heavily oversubscribed, and is not designed to accomplish the same science as the GBT with good efficiency, if at all. The Arecibo Observatory is also under threat of divestment, but regardless, it does not offer the same sky-coverage as the GBT and does not operate at the highest frequencies accessible with the GBT. The Effelsberg Telescope's blocked aperture and suite of receivers substantially reduces its sensitivity compared to the GBT, and it is only available under open-skies for 40% of the time, much of which is used by European astronomers in ways that make better use of the available instrumentation. None of these telescopes are suitable replacements for the GBT. Furthermore, the scientific landscape has changed so profoundly since 2012 that the PRC recommendation is simply no longer relevant. New technical capabilities have made the GBT a uniquely powerful instrument in the 3 mm band. At the same time, the recent detection of gravitational waves (GWs) by the Laser Interferometric Gravitational Observatory (LIGO) have officially ushered in the era of GW astronomy. The GBT (along with the Arecibo Observatory) are used by the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) to search for and characterize low-frequency GWs. The GBT and the Arecibo Observatory together represent the best telescopes in the world for studying this unique part of the GW spectrum (the GBT and the Arecibo Observatory both contribute approximately half of NANOGrav's sensitivity), which is totally inaccessible to LIGO and the planned Laser Interferometric Space Antenna (LISA). Use of the GBT and the Arecibo Observatory also offers an extremely cost-efficient way of studying the GW universe — both LIGO and LISA are billion-dollar-scale instruments, and LIGO's operating budget is \$130 million per year, while the GBT operates for approximately \$12 million per year (and only a portion of this is in support of NANOGrav). When given the opportunity to fully participate and comment, the wider scientific community has consistently judged GW astronomy to be of high scientific impact and priority. The New Worlds, New Horizons decadal survey highlighted GW astronomy as one of five science frontier discovery areas capable of "transformational discovery". NSF is currently funding NANOGrav through a Physics Frontier Center award of \$14.5 million (with contributions from the Midscale Innovations Program) after a competitive, community-sourced review judged it to be of high intellectual merit and broader impact. NSF itself has chosen multi-messenger astronomy as one of ten "Big Ideas" to be pursued in the coming decades by the Foundation as a whole — combining GW and electromagnetic observations is an example of multi-messenger astronomy. Outside of GW astronomy, the GBT contributes to a stunning diversity of scientific inquiry. It answers questions related to gravity and general relativity⁸, nuclear physics⁹, time-domain and transient astronomy¹⁰ astrochemistry and astrobology¹¹, astrometry¹², and galaxy formation and structure¹³. This is far from an exhaustive list... As you can see, the conclusion that the GBT has lower scientific impact is simply incorrect. New capabilities and a changing scientific landscape ensure that the GBT will continue to make unique contributions to highly valued scientific areas throughout the coming decades if GBO continues to operate as a healthy scientific facility. If the EIS cites the PRC recommendation as providing a need for the EIS process, then it should address the errors and inconsistencies in that report and acknowledge the numerous examples of strong support for the GBT and the work it carries out that have been expressed by the scientific community. To not do so threatens to place the EIS on a shaky foundation.</p>	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf

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121	e	Ryan	Lynch		<p>Educational Impacts</p> <p>The GBO has a long and exemplary tradition of educating the next generation of science, technology, engineering, and mathematics (STEM) professionals. This includes, but is not limited to, summer research programs for undergraduate and graduate students pursuing degrees in STEM fields, which involves approximately ten students per year¹⁴. This program began when GBO was formally a part of the National Radio Astronomy Observatory (NRAO) but will continue if GBO remains a scientific facility. These programs provide a critical educational opportunity to students from small colleges and universities that may not have large research programs. GBO has recently partnered with the National Society of Black Physicists on Physicists Inspiring the Next Generation (PING). This program offers a summer research experience to two underrepresented minority students as well as a two week leadership experience as mentors for middle school students attending a science camp at GBO. PING mentors are typically rising sophomores or juniors and so receive a unique educational opportunity at a critical point in their careers. GBO also partners with West Virginia University to offer senior undergraduate research opportunities.</p> <p>Educational programs also extend to high school students through the Pulsar Search Collaboratory (PSC). The PSC gives students across the country the opportunity to analyze real GBT data while searching for pulsars. A critical aspect of the PSC experience is students' interaction with real, research grade data — they are not simply carrying out a pre-packaged science fair project, they are working with the same data as professional astronomers.</p> <p>The GBO is one of the few world-class research facilities that offers true hands-on training for undergraduate and graduate students. Universities have led instrumentation projects for the GBT that provide technical training for scientists and engineers. Student observers at the GBT are required to go through on-site training and so receive an education in the design and operation of a large radio telescope. Unfortunately, these types of experiences are disappearing from many graduate curricula, making the GBO ever more important to the education of future scientists and engineers.</p> <p>The GBT is not the only GBO telescope that plays an educational role. The 20-meter telescope is used by the Skynet Junior Scholars program, which students across the country the chance to collect their own data. The 40-foot telescope is used for hands-on observing projects by hundreds of student groups every year. The Tatel telescope is historically significant as the first telescope constructed on the site and because of its use in the first Search for Extraterrestrial Intelligence experiment. The Tatel telescope is currently featured in the very popular SETI public tour. The remaining 85-foot telescopes are featured in public tours and provide an opportunity to introduce the concept of interferometry.</p> <p>Broader Impacts</p> <p>The educational programs discussed above have far reaching broader impacts. Since 1991, over 40% of NRAO/GBO summer students have been women, a larger percentage than is present in astronomy at-large. Women have historically been underrepresented in STEM fields, and the NRAO/GBO summer student programs are a critical pipeline for increasing participation by women in STEM. The PING program specifically targets underrepresented minorities, with all eight of the PING mentors thus far being of African American descent. Middle school students participating in PING are mostly minority students, as well. Finally, GBO has a disproportionately large positive impact on socioeconomically disadvantaged populations. Thousands of visitors come from rural parts of West Virginia and neighboring states. GBO acts as a rare example of cutting edge STEM investment in these regions of the country, increasing science literacy substantially. The scientific program of the GBT also cuts across a wide range of disciplines and administrative areas of NSF.</p> <p>I am personally spearheading a new educational initiative in partnership with NROCKS, a local outdoor adventure and education company in Pendelton County, WV. We are piloting a program that will combine night-sky observing with outdoor experiences for youth and the general public. While in its early stages, this program promises to increase knowledge and appreciation of both astronomy and natural resources, such as dark skies and fragile ecosystems.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	f	Ryan	Lynch		<p>Broader Impacts</p> <p>The educational programs discussed above have far reaching broader impacts. Since 1991, over 40% of NRAO/GBO summer students have been women, a larger percentage than is present in astronomy at-large. Women have historically been underrepresented in STEM fields, and the NRAO/GBO summer student programs are a critical pipeline for increasing participation by women in STEM. The PING program specifically targets underrepresented minorities, with all eight of the PING mentors thus far being of African American descent. Middle school students participating in PING are mostly minority students, as well. Finally, GBO has a disproportionately large positive impact on socioeconomically disadvantaged populations. Thousands of visitors come from rural parts of West Virginia and neighboring states. GBO acts as a rare example of cutting edge STEM investment in these regions of the country, increasing science literacy substantially. The scientific program of the GBT also cuts across a wide range of disciplines and administrative areas of NSF.</p> <p>I am personally spearheading a new educational initiative in partnership with NROCKS, a local outdoor adventure and education company in Pendelton County, WV. We are piloting a program that will combine night-sky observing with outdoor experiences for youth and the general public. While in its early stages, this program promises to increase knowledge and appreciation of both astronomy and natural resources, such as dark skies and fragile ecosystems.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	g	Ryan	Lynch		<p>Socioeconomic and Cultural Impacts</p> <p>Local, state, and regional socioeconomic impacts were thoroughly discussed at the EIS public scoping meetings held at GBO on November 9th, 2016. However, the scientific and educational programs of the GBO have positive socioeconomic impacts at the national level, as well. NRAO has not performed longitudinal tracking of summer students but anecdotally I can attest to several students who have gone on to academic careers in astronomy and/or come back to work for NRAO and GBO. Students have also gone on to non-academic careers in software design, electrical engineering, renewable energy, education, journalism, and finance, to name a few. These are high-paying jobs that add tremendous value to the economy of the United States. Many of these careers also increase science literacy, which is a positive cultural impact. Hundreds of researchers at all career levels, but especially students and early-career scientists, depend on research activities at the GBO for their continued employment and income. The GBO makes the United States a global leader in radio astronomy, especially in the emerging field of low-frequency GW astronomy. High visibility science of this sort contributes to the cultural environment of United States as a whole.</p> <p>The GBO is also a prominent member of the local community. In addition to supporting the local school system and emergency services, GBO staff hold an annual mountain and road biking festival called the Space Race Rumpus. All proceeds are donated to the Northern Pocahontas County Wellness Center, school system, and senior center. The Rumpus uses multiple facilities on-site, including the old tour center (which is also used as a day care for employees and for employee events). The recreation area, which includes a pool, tennis and basketball courts, a shooting range, and playground, are also open to the local community. These contributions raise the profile of the observatory and, in turn, the role of science in the local culture.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf

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121	h	Ryan	Lynch		Consequences of the Proposed Alternatives for the GBO No-Action Alternative This is the only scenario that will avoid severe, long-term negative impacts on the socioeconomic, cultural, educational, and scientific environments and that supports NSF's mission to broaden the impacts of facilities and activities.	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	i	Ryan	Lynch		Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope This scenario will have negative, long-term impacts on the socioeconomic, cultural, educational, and scientific environments and on NSF's mission to broaden the impacts of its facilities and activities. Specifically, it threatens the open-skies science program which is the foundation of GBO. I was struck by the assumption in the Arecibo Observatory draft EIS that reduced NSF-funded scope for that facility would have minimal impacts — this assumption is incorrect. The staff of GBO supports a wide range of science operations that in turn require broad technical and scientific expertise. A healthy open-skies program also supports a large user community. If funding and time for open-skies science decreases, this user community will necessarily shrink due to decreased supply, not decreased demand. Interested parties will likely need more specialized modes of operation and may provide their own technical and scientific support based away from GBO. This will make it more difficult to recruit the best scientists, engineers, technicians, and educators to GBO. Educational programs that rely on these staff will suffer. If staffing levels decrease it will have a severe, long-term negative impact on the surrounding community. Students and researchers that depend on the GBO for their employment and income will be forced to look elsewhere, but with the Arecibo Observatory also facing possible reductions of open-skies time, they will need to look internationally. Since astronomers in the United States currently have no guaranteed access to facilities like FAST and the SKA, those who are able may leave the United States, taking their expertise and socioeconomic, cultural, scientific, and educational outputs with them. Unfortunately, those without the resources to reorient their careers will disproportionately be women, underrepresented minorities, and members of socioeconomically disadvantaged populations that have been historically underserved in STEM fields. The United States will effectively cede leadership in cutting edge areas of science at the exact moment when it is poised to assume an even greater role, harming vulnerable members of the scientific community. These artificially imposed outcomes will decrease the vibrancy of the GBO and may be cited as reasons to further reduce funding for open-skies science in a negative feedback loop. The EIS must therefore not assume that operations with reduced NSF-funded scope will have minimal impacts.	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	j	Ryan	Lynch		Collaboration with interested parties for operation as a technology and education park All of the impacts discussed previously will be exacerbated and will manifest more quickly. Educational programs will suffer because the GBO cannot act as a quality education park if it is not engaged in science. This alternative will thus have severe, long-term negative consequences on the socioeconomic, cultural, educational, and scientific environments and on NSF's mission to broaden the impacts of its facilities and activities.	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	k	Ryan	Lynch		Mothballing of facilities or deconstruction and site restoration These scenarios should speak for themselves. They would devastate the socioeconomic, cultural, educational, and scientific environments and abdicate NSF's mission to broaden the impacts of its facilities and activities. The impact on the socioeconomic, cultural, and educational environment of the local community and the State of West Virginia would be especially destructive."	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
122	a	Alex	Hill	Senior Postdoctoral Research Associate	I write as an astronomer in support of Green Bank Observatory's ongoing operation of the Green Bank Telescope (GBT) as a premier radio facility with NSF-funded, science-focused operations, the no-action alternative. From my perspective as a multi-wavelength astronomer, the GBT's unique capabilities cannot be replaced by any other telescope. Removing these capabilities from the US portfolio would harm our progress towards addressing the key questions highlighted by the New Worlds, New Horizons decadal survey in midterm assessment. As the decadal survey highlighted, the GBT enables a variety of transformational science in astrochemistry, star formation, Solar System astronomy, stellar astronomy, and galactic science. In my own research, the GBT offers unparalleled resolution (both spatial and spectral) and sensitivity over a wide field of view for study of the dynamics of interstellar hydrogen gas in the Milky Way and other galaxies, teaching us about how stars form in galactic environments. The GBT makes this research possible, allowing us to address fundamental questions identified by the decadal survey including "what are the connections between dark and luminous matter?", "how do baryons cycle in and out of galaxies, and what do they do while they are there?", and "how do stars form?" The GBT is one of NSF's premier facilities, and recent scientific advancements in astronomy in general combined with the new 3 mm capability should solidify its place as a necessary component of the NSF's astronomy portfolio. All of the options under consideration other than no action threaten the GBT and NSF's intellectual merit and broader impacts goals.	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
122	b	Alex	Hill	Senior Postdoctoral Research Associate	In addition to these crucial capabilities, which were clear at the time of the decadal survey, the GBT has been upgraded with fundamentally new capabilities since 2012. The GBT is now a 3 mm telescope, enabling wide-field surveys which directly complement ALMA's capabilities and provide short-spacing data as a counterpart to ALMA 3 mm synthesis observations. Moreover, the recent detection of gravitational waves by LIGO has opened an entirely new field of astronomy. The GBT will open a separate window into gravitational wave astronomy through pulsar timing, which will most likely detect low-frequency gravitational waves in the near future. Without the GBT, the US contribution to low-frequency gravitational wave astronomy will suffer.	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
122	c	Alex	Hill	Senior Postdoctoral Research Associate	Because of the sensitivity and survey speed of a single dish radio telescope and the GBT's location in the National Radio Quiet Zone, no telescope can match the GBT's capabilities in this exciting new field of astronomy and fundamental physics.	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
122	d	Alex	Hill	Senior Postdoctoral Research Associate	As an educator and researcher at a small, undergraduate-focused college, I am keenly aware of the GBT's importance as an education and outreach tool. This education mission is best-served by maintaining the GBT as a world class research telescope so that students trained on the GBT are working on a premier facility.	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
123		Sylvester	Burford	West Virginia native and current resident of Greenbrier County	<p>I attended the Nov. 9 public meeting at the Green Bank Observatory and was distressed to hear that the National Science Foundation was even considering decommissioning the Green Bank Telescope.</p> <p>I believe the number that was thrown out that night was \$11.5 million in yearly expenses to keep the telescope running. In a society that pours half its tax resources into military spending with a Dept. of Defense budget over \$500 billion, are we seriously discussing the paltry sum of \$11.5 million to keep an instrument of science, discovery, and education working?</p> <p>If the telescope were not being used, then get rid of it, but that is not the case. Scientists from around the world rely upon the data collected from the Green Bank Telescope for research. Two of the attendees at the Nov. 9 meeting were from Asia and both stated that they came to West Virginia specifically for access to this telescope. The telescope is the largest and most sensitive of all moveable radio astronomy telescopes currently in operation and is a great source of National and state pride.</p> <p>In a world of increasingly violent politics, we cannot afford to dismiss science as an instrument of peace and unity. For a fraction of the cost of weapons, instruments that divide mankind with war and misery (the worst of human nature) we could instead keep this instrument of science that unites the world in curiosity and knowledge (the best of human nature).</p> <p>I fear what this says about America, as a whole, that we are so willing to sacrifice our science and future so easily.</p>	Against Closure	Email	11/24/2016	
124		Sue Ann	Heatherly	Senior Education Officer, Green Bank Observatory	<p>From email: As the National Science Foundation weighs the value of the Green Bank Observatory against the five options listed in the environmental impact survey scoping meetings, it is critical that you expand the criteria by which impact is measured. The educational program of the Green Bank Observatory has had deep impact on thousands of US students since we began our undergraduate program in 1959. Since then, the education program has grown to offer truly authentic research experiences to participants from youth starting in the upper elementary grades, to college professors who teach at small colleges and community colleges which do not have research programs of their own.</p> <p>What makes these programs deeply impactful, is that participants in our programs are embedded in a working research center where the all of the staff-- whether they be astronomers, engineers, technicians or machinists--welcome and include them in the work that is going on. The open-skies operation of the Observatory is inspiring to our visitors no matter where they sit on the educational ladder. The collaborative problem solving environment, the very visible work-ethic of our staff, and the notable fruits of that labor- namely GBT discoveries--result in the development of aspiration toward STEM in our youngest participants.</p> <p>As a facility of the NSF, the Green Bank Observatory EPO program is YOUR EPO program; one that celebrates your mission: the value and worth of basic research, and the understanding that we can ALL do science.</p> <p>Our educational program is strong, diverse and effective at meeting our nation's STEM education goals. As you deliberate the future of the Green Bank Observatory, I invite you to study the following overview of our current education program. It is imperative to the future success of these programs that the Green Bank Observatory remains a cutting edge research center dedicated to astronomical research.</p>	Resource Considerations	Email	11/24/2016	EPO summary.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
125		Nissim	Kanekar	Associate Professor	I am writing this mail to you as an international user of the Green Bank Telescope (GBT). I have obtained nearly a thousand observing hours of GBT time,... and have written around twenty refereed scientific papers based on GBT data, on a variety of subjects including studies of gas in high-redshift galaxies, pulsars at the centre of the Milky Way, and fundamental constant evolution. I feel that the GBT is an outstanding telescope for astronomy today and (certainly) for the next decade, and also feel that it would be a huge loss to US and world astronomy if the GBT's scientific potential were curtailed in any way. From my perspective, some of the areas in which the GBT is likely to make a huge impact in the near future are pulsar timing (and the search for gravitational waves), searches for pulsars at the Galactic Centre (which would allow us to test general relativity in the strong field regime), using spectral lines of methanol, ammonia, hydroxyl, and other molecules to probe changes in the fundamental constants of physics, searches for atomic and molecular line emission in galaxies at cosmological distances, interstellar chemistry, finding H2O megamasers at cosmological distances, etc.. Picking just two of these, the GBT's superb spectral line and continuum capabilities in the frequency range 67-116 GHz are far ahead of any telescope in the world. The excellent performance of the GBT's active surface will allow the high GBT sensitivity to be exploited to its maximum. The Argus spectrometer and Mustang-II camera make the GBT an outstanding complement to the Atacama Large Millimeter Array for a wide range of studies in the 67-116 GHz frequency range. At lower frequencies, the GBT is a critical part of the Nanograv collaboration, aiming to probe fundamental physics by detecting gravitational waves via their effects on pulsar timing. Based on new theoretical models, this is likely to achieve an indirect detection of low-frequency gravitational waves in the next 5-10 years, simply using the present observational facilities. Further, a proposed new wideband GBT receiver would make a huge impact on such studies, by reducing systematic effects due to interstellar scattering. I note that I do not work in either of the above areas, but feel strongly that the GBT has a critical role to play in both of them. I have, however, worked in, and continue to work in, the area of searches for pulsars at the Galactic Centre: finding a pulsar orbiting around the super-massive black hole at the centre of the Milky Way would allow us to probe general relativity in the strong field regime. After a detection of such a pulsar, follow-up GBT pulsar timing studies would let us search for minute deviations from general relativistic predictions that would be the signposts to theories that unify relativity with the standard model of particle physics. We have already used the GBT to obtain the most sensitive constraints on the presence of pulsars around the Galactic Centre, and have recently carried out the deepest ever integration on the Galactic Centre for this project. In case of a further non-detection, we plan to use the wide frequency coverage of the GBT to extend these searches to even higher frequencies, to take into account the possibility that strong scattering in the medium between us and the Galactic Centre might be washing out the signals. The outstanding frequency coverage and sensitivity of the GBT imply that it will remain at the forefront of such pulsar studies for a long time to come. Another area where the GBT excels, and in which I have a strong research interest, is fundamental constant evolution, where we have used GBT observations of hydrogen, hydroxyl, and ammonia, lines from high-redshift galaxies to obtain the most stringent constraints on changes in two fundamental constants of physics, the fine structure constant and the proton-electron mass ratio. Such high-sensitivity astronomical spectroscopy is the only tool to probe evolution in the fundamental constants of physics over cosmological times, and the GBT is again at the frontier of such research. Overall, I have no doubt whatsoever that the GBT remains an outstanding telescope. Indeed, taking all factors into account, the GBT is quite simply the best single dish telescope in the world today and should retain its premier status for easily the next decade. It would be a huge loss to the international astronomy community if the GBT's scientific operations were adversely affected due to funding constraints. I hence urge you to choose "no action" in the NSF review process.	Against Closure	Email	11/24/2016	
126		Fabian	Heitsch	Associate Professor	I am writing in support of the No-Action Alternative. My background: I joined the Department of Physics and Astronomy at the University of North Carolina Chapel Hill in July 2009, ...My research is in interstellar gas dynamics, specifically the physics controlling the formation of molecular clouds and stars. My research: The interstellar medium (ISM) provides the matter reservoir for star formation in our Galaxy. All star formation occurs in over-dense regions of the ISM, called "molecular clouds" because high gas densities allow the gas to be shielded from ambient stellar radiation, thus leading to the formation of molecules. Given the observational fact that all molecular clouds form stars, star formation must begin immediately upon molecular cloud formation, meaning, these clouds are not long-lived entities but form and disperse as a consequence of large-scale interstellar medium dynamics. Thus, understanding star formation requires understanding molecular cloud formation and evolution. This evolution manifests in the dynamics interstellar gas.... I am very grateful for the generous support by the NSF for much of this work (AST-0807305, AST-1109085). Relevance of GBT for my research: While I am not using the GBT myself (though I am involved in the Green Bank Ammonia Survey [GAS, PI R. Friesen]), observational programs provide the basis for my group's research. As indicated above, the key to solving the puzzle of how stars form lies in the dynamics of the parental molecular clouds. Star formation is a multi-scale process. While the actual star is being formed out of a protostellar core (size scale of ~0.3 light years), the parental molecular cloud providing the mass reservoir necessary for gravitational collapse ranges over scales of a few to tens of light years. These scales are not separated – the gravitational potential generated by the overall cloud mass distribution connects directly to the evolution of protostellar cores. The cores themselves are not isolated structures, but are embedded in filaments, which seem to act as an intermediate stage between the parental cloud and the protostellar cores. While ALMA and the JVA with their interferometric capabilities allow us to study the evolution of protostellar cores as the last stage before the onset of star formation in detail, gas dynamics on larger scales are much more efficiently studied with the single-dish GBT. Specifically the newly acquired 3mm band on the GBT provides invaluable insight into the gas dynamics connecting the parental molecular cloud with the filaments feeding cores. It is such observations that inform the fluid dynamics simulations of my group, investigating with highly-parallelized computer models, including magnetic fields, gravity, thermal physics and chemistry, the evolution of molecular clouds. Result of reduced GBT operations on star formation research: Reducing the GBT operations would result in a focus on high-resolution, interferometric studies without the large-scale counterpart necessary to understand the physical conditions for star formation. In a way, interferometric observations tell us about the final stages of star formation, yet, without any capabilities to investigate efficiently the large-scale dynamics leading to those final stages, our picture of the star formation process will remain woefully incomplete. Star formation is driven by gravity, and gravity is a long-range force. Therefore, understanding the gas dynamics on molecular cloud scales (i.e. the large scales feeding the protostellar cores) is crucial for our understanding of how our Galaxy forms stars. Summary: Star formation is a multi-scale process. Only by combining large-scale surveys of gas dynamics (single-dish) with small-scale (interferometric) observations, can we hope to identify the physical processes driving star formation. While computer simulations such as done by my group can help to arrive at a more complete picture, the usefulness of such simulations is strongly tied to the completeness of the observational evidence. Thus, I am strongly supporting the No-Action Alternative.	Against Closure	Email	11/24/2016	gbteis-fheitsch.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
127	a	Clarissa	Lynch		<p>I'm writing to support the Green Bank Observatory and to ask the National Science Foundation to keep fully supporting science at the GBO. Green Bank has had a profound impact on my life and on my appreciation for science. I grew up wanting to be a scientist and studied chemistry in college. Even with these interests, I never really learned much about astronomy, and never even heard of radio astronomy. That changed when I was introduced to Green Bank. Without the GBO I probably wouldn't even be able to give you an example of science supported by the NSF! But Green Bank has taught me about the wonders of radio astronomy and act as a visible example of NSF investment in our communities. It has also taught me about incredible feats of engineering and technical development. Everytime I see the GBT I'm reminded of the importance of science and technology in our society.</p> <p>But none of these impacts would be possible if the GBT wasn't performing cutting edge scientific research. Green Bank is too important to our communities and to the culture of the United States for NSF to consider cutting back on its investment now. I urge NSF to choose the No-Action Alternative.</p>	Against Closure	Email	11/24/2016	Clarissa_Lynch_GBO_EIS_Comments.pdf
127	b	Clarissa	Lynch		The community of Green Bank has also opened its arms to me and had a profound impact on my life over the last few years. I spread these lessons every time I talk to people about the GBO, and that happens very frequently!	Against Closure	Email	11/24/2016	Clarissa_Lynch_GBO_EIS_Comments.pdf
128	a	Adam	Leroy	Assistant Professor	<p>I am writing in response to the request for comments regarding the future of the Green Bank Observatory as part of the NSF environmental impact study. I am a faculty member at Ohio State University who regularly uses the Green Bank Telescope for scientific research and student training. I am writing in the capacity of a member of the astronomical community and a GBT user, not as a representative of Ohio State University. In this capacity, I would like to highlight the following key points regarding the GBO:</p> <ul style="list-style-type: none"> • The Green Bank Telescope is a world-leading facility at mm wavelengths. Over the last 10 years, the GBT has built its capabilities at mm-wavelengths (similar to those used by the NSF operated ALMA telescope) to the point where it is, by many metrics, now the best single dish telescope operating at these frequencies. This is a crucial frequency range for studying how planets, stars, and galaxies form – with new instruments on the telescope in the last year or two, the GBT is really the best telescope to survey interstellar molecules over large areas of the sky. No facility anywhere else in the world, even ALMA, can match this. My collaborators and I use this capability to map the immediate sites of star formation across whole galaxies, a new direction that is helping to merge two previous disparate subfields. These capabilities are summarized in a recent white paper, which I completely endorse. <p>MM-wave is a huge growth area in astronomy now, with the NSF-operated ALMA and new facilities in France, Mexico, and Japan opening new vistas and fueling rapid growth on many fronts. In many key aspects, the GBT outstrips all of these with the prospect to further improve by leaps and bounds over the next decade. More:</p> <ul style="list-style-type: none"> • The Green Bank Telescope is the ONLY large cm- and mm-wave telescope available to the U.S. community. Radio astronomy is one of the two main ways that we study the universe from the ground. Large single dish telescopes like the GBT are a crucial part of this study, their capabilities to map large areas quickly cannot be replaced by arrays like ALMA. The GBT is the best telescope at these frequencies in the world, but maybe even more important to me and my students: this is the only such facility open to the whole US community. The NSF-run national radio observatories have been an incredibly success story, allowing active radio groups to spring up around the country. 	Against Closure	Email	11/24/2016	GBTLetterAKL.pdf
	b	Adam	Leroy	Assistant Professor	<p>I use these facilities to train Ph.D. students and undergraduates at Ohio State University. Similar groups exist at dozens of universities around the country. The competing facilities in Japan, Mexico, Spain, and France are not open to the US community, and they do not represent viable paths to train students (something the GBT excels at). If the GBO closes and these become the only facilities in the world, the U.S. will lose its leadership in this area and the radio groups at universities around the country will suffer. As a big single dish facility, the GBT serves as a flexible platform for the development of new world class instruments (usually built at Universities). For my purposes, the GBT offers training to Ph.D. and undergraduate STEM students that is hard to find anywhere else right now. Most of the U.S. university radio observatories have closed, and facilities like ALMA operate in a vein similar to space missions, offering limited opportunities for such student interaction with the telescope itself. The GBT is the exact opposite, giving students direct access and indispensable hands-on training. All four of my Ph.D. students have trained and observed at the GBT and the experience has been indispensable.</p> <p>In summary: the steerable 100-m Green Bank Telescope is a tremendous facility only 16 years in to its life span (which is usually many decades for such a facility). It is a world-leading facility at mmwavelengths, one of the fastest moving fields in astronomy today. It is the only major single dish mmwave observatory available to scientists, like myself, at U.S. universities. It offers an indispensable avenue to train students in radio astronomy, one of the two major ways we study the universe from the ground. I regularly use the GBT, and my collaborators and I have major plans for the coming years. I have trained four students using the GBT. This is a vibrant facility in the first stages of its life as a major national observatory, I strongly urge the NSF to consider the "no action" option.</p>	Against Closure	Email	11/24/2016	GBTLetterAKL.pdf
129	a	Cliff	Nieuwenhuis	4-H volunteer	As a 4-H volunteer leader, I am constantly reminded of the importance of STEM (Science, Technology, Engineering and Mathematics) for the future of the kids we teach. I have found that high quality programs like those available at the Green Bank Observatory are critical for sparking the imagination of the students and fueling their enthusiasm for learning.	Against Closure	Email	11/24/2016	
129	b	Cliff	Nieuwenhuis	4-H volunteer	<p>Using the Green Bank telescopes are, after all, "the real thing."</p> <p>Please include me among those who see real value in keeping the Green Bank Observatory in it's position as a world leader in technology, open and operational, continuing it's important work and inspiring future generations.</p>	Against Closure	Email	11/24/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
130	a	Steve	Croft	Researcher/Outreach Specialist	We are the Berkeley SETI Research Center, a research group at the University of California, Berkeley, working on the Search for Extraterrestrial Intelligence (SETI). The Green Bank Observatory (GBO) and the Robert C. Byrd Green Bank Telescope (GBT) are critical resources for our team. The GBT supports six on-going research projects for our team, including the Breakthrough Listen Initiative, the Search for Extraterrestrial Radio Emissions from Nearby Developed Intelligent Populations (SERENDIP), SETI@Home and a myriad of targeted Piled efforts, including a detailed study of the mysterious Kepler star KIC8462852. To execute these programs, our group currently employs more than a dozen full time research and administrative staff at UC Berkeley, along with twice that number of students and summer interns, all of which would be drastically and detrimentally affected by any changes to GBO's operating model that impacted availability of the GBT. Our research group has also tremendously benefited from engagement with GBO staff on both science and outreach, and it would be severely detrimental to our ability to execute our research on the GBT without their continued involvement. A large fraction of our current funding comes from the Breakthrough Listen (BL) initiative, a 10- year, \$100-million project to dramatically expand the search for intelligent life beyond Earth. The GBT is one of three facilities that are lynchpins of the BL observing strategy. BL has purchased approximately 20% of the available time on GBT, in addition to time on the Parkes Telescope in Australia, and the (optical) Automated Planet Finder in California. To accomplish the BL science program, we have recently deployed hundreds of thousands of dollars' worth of equipment to GBO, in order to take advantage of the exceptional capabilities of the GBT for searches for artificial transmissions. We were dismayed to hear that NSF is considering divestment from GBO, just as exciting projects like BL are getting going. GBO has the potential to make one of the most profound discoveries in science, the detection of cosmic company, at little to no cost to NSF. BL purchases time on the telescope directly, but the withdrawal of NSF funding would affect not just NSF programs, but programs like BL that pay their own way. The science from GBO represents excellent value for NSF and we urge them to carefully consider any options that would result in decreased access to this world-leading facility. In addition to the potential harm to the search for the answer to one of the most profound questions in science, divestment from GBO would put in jeopardy the training of researchers from undergraduates through postdocs. The loss of GBO would also mean that no US radio facilities are participating in the BL program.	Against Closure	Email	11/24/2016	bl_gbt_eis.pdf
130	b	Steve	Croft	Researcher/Outreach Specialist	Over the past year we have also built up a thriving student research program at UC Berkeley, engaging a diverse group of 10 students in analysis of GBT data, design of GBT data analysis algorithms, and training in the running of observations on the world's largest fully-steerable radio telescope. Several of these students have become experts in the GBT and its systems, and have excellent prospects for pursuing careers in radio astronomy going forward.	Against Closure	Email	11/24/2016	bl_gbt_eis.pdf
130	c	Steve	Croft	Researcher/Outreach Specialist	Breakthrough Listen represents an excellent opportunity for public engagement in science, as evidenced by the large amount of media interest around the project, and the healthy following for Berkeley SETI Research Center on social media (with over 10,000 followers on Facebook and Twitter). We are collaborating closely with GBO on public outreach efforts, which also directly reach the local community in West Virginia. This includes a GBO SETI tour which acts as a large draw for tourists coming to this remote area of the country. Were GBO to be threatened, both the direct investment from BL as well as the indirect benefits of BL to the WV community would be impacted. We urge the NSF to consider carefully these broader impacts of investment in GBO when planning the next steps in its future. We would be happy to answer any questions arising.	Against Closure	Email	11/24/2016	bl_gbt_eis.pdf
131		Richard	Wolfe		Hello and Happy Thanksgiving. I hope you will find a way to keep Greenbank Observatory open and operational, in the interest of furthering scientific learning and the inspiration and hope that only this kind of exploration can offer the human spirit.	Against Closure	Email	11/24/2016	
132			Aroshi (?)		Summary: My recommendation to NSF is to continue investment for science-focused operations of the GBT (ie the no-action alternative in the EIS). It is with great dismay that I have been watching the National Science Foundation's (NSF) steps to make a historical blunder i.e shutting down and deconstructing the Green Bank Telescope. Even a cursory look at the list of radio telescopes available round the world makes it immediately obvious --(a) the number of 100 m telescopes are very few, (b) even fewer in number are those that can operate in the mm-wave band and (c) in that class the GBT is a rare telescope that allows open access to the astronomical community all over world. Personally, I came to know of the many American astronomical facilities while I was doing my graduate work in India. And this was only because of the open access policy of these facilities. Many of my colleagues used data from these facilities for their thesis work. But more important, in my opinion, is the fact that open access provides opportunities to break what I will call the 'bandwagon effort' that is unfortunately common in Science for it makes telescope time available for radically different observational projects. Open access also helps in the development of new observational techniques and instrumentation. So I very strongly feel that the NSF should retain the GBT facility and fund it in a way to preserve the open access policy. Since its commissioning in early 2000, the GBT has been augmented with new instrumentation and its performance has been enhanced particularly in the mm-wave band. The GBT now is the largest, fully steerable, filled aperture mm-wave telescope in the world. The most important improvement in mm-wave instrumentation is the capability to increase the field-of-view of telescopes using conventional focal plane array. Such instrumentation equipped the GBT to tremendously increase its survey speed. The emerging developments to increase field-of-view can make large telescopes an integral part of the existing and up-coming interferometers. It will be an embarrassment if large telescopes do not exist when such instrumentation are available. At frequencies below 10 GHz, when telescope facilities elsewhere are being equipped with new instrumentation to make them suitable for new discoveries in the field of Gravitational wave and Fast radio bursts, the decision to close down the GBT appears to be ill-judged. These new instrumentation include phased array feed and broadband, low noise feed system. In short, my recommendation to NSF is to continue investment for science-focused operations of the GBT (ie the no-action alternative in the EIS).	Against Closure	Email	11/24/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
133	a	William	deWindt	Director Virginia Tech SNO, Server and Network Operations	<p>Allow me to introduce myself first. I am William S. deWindt and I am a faculty member at Virginia Tech in the TLOS division which supports a vast array of technology based services. I am also a proud graduate of the class of 1996 at Hampden-Sydney College and was lucky enough to get hired after graduating for a position in the Physics and Astronomy Department at the College. I worked with wonderful people such as Dr. Keohane and was fortunate enough to work at the HSC observatory on a number of projects all of which inspired me to become an amateur astronomer after everything I learned both in the classroom as an undergraduate and during my tenure there as a staff member.</p> <p>In closing, I have just a few points. First, for the latest trip Hampden-Sydney made to Green Bank my family donated most, if not all, of the funding to make the trip possible illustrating our commitment to education and astronomy. Second, just shutting it down would be a huge disservice to the astronomy and educational sectors. Please accept my letter and ponder it before you make your decision.</p>	Against Closure	Email	11/24/2016	
133	b	William	deWindt	Director Virginia Tech SNO, Server and Network Operations	The Green Bank Observatory is a vital asset not only for astronomy as a whole but, as Dr. Keohane pointed out, also for the education of our students. Simply shutting it down would be a tremendous mistake. I agree 100% with Dr. Keohane that the only viable options are options #1 and #2 and if we must go with option #2 and I'm sure you could reach out to Virginia Tech to collaborate on keeping the facility operational. With Green Bank being so close to our Virginia Tech campus and our own observatory that makes total sense.	Alternatives Consideration	Email	11/24/2016	
134	a	Gautam	Jain	PhD student	My name is Gautam Jain and I am currently a finishing PhD student in chemistry at the University of Melbourne in Australia studying next generation solar technologies. I had the pleasure of visiting the Green Bank telescope (GBT) when I was an undergraduate studying astrophysics at Rutgers University with Professor Andrew Baker in 2008. I regard this trip as one of my favorite learning experiences as an undergrad. I remember we started mapping the Orion constellation with a very old-school 40 ft telescope, doing everything manually. It was such an interesting experience to do everything manually, and thus having to work in a team to map the constellation. We also got a chance to climb onto to the 140 ft. telescope which if I remember correctly had a bearing joint that was quite different from the other telescopes on the campus. I remember even watching an old documentary on how they decided to build this telescope and issues with the bearings that caused setbacks in its eventual construction. Everything about the campus from the nature, to the people, to the science made it a trip I remember very fondly to this day.	Against Closure	Email	11/24/2016	
134	b	Gautam	Jain	PhD student	I also have a bit more of a personal stake in the Green Bank Telescope. I worked as a summer research student under Professor Andrew Baker studying 21cm spectra (HI spin-flip transition) of isolated elliptical galaxies to better understand galactic evolution through mergers. Through the research conducted on these galaxies, follow up studies were done using the VLA on galaxies that were observed to have significant HI lines as found by the GBT. The Green Bank telescope was essential in my research then, but furthermore influenced my path into scientific research. Because of these reasons, I hope the National Science Foundation will still continue funding the Green Bank Telescope so future students and researchers can have similar experiences. Thank you for your time.	Against Closure	Email	11/24/2016	
135		Marian	Pyles	Citizen of WV	<p>I am writing in support of full funding for the Green Bank Observatory. I am writing strictly from the viewpoint of a citizen of West Virginia. I have lived throughout the state of West Virginia for my entire life, and for it I feel passionately. My husband obtained a teaching job at Pocahontas County High School during 2013. Not knowing what we were getting into, we moved along with our then one year-old daughter to Green Bank.</p> <p>There was something special about the community right away. In addition to its beauty, there was a sense of intelligence that could be immediately felt. Coming from Charleston, we were used to pollution, constant cell phone use, and a general disregard for the land. Green Bank seemed to be a sanctuary—a quiet place where one could come to think, appreciate nature, and expand one's horizons beyond the hustle and bustle of the American life.</p> <p>While we were blown away by the beauty of the area—using the observatory for daily walks with our daughter—we quickly noticed that this was not only a sanctuary for nature, but it was a place full of amazing scientists who visited from around the world to come for research. This wasn't just some science center tucked away in the mountains of West Virginia; this was an amazing hub of learning and astronomy. As our daughter grew older and began to talk more, words like satellite and astronomy were in her vocabulary. She developed an intense interest in space and its relation to our planet that continues today, even though a job changed has moved us an hour north of the town.</p> <p>I have several points in writing all of this. To say that the Green Bank Observatory is important to the community of Green Bank and the state of West Virginia is a huge understatement. It is a source of pride for the members of the community; it is a place of reason and it is real. In a world where so much of what children see is virtual, this stands as a concrete example of science. In a world filled with propaganda, this is a place free from persuasion—an escape from the narrow confines of the norm and a gateway to thinking and observation.</p> <p>As I mentioned, my perspective as that of a regular citizen. I cannot begin to understand the capabilities the facility has to offer, but I know it is regarded as top-of-the-line. I feel the value the Green Bank Observatory brings goes well beyond the state of West Virginia and even the United States. It sparks an interest in science among youth and anyone who visits. I hope funding will continue so that this wonderful place can inspire critical thinking and a love of science for years to come.</p>	Against Closure	Email	11/24/2016	Observatory letter.docx
136			Whitmore (?)		I went there on my ninth grade field trip and it made me think we can do anything. I ended up going to Marshall University in Safety. I am 60 now and thankful for that experience. Please keep them so future children can see what is possible in West Virginia. Science is needed to be observed by all.	Against closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
137		Jacob	Harrell	Coordination Biologist	Thank you for giving the Environmental Coordination Unit of the Wildlife Resources Section within the WV DNR the opportunity to comment on proposed changes to the Green Bank Observatory (GBO). Due to upcoming financial restraints, the National Science Foundation (NSF) has decided to explore several options for the GBO and has initiated the EIS/Section 106 consultation process for the GBO. These proposed changes could potentially have an impact on the wildlife and natural resources of the area, depending on what route the NSF ultimately chooses to take. The NSF has asked for comment concerning the direction and extent to which they should be focusing their EIS. To that effect, the Coordination Unit presents the following comments: Comment 1: The GBO property is bordered to the west by Deer Creek. The EIS should focus attention on this watershed and its many tributaries that run through the property. Deer Creek is a high quality stream currently stocked for trout with trout stockings occurring downstream of the GBO. It has historically held populations of New River Crayfish (<i>Cambarus chasmodactylus</i>), New River Shiner (<i>Notropis scabriceps</i>), Tongue-tied Minnow (<i>Exoglossum laurae</i>), and the Candy Darter (<i>Etheostoma osburni</i>). Populations of these aquatic species have also been reported to occur within the tributaries found on GBO property. These are all aquatic species with compromised statewide populations, but particular special concern is given to the Candy Darter which is currently facing a drastic decline across the state due, in part, to habitat loss and over-competition/hybridization by the more aggressive Variegated Darter (<i>Etheostoma variatum</i>). There is evidence that populations of Candy Darter are becoming more and more isolated as a result. Deer Creek is also listed as a state mussel stream. As is such, a mussel survey will need to be performed in the event that the eventual changes that NSF proposes will have an impact on the stream's mussel communities. Comment 2: Historically, WV DNR has managed special hunts within the GBO property. These hunts are widely viewed as being successful and essential to maintaining proper stewardship of the state's flora and fauna. A wealth of biological data has been collected thanks to the hunts within this area. The EIS needs to address the concern about the future of hunting within the area. In order to more aptly manage the state's deer populations, hunting should continue on the property. Comment 3: There are a number of plant species of concern that have been previously observed on the property. These include Hemlock Witchgrass (<i>Dichanthelium sabalorum</i> var. <i>thinium</i>), Bashful Bulrush (<i>Trichophorum planifolium</i>), and the Black-Girdled Bulrush (<i>Scirpus atrocinctus</i>). The EIS should involve a measure of focus devoted towards the continued presence of these plants. Comment 4: The GBO property includes a medium core forest area (250-500 acres) and several small core forest areas (less than 250 acres). The impacts of potential fragmentation of these core forest areas should be analyzed. Also, there is potential that these forested areas may include roosting trees for bats. The EIS should include focus on potential impacts to bat and migratory bird communities.	Resource Considerations	Email	11/24/2016	GreenBank Comment.pdf
138	a	Masao	Saito	Director	My name is Masao Saito, director of Nobeyama Radio Observatory, a branch of National Astronomical Observatory of Japan. Our observatory operates the Nobeyama 45-m radio telescope at mainly 15 - 2.6 mm and the solar polarimeters. My scientific background is star formation and protoplanetary disk formation. I'd like to express my opinion on Green Bank Telescope (hereafter GBT) and ask NSF to reconsider their funding. GBT with its diameter of 100 m is the largest steerable single dish telescope in the world is a perfect complement to a large radio interferometer such as JvLA and ALMA. For example, GBT can be considered as a magnifying glass and searched interesting phenomena in a large area with moderate resolution. JvLA or ALMA can be taken as microscope to look more details with very fine resolution. I here describe four notable achievement and activities related to GBT. First, GBT rapidly improved its capability significantly since 2012 when GBT was evaluated. GBT successfully installed a highly sensitive K band receiver and a 16 beam 3 mm receiver Argus. More details can be found in a white paper by Lockman et al. It is true that there still is room for improvement in daytime performance of pointing and surface accuracy under study and currently limited time can be spend on 3 mm observations. For us, GBT is a good-matching telescope and our scientific outcome is better together with GBT because the beam size of Nobeyama at 3 mm is comparable to GBT at 7 mm, and our beam size at 7 mm matches with GBT 15 mm. Thus direct comparison can be done in deriving physical conditions of excitation temperatures and column densities. As stressed again, GBT will produce an excellent guide map to be followed by JvLA and ALMA observations in the further study. In particular, ALMA band 1 at 7 mm and band 2 at 4 mm coming soon expects GBT's guide maps at the same wavelength. Second, GBT contributed significantly to various science areas including star formation in the past decade or so. In particular, molecular line study at 3 mm are important star formation studies. For example Nobeyama produced a wide-field galactic plane map in CO(1-0) and its isotopologues at 3 mm that are fundamental tracers of molecular material. These map illustrates distribution and kinematics of molecular clouds on a large scale, but we need a map of dense gas tracers within our CO maps to connect star formation and its natal gas. GBT with Argus will produce dense gas tracer maps at high resolution in HCO+, HCN, and N2H+ enabling us to investigate dense gas properties closely related to star formation on a moderate scale. GBT's impressive performance was already demonstrated in a white paper written by Bally et al. Further, large collecting areas enable one to detect faint emission from biomolecules in the interstellar space. Third, presence of GBT motivates other single dish radio telescopes including ours to seek for performance as good as one can achieve. These atmosphere bring the large single dish community up together to the next stage required to push the border of cutting-edge science. At the same time, astronomers in GBT also have spread their knowledge and expertise in both science and technology to large single dish radio telescopes community in the world particularly a newly built 65-m Tien Ma telescope in China. We, of course, have done mutual collaboration, and have learnt things and issues with each other. These learn-together activities have deepened our understanding, improved characterization, and enhanced capabilities of large single dish telescopes world wide. In fact, GBT hosted a workshop in Sep 2016, and formed a consortium that will collaborate to improve large single dish performance in the future.	Against Closure	Email	11/24/2016	

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138	b	Masao	Saito	Director	<p>Lastly and importantly, GBT has been a crucial asset to attract young generations from all over the world to radio astronomy and to motivate them to become future radio astronomers. This healthy cycle is quite important for future radio astronomy and once broken it requires tremendous effort to recover a good cycle again. Indeed, I have met many radio astronomers who learned things at GBT in their early career, summer student, Ph.D. student, Postdocs, and so on.</p> <p>In concluding my remarks, GBT's leading role in the field is still very crucial in radio astronomy and I, as the director of Nobeyama radio observatory, am asking NSF to invest GBT at healthy level to continue their science operation and to provide opportunities to astronomers to explore cutting edge science with GBT's unique and superior capabilities.</p> <p>Such investment is very important to keep up radio astronomy in not only U.S. but also worldwide and matches with the International Astronomical Union's mission "Astronomy for the Developing World".</p>	Against Closure	Email	11/24/2016	
139	a	Brian	Svoboda	PhD student	I am writing in support of a "no-action" position for the NSF's Environmental Impact Statement for changes to operations at Green Bank. As a PhD student in my fifth year at the University of Arizona, the staff at Green Bank and the Green Bank Telescope (GBT) have been instrumental to my thesis research in star formation throughout my time in graduate school.	Against Closure	Email	11/24/2016	
139	b	Brian	Svoboda	PhD student	<p>To summarize the numbered paragraphs below: (1) data from the GBT has formed the core of my thesis and could not have been replicated with the VLA or Arecibo, (2) the unique capabilities of the GBT 100m at 3mm for research in star formation cannot be substituted by non-US facilities such as the LMT, NRO, or IRAM, and (3) the ground-breaking capabilities of ARGUS on the GBT make my in-progress research possible.</p> <p>(1) I study the earliest evolutionary phases of high-mass star formation, which involves observing the molecular cloud "clumps" that are the precursors to stellar clusters. The foundation of my research involved a blind Galactic Plane survey of over 4600 clumps discovered in the millimeter radio continuum to identify and characterize clumps without any indication of star formation activity (Svoboda et al. 2016 [1]). Data from the GBT formed the cornerstone of this work by supplying sensitive and wideband molecular line data (courtesy of VEGAS) in K-band of ammonia and the 22 GHz water maser line, forming the largest catalog of such data to date (>3200 pointings). The ammonia data provided gas kinetic temperature information essential for accurate cloud mass calculations and the water maser line for an unexpectedly sensitive indicator of star formation -- more sensitive in fact than existing mid-infrared surveys such as Spitzer GLIMPSE. Due to the effects of sensitivity, spatial filtering, and resolution, the GBT is the only instrument capable of a survey such as this. The VLA would have too poor resolution in a phased-array configuration and would filter out molecular emission on these ~1 pc spatial scales. Arecibo cannot observe above 5 GHz and could simply not observe these targets because it has an extremely limited view of the Galactic Plane. In short, the 2012 Eisenstein-Miller committee in the NSF AST portfolio review did not consider such facts when recommending to divest from Green Bank. (2) Building upon this large survey as the foundation of my thesis, my further progress research has involved targeted follow-up of the most massive starless clump candidates with the GBT at 3mm (W-band). Taken from a blind survey, these targets represent the best candidates for starless protoclusters and the initial conditions of high-mass star formation. For these cold, dense molecular sources, the J=1-0 ground-state transitions of the most abundant dense gas tracers lie in the 4 to 3mm band from 70 to 115 GHz. (3) To characterize the chemistry and stability of the substructure in these high-mass starless clumps, I have observed N₂H⁺/HNC and their deuterated counterparts with the GBT in W-band (Svoboda et al. in prep.). The filled aperture of the GBT is essential for accurate column density calculations. We also have the good fortune of receiving a large allocation of ARGUS time to map the molecular line profile, which shows a signature of global infall, towards a sample of six high-mass starless clumps (to be executed in March-May 2017). These sources were selected from an infall survey on the ARO 12m of more than >100 starless clump candidates (Calahan, Shirley, & Svoboda in prep.), however the large 70 arcsec beam of the 12m is insufficient to determine if infall is actually present. Infall motions can only be secured through modeling spatially resolved maps, without filtering effects, and this is something only the GBT can provide in the optically thick ground state transitions. These observations are especially exciting and important because they could represent the very cusp of clustered, high-mass star formation, and are only possible through the sensitivity, resolution, and filled aperture of the GBT & ARGUS. In the near future I plan on applying for several future observing proposals to the GBT, taking advantage of ARGUS and MUSTANG, to better understand the initial conditions of high-mass star formation, that will likely form the basis of post-doctoral fellowship applications, complemented by the VLA and ALMA. It is my sincere hope that Green Bank will continue to operate at high-frequencies with continued NSF support, and that the NSF will conclude that a "no-action" in their Environmental Impact Statement is the best choice for the US astronomical community.</p>	Against Closure	Email	11/24/2016	
139	c	Brian	Svoboda	PhD student	<p>As clearly stated in the white-papers Lockman et al. (2016 [2]) and Bally et al. (2016 [3]), the GBT is a cutting edge and unparalleled instrument in sensitivity for this scientifically valuable frequency range for star formation. To be clear, The LMT 50m, NRO 45m, and IRAM 30m would not have the sensitivity or the resolution of the GBT 100m to reach spatial scales of high-mass starless cores (9 arcsec, <0.2 pc at 5 kpc) at Galactic distances for the 1-0 transitions. Moreover these facilities are not accessible to US astronomers such as myself.</p> <p>[1] Svoboda, B.E., Shirley, Y.L., Battersby, C., et al. 2016, ApJ, 822, 59 [2] Lockman, F.J., Lynch, R., Frayer, D.T., Mason, B.D., & Ransom, S.M. 2016, arXiv:1610.02329 [3] Bally, J., Blake, G., Bolatto, A., et al. 2016, arXiv:1610.09014</p>	Against Closure	Email	11/24/2016	

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140	a	Larry	Davis	President, Greenbrier Valley Chapter of Sigma Xi and Professor Emeritus at the West Virginia School of Osteopathic Medicine	The scientists and educators at the Green Bank Observatory in West Virginia contribute much to the programs of our chapter of the Sigma Xi research society. The radio astronomy observatory is located just seventy miles to the north of the West Virginia School of Osteopathic Medicine which serves as the home institution for the chapter.	Against Closure	Email	11/24/2016	
140	b	Larry	Davis	President, Greenbrier Valley Chapter of Sigma Xi and Professor Emeritus at the West Virginia School of Osteopathic Medicine	On two occasions Dr. Felix Lockman delivered scientific talks to chapter members, other medical school faculty, staff, and students. People from the surrounding community also attended these talks. He also masterminded an excellent fall visit to the facility in Green Bank by Sigma Xi members, friends, and families. This included the Green Bank Science Center tour and a comprehensive behind-the-scenes tour of the entire facility. One of the many educational programs at Green Bank is the Pocahontas County Middle School Science Fair that is organized by the people at the science center. Winners of that annual science fair come to Lewisburg to participate in the Southern West Virginia Regional Middle School Science Fair put on by Sigma Xi and the medical school in the spring.	Against Closure	Email	11/24/2016	
140	c	Larry	Davis	President, Greenbrier Valley Chapter of Sigma Xi and Professor Emeritus at the West Virginia School of Osteopathic Medicine	The following two recent papers posted on the Cornell University Library website specify good reasons that the research activities at the Green Bank Observatory should continue with NSF and many research institutions participating. Please take them wisely into consideration. New and unique capabilities of the Green Bank Telescope for studies utilizing operations in the 3mm band wavelength are unrivaled in the world. (1) The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper Authors: Felix J. Lockman, Ryan Lynch, David T. Frayer, Brian D. Mason, Scott M. Ransom (2) The Case for a Publicly Available, Well-Instrumented GBT Operating at 20-115 GHz Authors: J. Bally, G. Blake, A. Bolatto, C. Casey, S. Church, J. di Francesco, P. Goldsmith, A. Goodman, A. Harris, J. Jackson, A. Leroy, F. Lockman, A. Lovell, A. Marscher, D. Marrone, B. Mason, T. Mroczkowski, Y. Shirley, M. Yun At our President's Advisory Committee meeting on November 15 Green Bank Observatory support was unanimously voiced by those present. Please do all you can to keep things going full speed at the Green Bank Observatory so that the benefits stated above continue to be realized.	Against Closure	Email	11/24/2016	
141	a	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	My research activities are already being impacted by the divestment by NSF in the Green Bank Telescope (GBT), and would be severely hampered by the proposed changes. Three major aspects of my research rely on the unique features and capabilities of the Green Bank Telescope: (1) understanding diffuse radio emission that may confuse detection of the signature of inflation after the Big Bang, (2) probing the details of the brightest radio pulses in our galaxy from the Crab Pulsar, and (3) searching for gravitational waves using pulsars. The GBT is the single best instrument in the world for studying diffuse radio emission on degree-sized scales because of its large, unblocked aperture and its wide frequency coverage. Radio interferometers, like the Jansky Very Large Array and the future Square Kilometer Array are not able to accurately measure diffuse emission because they are not single dish telescopes like the GBT. Accurately determining the contaminating effects of diffuse polarized emission from the galaxy is crucial to cosmology experiments that seek to measure the so-called B-mode signal that is predicted to be produced by the process of inflation immediately after the Big Bang. With the reduction in open-skies telescope time available at the GBT, my collaborators and I are already finding it difficult to get the data we need to investigate this problem. The GBT is also uniquely suited for studying the details of radio emission from pulsars. There are several pulsars that are known to emit radiation across the full range of frequencies to which the GBT is sensitive. Some of these pulses of radiation are brighter than anything else in the galaxy. No one knows for sure how this emission arises, but understanding it could lead to new technologies for radio communication. No other facility provides the combination of sensitivity and bandwidth needed to study this emission in general. The bandwidth required to study this problem requires that we bring our own specialized equipment to the telescope to record the raw signals from the telescope. I can speak from personal experience how inspiring that level of hands-on activity is for young scientists and engineers. I can also attest to the fact that it is nearly impossible to access the equivalent raw signals at other facilities, for technical, logistical, or policy-based reasons. Reduced open-skies access to the GBT will directly delay studies to understand this enigmatic radio emission mechanism. Finally, I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes - a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks - to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves. Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists like myself are at the early stages of their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at Columbia University, and at scientific institutions across the United States.	Against Closure	Email	11/23/2016	

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141	b	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	Here are the impacts of each proposed scenario, as I see it: No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.	Alternatives Consideration	Email	11/23/2016	
141	c	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.	Alternatives Consideration	Email	11/23/2016	
141	d	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers; they would incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.	Alternatives Consideration	Email	11/23/2016	
141	e	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher-tech areas of the country. The people of Pocahontas County are proud of this observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/23/2016	
142	a	Paul and Linda	Kamienski		Although we attended the NSF meeting (afternoon session) at the Green Bank, WV Observatory on November 9, 2016 we did not speak at the meeting. There were a large group of people from all over Pocahontas County and from other parts of WV as well as from Virginia, North Carolina and Pennsylvania who spoke in support of the GBO and offered a wide variety of perspectives in their support. Everyone supported the first two options: a) Continued full NSF Support and b) Increased Collaboration with other parties and continued science focused operation with gradual reduction in NSF funding. Based upon sound reasoning, there was no support for the other options. We offer the following comments in the two categories below in continued support for GBO (options 1 or 2): Technical Relevance and Quality of Research & Personnel While it was pointed out that input on technical topics was not the purpose of the meeting, this issue is critically important to a sound decision on the future disposition of GBO. The NSF overview by Mr. Edward Ajhar, although very brief, indicated that GBO researchers had made significant contributions to pulsars for detecting gravitational waves and other research areas which would indicate that high quality and relevant research continues to be conducted at GBO. Other speakers indicated that the facility had unique research capabilities and was well respected by scientists worldwide, and that new capabilities were just now being fully commissioned. Some questioned how the prior 2012 study was conducted including: who provided input, who had participated and their level of subject matter expertise, or who reviewed and commented on the study results. Because this is so important, if there is any question about the validity of the prior conclusions, the study should be redone resolving any and all of these outstanding issues. Assuming that GBO has unique capabilities, providing solid research results with highly qualified scientists and therefore is a solid contributor, then options 3, 4 and 5 should not even be on the table for consideration.	Against Closure	Email	11/23/2016	
142	b	Paul and Linda	Kamienski		Impact on Community, County and WV Many of the speakers representing a wide variety of professions and perspectives spoke about how GBO had a positive impact on them personally, on their children, on their businesses, and overall on their community. While we were aware of many of the positive impacts GBO had on the community, we realized our knowledge and understanding did not even scratch the surface. Hosting and promoting science fair competition for local schools, promoting STEM careers, involving students of all ages in real live research programs, assisting in training of local EMS as well as machinists and other trades, direct volunteer participation in a variety of civic activities are among the contributions of the GBO personnel that make them an important, integral and invaluable part of the community. While this would be very important in any location, it is particularly valuable in rural WV. Promoting students to pursue STEM careers by exposing them to top notch people and top notch research is invaluable for the population of this rural community. (see transcripts of speakers for many specific examples).	Against Closure	Email	11/23/2016	

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142	c	Paul and Linda	Kamienski		Options 3, 4 and 5 are realistically a step-wise approach to shutting down and dismantling the facility which would be devastating to the community, and bad for WV as well as the Country. Education of the next generation happens if top-notch research is being conducted by top-notch scientists as is done today. Without this the facility becomes an interesting but much less relevant "museum" which would eventually lead to mothballing the site. Continuing costs for maintenance would ultimately lead to dismantling.	Against Closure	Email	11/23/2016	
142	d	Paul and Linda	Kamienski		Currently, residents in Pocahontas County have no cell phone service and poor internet capability in large part due to the NRAO "quiet zone" in the area. They put up with this inconvenience due to the greater good that GBO provides. In options 3, 4, 5 that leads to mothballing, the quiet zone would likely be eliminated. This unique quiet zone would be difficult if not impossible to reinstate in the future. Therefore, NSF needs to think carefully about both the technical capability as well as the major positive impact that GBO has on the community before reaching a decision.	Against Closure	Email	11/23/2016	
142	e	Paul and Linda	Kamienski		NSF Funding Approach Since relevant and productive research is being conducted at GBO, and recognizing that NSF funding sources are under pressure, option 2 with increased collaboration with other third parties appears a logical alternative. However, instead of GBO being primarily responsible for finding other partners and funding, NSF should have a vital and active role in this activity in partnership with GBO. Any funding reductions from NSF should be directly tied to the amount of additional funding that this collaboration achieves in order to keep GBO funding whole in conjunction with continued good management of costs by GBO.	Alternatives Consideration	Email	11/23/2016	
143	a	Jack	Shilt		It would be foolish to eliminate the largest steerable radio dish from the USAs assets. The current facility and the dish prior served as invaluable resources to NASAs space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently prevented significant losses to the return from tax payer investments into space missions. Rebuilt as recently as the early 90s, it also has hardly been utilized long enough to return taxpayers investment into it. Around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days, and is unique among various radio telescope systems operating in GHz observing with its open proposal process.	Against Closure	Email	11/23/2016	
143	b	Jack	Shilt		Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and thus instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email	11/23/2016	
143	c	Jack	Shilt		Finally being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands of research to the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average hammer. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email	11/23/2016	
144		John	Makous	HS Physics Teacher	I am a high school physics teacher at Providence Day School in Charlotte, NC, where I have taught for the past 25 years. Over the past 10 years I have taken a group of physics students annually to the Green Bank Observatory to experience the excellent education outreach program this observatory offers. I am asking that in considering the future of this observatory you choose either of these options: 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope I use a "modeling" method to teach physics, in which the students develop an understanding of physics by doing physics and developing models to explain their investigations. This methodology addresses the current outcry by experts that emphasizes the need for students to develop good critical thinking and analytical skills through STEM experiences. The group of students I take to the Green Bank Observatory include my AP Physics students (mostly seniors) and some ninth graders. The program my students experience at the Green Bank facility is the epitome of a modeling method of learning, and it resonates strongly with the STEM skills training needed for today's students. My students spend four days using the equipment at the observatory to collect and analyze radio astronomy data. The courses I teach are not astronomy courses, and most of the students are very unfamiliar with astronomy going into the four day experience at Green Bank. They struggle at first, but by the end of the four days the students are able to make sense of their data and provide reasonable explanations of their observations. This is an experience that cannot be duplicated elsewhere. For most of my students this is a memorable experience that they look back on fondly. Regardless of what my students go on to study, whether it is science, engineering or business, their experience at the Green Bank Observatory provides an excellent sampling of future challenges they will be facing regarding new learning and problem-solving experiences. In considering the future of the operations of the Green Bank Observatory I urge you to make a choice that will enable the observatory to continue providing the excellent educational opportunities that my students have been able to experience, and future students will be able to experience in years to come.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
145	a	Saira	Rizwan	Student Government Association Secretary S.P.A.C.E. Club President WV SPOT Ambassador West Virginia State University	<p>My name is Saira Rizwan and I am an undergraduate biology major studying in West Virginia State University (WVSU). I am the current student president of the Student Partnership for the Advancement of Cosmic Exploration (SPACE) club at WVSU. I am now also a WV Science Public Outreach Team (SPOT) Ambassador. I want to share my thoughts before a decision is made about the future of the Green Bank Observatory.</p> <p>Hearing about NRAO and NASA's jointly funded West Virginia SPOT program that is dedicated to bringing space and STEM science to West Virginia K-12 schools, I decided to apply to become a SPOT Ambassador this year. I felt it was important to go to these schools as a STEM role model and show the students that great science is for everyone and can come from anyone. As some schools may not have enough funding, these space-themed presentations and hands-on activities may be the students only exposure to a space topic in their entire K-12 career. Me along with other college students from various West Virginian higher education institutions who were accepted into the program this year, received a weekend of training (Sept. 16-18, 2016) at the National Radio Astronomy Observatory in Green Bank. There we got to tour the observatory, learn about all the different telescopes, and see the Green Bank telescope up close. Under the guidance of the Green Bank Observatory education coordinator, Ms. Sue Anne Heatherly, we even got to operate the 140-ft radio telescope and collect our own Hydrogen spectra data.</p> <p>At the Green Bank Science Center, we got to perform and learn different hands-on activities like the Green Bank Telescope Engineering design challenge, sizing up the moon, robotic arm, molecular structures, and design an alien. It was also a learning opportunity where we expanded our knowledge through understanding and presenting presentations about space science and astronomy topics, such as radio waves and pulsars, black holes, gravitational waves, and the search for extraterrestrial life. The training was a substantial professional development experience, and meeting Dr. Kathryn Williamson, and the extraordinary people who call the Green Bank Observatory home was an opportunity of a lifetime. I would like to see the continuation of the SPOT program, and the training especially, which is a crucial element, because it enriches education at a time when it is severely underfunded and facing even more cuts. It helps college students like me develop better public speaking skills, become more adaptable, and broaden our horizons. SPOT allows us to promote higher education, reach out to K-12 school students, be role models, and inspire students to pursue STEM and space careers. We need to keep supporting such programs.</p>	Against Closure	Email	11/23/2016	
145	b	Saira	Rizwan	Student Government Association Secretary S.P.A.C.E. Club President WV SPOT Ambassador West Virginia State University	<p>In addition, the 300-ft Green Bank Telescope at the NRAO Observatory, is the most powerful and state-of-the-art instrument in the entire world right now. It has helped lead radio astronomy not only in the United States, but globally, and is now the need of the hour since the recent discovery of gravitational waves. Due to it's huge size (detects lots of radio signals at a time), steerability (covers 80% of the sky at once), and the location of the facility (national radio quiet zone, in a mountain valley), the capability of the telescope is unrivaled. Scientists from all over the world request time slots to use the telescope because it is the best technology in the world! The Green Bank Telescope is a valuable science resource that should be kept open and fully-functional, and not be deconstructed. Many undergraduate and graduate students dissertations depend on the data acquired from using the Green Bank Observatory telescopes. Even the educational outreach efforts, training programs and internships for students of all ages at the facility are integral to its operations. The observatory has immensely benefited the fields of education and research. It needs to stay!</p> <p>Furthermore, historically, the state of West Virginia has been a pioneer in space research and exploration, and has it's roots deep in the field; be it Katherine Johnson, a NASA Langley Mathematician who calculated the trajectory for Alan Shepard's space walk and her calculations proved critical for future Apollo missions; or Homer Hickam Jr., the "rocket boy" who built and launched rockets, and was hired by NASA to train astronauts about space payloads and much more. There is also Adrian Melott, the first individual to use supercomputers to see large-scale structures of the Universe that is full of dark matter; or even the astrophysicist Kim Weaver, an expert in x-ray astronomy today, who saw the Green Bank Telescope as an inspiration to become a scientist, and ended up working at NASA. In the same regard, the Green Bank telescope may be an inspiration to countless other children and students in West Virginia who may be the next Katherine Johnson, Homer Hickam Jr., Adrian Melott, or Kim Weaver. Please do not take that away from them. Please let the observatory continue its role as a front-runner in radio astronomy, and continue to provide these educational and research opportunities to the people of West Virginia and the world.</p> <p>I hope to be able to return to the Observatory in the upcoming Spring semester as part of the WVSU SPACE club trip, and attend the WV SPOT annual training next year.</p>	Against Closure	Email	11/23/2016	
146	a	Evan	Smith		<p>I am Evan Smith, an employee of the West Virginia University Research Corporation working at the Green Bank Observatory. I've been a tour guide at the Science Center this summer and am now researching interference mitigation. The observatory has given me the chance to develop my research and science communication skills, and has been an incredibly propitious springboard for my future as an astronomer. I have also gained a very optimistic view of how people see science in the modern world, based on how well they reacted to the resources at the Science Center.</p> <p>I am an aspiring astronomer that has just finished an undergraduate degree in Physics and Math and hoping to move on to a Ph.D. program in the next few years. I came here in May 2016 to be a tour guide after finishing my undergraduate degree, with the hope of making connections with the scientists here that would propel my career forward, and also with the hope of landing a research job to add experience to my resume.</p> <p>Before starting my job as a tour guide, I had the notion that science was becoming less and less popular. I thought that people didn't care about science research and that was translating into decreased funding. I have done research at the Arecibo Observatory as well, through an undergraduate program at my university, so I indeed had first-hand experience of the ever-tightening belt of decreased funding.</p> <p>However, that pre-conceived assumption was completely flipped around during my summer as a tour guide. I gave tours to all sorts of people visiting the science center, and was very surprised by how excited people were about astronomy and science in general, even those I wouldn't have expected to be. The experience of being amongst all of these fascinated people and engaging them in astronomy really opened my eyes to how much people still appreciate science. I now hold a much more optimistic view of the popularity of science, thanks to my summer as a tour guide.</p>	Against Closure	Email	11/23/2016	

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146	b	Evan	Smith		<p>After the summer, I was able to attain my original goal of coming here and was hired by a staff scientist at the observatory and a professor from West Virginia University who does a substantial amount of work here at Green Bank. I am investigating the most modern methods of interference removal in radio astronomy and so this work will hopefully directly benefit at least the next half-decade of data-taking at the observatory by cleaning away harmful interference and increasing the quality of data from the telescope. The work is very involved and I am gaining incredibly valuable experience that will help me get into a Ph.D. program so that I can continue my dream of being an astronomer.</p> <p>In one place: the Green Bank Observatory, I was able to hone two of the arguably most important skills of a scientist, communication and research. After the summer of guiding tours, I am very confident in my science communication skills, and my current job in interference mitigation here is greatly enhancing my research skills. Of course, there are countless testimonies in addition to mine to the educational opportunities for students from elementary school all the way to undergraduate, so let me say this as a twenty-two-year-old: The Green Bank Observatory is a great place for developing scientists of all ages, including someone like me.</p> <p>In order to be world leaders in astronomy, the United States needs to have world-class telescopes doing frontier-smashing science, and I know that both Green Bank and Arecibo are, in fact, doing this level of science, despite their daunting ages. I've personally done recent research at both facilities! I do not wish to see any facility mothballed on the Green Bank Observatory campus, or even at Arecibo. First-class facilities with great education programs are the first steps to leading the world in science, and the Green Bank Observatory offers exactly these qualifications. We cannot slice away financial support from such a facility.</p>	Against Closure	Email	11/23/2016	
147		Jo	Blackwood		<p>My husband, Edwin Neale Blackwood, and I are Professors Emeriti, University of Charleston. We both taught several years including one co-taught course in Physical Science. As part of that class, we took our students on a field trip to the GBO.</p> <p>As a Venturing Crew leader (coed Boy Scouts group for ages 13-21), I have also accompanied Scouting groups on tours several times.</p> <p>Both my husband and I have participated in professional development study programs at GBO.</p> <p>We have utilized the facility over the years, attending ground breaking and dedications of telescopes. It would be a terrible loss to educators to lose such a facility.</p> <p>On another personal note, both our sons served as tour bus drivers at Green Bank when they were in college. That experience impacted them; both have earned doctorates.</p> <p>Let this message be one carrying strong support.</p>	Against Closure	Email	11/23/2016	
148		Eric	Briggs		<p>The past week in November is auspicious for several NRAO anniversaries: the foundation of the agency in 1956 and the collapse of the 300-foot transit in 1988 to name a few. Over the past 10 years I have gained good experience in studying historic observatories. I have watched the original film about the difficult completion of the 140 foot equatorial dish at Green Bank, and from that I can tell how often we should have to replace the previous generation's largest telescopes: Not Often. I have visited the GBT just this last month for the first time and I hope to return for many more visits. Please, everyone work together on this one.</p>	Against Closure	Email	11/26/2016	
149	a	Joseph	Kania		<p>I would like to voice my support of continued NSF support for the Green Bank Site, in either the no action alternative or in collaboration with other parties.</p> <p>I first went to the Green Bank site when I was thirteen, and doing so helped reinforce my interest in radio engineering and astronomy. I am sure this is the case for many other people who like me grew up in Appalachia, a region currently suffering from economic stagnation as heavy industry and coal mining leave the area.</p>	Against Closure	Email	11/25/2016	
149	b	Joseph	Kania		<p>Having a cutting edge observatory that they can visit sets the minds of the today's students to the future and how they can be a part of it. If the site was mothballed or dismantled it would not be there to provide inspiration. If Green Bank is kept as an educational it could help excite about science, but that is all; it would not connect the students from the present to the future whether it is the next discovery or instrument.</p>	Against Closure	Email	11/25/2016	
149	c	Joseph	Kania		<p>As a radio astronomer, Green Bank represents a valuable resource. It will be an important instrument until the Square Kilometre Array is completed, and even then it will remain important for its northern hemisphere coverage. Radio Telescope Effelsberg can provide many of the services of the Green Bank telescope, however North Rhine-Westphalia has a population density orders of magnitude greater than Pocahontas County and does not have the protection of the National Radio Quiet Zone. Given the importance of a radio frequency interference free site for single dish astronomy, it would be imprudent to dismantle the site because such an environment would be nearly impossible to recreate. Either the current funding mode, or the addition of partners would allow students like me, and the wider astronomical community, to reap the benefits of the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
150	a	James	Crum	Certified Wildlife Biologist	<p>The following comments are in response to the request for scoping comments needed to prepare an EIS on the future operation of the Radio Astronomy Observatory at Greenbank, WV. The only proposed alternative that would be in the best interest of the residents of Pocahontas County, the citizens of West Virginia, the people of the United States of America, and the world scientific community would be the continued full operation of the facility at full staff and operational capacity.</p> <p>Operation of the facility as an educational center would be significantly without the full use of operational capacity and staff. Anything less than the full NSF funding utilizing the entirety of the technology and human resources currently available at Greenbank would be unacceptable. The fiscal support for the cutting edge science has provided that attracts cooperating agencies and multiple disciplines other than radio astronomy.</p>	Against Closure	Email	11/25/2016	

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150	b	James	Crum	Certified Wildlife Biologist	<p>For example, the facility has proven to be a leader in land stewardship. Providing the West Virginia Division of Natural Resources a proving ground for controlled deer harvest that has led to similar harvests on state park lands and served as an example of deer harvest compatibility with land uses once considered "un-huntable." This has led to special urban controlled deer hunts across West Virginia.</p> <p>In summary, the Greenbank Radio Astronomy Observatory is an invaluable resource for not only the advancement of science of the heavens, but also the early natural resources associated with the facility. The fully funded operational facility provides a unique mixture of multiple discipline intellects to interact for the advancement of science - in not only astronomy but the natural resources.</p>	Against Closure	Email	11/25/2016	
151		Katie	Rabidoux		<p>I am writing in support of the continued operation and funding of the Green Bank Observatory. I first came to the Green Bank Observatory as a high school junior with the Grosse Pointe North High School Radio Astronomy Team. While I had been interested in astronomy since elementary school, it was my visit to Green Bank that made me think that a career as an astronomer was achievable. I chose West Virginia University for graduate school because of its close connection to the Green Bank Telescope. I obtained a significant portion of the data I used in my PhD work with the Green Bank Telescope, and I visited the site to collaborate with researchers many times throughout graduate school. I am now an assistant professor at an undergraduate-focused university, and I would like to involve my students in undergraduate research using the GBT in the future. I have appreciated and benefitted from the the Green Bank Observatory's strong dedication to working with students of all levels. The Green Bank Observatory inspired and supported me as a young astronomer, and I hope to see it do so for many more generations of students. I urge the NSF to continue its support of the Green Bank Observatory to keep skies open for aspiring radio astronomers.</p>	Against Closure	Email	11/25/2016	
152	a	Charles	Liu		<p>Please accept this email as an expression of my strong support for the option of "Continued NSF investment for science-focused operations (No-Action Alternative)" for Green Bank Observatory.</p> <p>Green Bank Observatory's impact upon me has been strong and positive since my time as an undergraduate student. The observatory, and my colleagues who have worked there over the years, have made significant contributions to the body of scientific knowledge in the world, as well as enhanced and improved my own research in the areas of starburst galaxies and colliding galaxies.</p>	Against Closure	Email	11/25/2016	
152	b	Charles	Liu		<p>Far beyond Green Bank Observatory's impact upon me, however, is its impact on the nation, the world, and the great state of West Virginia. Indeed, the observatory stands out in my mind as perhaps the leading center of transformative research, innovation, and technology development in West Virginia. Whenever my students or my non-scientist friends, colleagues, and acquaintances in New York City talk about West Virginia with any level of uncertainty or lack of knowledge, I am always able to tell them that one of the world's most significant radio astronomy research centers in the world is in West Virginia - that the National Science Foundation's support of that site embodies a powerful national commitment to excellence and to the future - and that Green Bank Observatory is a facility in which the residents of that state can be very proud. I firmly believe the No-Action Alternative will allow that well-deserved reputation to continue - both for the state, and for the nation's strong investment in a bright future.</p>	Against Closure	Email	11/25/2016	
153	a	John	Lazio		<p>I am writing in response to the NSF's intent to prepare an Environmental Impact Statement and Initiate Section 106 Consultation for proposed changes to Green Bank Observatory operations, Green Bank, West Virginia. I focus most of my comments on the possibility of changes to the operational model, but one of my comments also includes potential environment effects.</p> <p>Regarding the topic of changes in the operational model for the Green Bank Observatory, consideration should be paid to the Green Bank Observatory's role in training and outreach for science, technology, engineering, and mathematics. This training and outreach takes at least two forms. First, the Green Bank Observatory has been the site of many graduate students and post-graduate researchers obtaining training in the science and technology of radio astronomy. Not all of these students and post-graduate researchers remain in radio astronomy, or even in astronomy. A significant fraction of these students and post-graduate researchers switch fields. I personally am aware of researchers who conducted work using the Green Bank Telescope and later switched fields to work in areas as diverse as Earth remote sensing, high performance computing, and and reconnaissance. Their training in radio astronomy in general, and with the Green Bank Telescope specifically, was invaluable to their later employment in these areas, and, in some cases, their work is not only commercially valuable but it is contributing to the defense of the Nation. Consequently, any change to the operational model of the Green Bank Observatory should consider the potential effect on the advanced training and future employment in the areas of science, technology, engineering, and mathematics.</p>	Against Closure	Email	11/25/2016	
153	b	John	Lazio		<p>Another consideration is that the Green Bank Observatory has had a long history of bringing students from around the state of West Virginia to the site for exposure to science, technology, engineering, and mathematics. The economy of the State of West Virginia consistently ranks near the bottom of the entire Nation. It is widely recognized that the development of science, technology, engineering, and mathematics has a considerable economic impact, with some estimates placing a majority of the United States' economic growth since World War II being due to investment in science, technology, engineering, and mathematics. A change to the operations model of the Green Bank Observatory that affects the capability to expose students in West Virginia to one of the world's leading scientific research facilities may have an effect on the entire economy of the State of West Virginia.</p>	Against Closure	Email	11/25/2016	
153	c	John	Lazio		<p>Finally, the Green Bank Telescope has been used increasingly for bistatic radar observations of near-Earth asteroids, including objects classified as potentially hazardous. While the odds of an asteroid impact in the near term are small, the potential environmental effects of such an impact could be significant. While the identification and tracking of asteroids is a responsibility of NASA, a change to the operations of the Green Bank Telescope must be done in a manner that does not preclude its use, should NASA determine it to be of value for the tracking of near-Earth asteroids.</p> <p>In conclusion, there are a number of potential environmental and operational considerations related to any change in the operational model of the Green Bank Observatory that should be considered. I would be happy to answer any potential questions that you might have regarding my comments.</p>	Against Closure	Email	11/25/2016	

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154		Una	St. Clair-Moniz		<p>Please accept this message as my public submission regarding the Green Bank observatory.</p> <p>Please choose: Option 1) Continued NSF investment for science-focused ops (no-action alternative).</p> <p>Green Bank is recognized worldwide as providing high quality scientific information, which data could have multiple vital uses over time and in historical and comparable analysis. There is nothing similar to Greenbank within North America, and it would be short sighted to close down this observatory, not just for the USA but for the world as a whole. The investment to bring the observatory to where it is today would be lost if the scientific programs were abandoned or altered away from their original purpose. Possibilities, as yet unimaginable, would be incapable of existing in the future if critical investments of time, energy, knowledge, design are effectively thrown away, shortchanging all of us today, and future generations.</p> <p>We must stand guard and maintain the integrity of this ongoing science based operation, as society does not think further than how to put food on the table and gas in the car yet may need to rely on information from any number of critical scientific understandings. Please protect this amazing United States asset by continuing the functionality and funding.</p>	Against Closure	Email	11/25/2016	
155	a	Charlotte	McCullum		Greenbank has been a vacation destination for me on 4 occasions in the past 2 years. Keep the observatory functioning. The important scientific work being performed here will likely contribute to very important information about the health of people on earth, through the observations of the sky around us.	Against Closure	Email	11/25/2016	
155	b	Charlotte	McCullum		The town depends on the observatory's existence. Greenbank is becoming increasingly popular around the world, as demonstrated by it's unique visitors and multiple documentaries featuring Greenbank and the observatory.	Against Closure	Email	11/25/2016	
156		Sebastian	Stahlberg		<p>As a science enthusiast I feel that keeping the GBT open and running is important. Knowledge and understanding of the world and universe around us is far more important than cost cutting measures and that is why I believe that the best option is the first one. Continued NSF investment for science-focused operations (No-Action Alternative) the Green bank radio telescope is an important tool that complements the other tools.</p> <p>A quick search reveals that the GBT was used for these discoveries and many others</p> <p>Unique double Pulsar Tests Einstein's Theory</p> <p>Star Cluster Buzzing with Pulsars</p> <p>Cold Sugar in Space Provides Clue to the Molecular Origin of Life</p> <p>Starburst-Driven Winds May Have Created Giant "Lobe" in Galactic Center</p> <p>Galactic Building Blocks Seen Swarming Around Andromeda</p> <p>Water in Lunar Craters?</p> <p>Scientists Discover Two New Interstellar Molecules</p> <p>Radio Telescopes Reveal Youngest Stellar Corpse</p> <p>VLBA Reveals Dust-Enshrouded "Supernova Factory"</p> <p>Youngest Radio Pulsar Revealed with Green Bank Telescope</p> <p>GBT Reveals Satellite of Milky Way in Retrograde Orbit</p> <p>Clouds Dominate the Galactic Halo</p> <p>and more https://science.nrao.edu/GBT_DiscoveriesV4.pdf</p>	Against Closure	Email	11/25/2016	
157		Sheena	Symington		Green Bank needs to be kept open because it provides a safe place for people who are EHS. It is necessary to support these individuals in providing a low Electromagnetic Pollution environment.	Against Closure	Email	11/25/2016	
158	a	Magda	Havas		<p>I am in support of the first two alternatives listed below with the first option being my top priority.</p> <p>This is a unique site that has been in operation for a long time and deserves to be protected in a way that still allows it to operate and obtain scientific information related to space research.</p>	Against Closure	Email	11/25/2016	
158	b	Magda	Havas		It is also one of a very few locations in the U.S. that is a radio-free zone. This allows for people who have developed a sensitivity to radio frequency radiation. It also provides a potential site for research related to the effects on humans as well as flora and fauna. Expect this research will become increasingly important as more wireless devices are deployed.	Against Closure	Email	11/25/2016	

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159		William	McNeel	Resident	<p>I am writing about the Environmental Impact Statement concerning the future of the Green Bank Observatory at Green Bank, West Virginia. First, a little about myself. Native West Virginian and resident of Pocahontas County, the location of the Observatory, for most of my life (both parents were from the county). Now retired, I first taught in the schools of the county as a high school math teacher. The longest part of my working life was with The Pocahontas Times, a weekly newspaper in the county. I was editor for 25 years. My educational background includes a BS in geology and a MS in mathematics education.</p> <p>Of the five options being considered by the NSF for the future of the Observatory, numbers four and five are incomprehensible. I cannot believe that the National Science Foundation would even take such actions into consideration. How could you even think of mothballing or, worse, deconstructing of one of the most important facilities in the science of radio astronomy, in particular the recently constructed Robert C. Byrd Radio Telescope. That telescope has many useful years left for use by radio astronomers, both those in the midst of their careers and those studying to become radio astronomers.</p> <p>As for option three, I am not sure what is meant by a "technology and educational park." If the Observatory is not being used to conduct research in radio astronomy, this option is the same as numbers four and five - incomprehensible.</p> <p>As you might have assumed at this point, my preference is for options one or two. Being realistic about the situation in the federal budgeting process and with the result of the recent election making the future of funds for the NSF more of a concern, I think option two is the most reasonable of the five. The NSF, regardless of budget problems, must continue to fund the Green Bank Observatory to some extent. It is too important to the science of radio astronomy for the NSF to do otherwise.</p>	Against Closure	Email	11/25/2016	
160		Melissa	Chalmers		I was only informed today concerning the public comment for Green Bank. There are many other parties I'm in contact with that would like to comment. Is it possible to keep it open for a few more days to ensure they would have a chance to send their comment to you?	General	Email	11/25/2016	
161		Michelle	Krone		<p>I have brought 2 groups of girl scouts bank to the education program that green bank currently has in the past few years. This is an experience that is invaluable to our girls. Greenbank allows the girls to get hands on experience to explore a love of science and grow an interest in stem programs. In also allows many girls or children to learn about jobs within the science field.</p> <p>We love Greenbank please consider only options 1 or 2.</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope <p>I would love to be able to expand this experience to all girl scouts in the state of Virginia. I think of all the girls that could get this wonderful experience but only if you would consider the continuation of funding.</p>	Against Closure	Email	11/25/2016	
162		Kelsi	Taylor	Student	The GBO is important to my community and me. The GBO brings lots of tourism and puts us on the map. The GBO also supports my school and brings science opportunities. Thank you for your support so far. I hope you will continue funding the GBO.	Against Closure	Email	11/25/2016	
163		Karissa	Friel	Student	The GBO is important to my community and me because millions of people come across the world to see it and it provides jobs. Also the Green Bank School soccer teams get to have their games and their practice on the GBO property. After school students can go on nature walks and see the telescope. It is important to us. It is really cool to get up close to the GBT. I hope the community can keep it.	Against Closure	Email	11/25/2016	
164		William	Wilson	Student	The GBO is important to my school because of our soccer fields and our walks to the observatory for P.E. Our school has its Social Studies, Math and Science Fairs there. It is important to my community because a lot of people will lose their jobs if the GBO closes and most people will not be able to pay for food. I love science so much and it is so cool to have the GBO in our community. Please fund the GBO!!!	Against Closure	Email	11/25/2016	
165		Andrew	McNichols		<p>I am writing to encourage you in the strongest possible terms to advocate for the expansion of NSF investment in science-focused operations of the telescopes managed by AUI at the Green Bank Observatory.</p> <p>As a young scientist, I know I am not alone among my colleagues in the hope for opportunities throughout my career to utilize the telescopes at Green Bank in my research. It would be disheartening to see public support for this singular facility wane, especially given its established, versatile record of successful discovery and advancement.</p> <p>The Green Bank Observatory, with its rich history, environment, and infrastructure, is a special and remarkably productive endeavor truly unique to this world. In my view, it encapsulates and enhances most of the best aspects of my country, my communities, and my home planet. To classify myself as an active supporter of the Green Bank experiment brings me great pride, and the activities and experiences gained from this Observatory are valuable not only to the scientific users in this country but to all of humanity. Indeed, I have never met a person who visited the site and returned uninspired to the world of radio frequency interference.</p> <p>It is important to preserve the facilities of this unique, world-leading resource for the sake of our country's scientific edification and future technological endeavors. There are few other tools available to the United States' telescope-using public which are capable of such a wide range of potentially revolutionary scientific inquiry. We must support the precious opportunity established by the Green Bank telescopes. Speaking as an impassioned private citizen and scientist, I am urging you to please increase, or at the very least do not diminish, your investment in this magnificent and necessary project. Thank you for your consideration.</p>	Against Closure	Email	11/25/2016	

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166	a	Eve	Klopf	Assistant Professor of Electrical Engineering Program Director (BSEE)	<p>This letter is to express support for the continued federal financing of the Green Bank Observatory, which is a tremendous scientific resource for the world. This facility allows numerous scientists from around the world to take radio astronomical measurements of the galaxy around us, leading to a tremendous increase of our basic knowledge of the universe.</p> <p>The attitude of the staff at the Green Bank Observatory is that everyone can and should do science, and they provide a warm and welcoming environment for scientific exploration. I hope that you will support them in their dual mission of providing scientific data about the universe around us while inspiring many future scientists and engineers.</p>	Against Closure	Email	11/25/2016	GBO_support_letter_Oregon_Tech.pdf
166	b	Eve	Klopf	Assistant Professor of Electrical Engineering Program Director (BSEE)	<p>Additionally, it serves as a welcoming hub for scientific education with its public tours and outreach programs.</p> <p>I've personally had a wonderful experience interacting with staff scientists at the Green Bank Observatory. For the past couple of years, I have worked as tenure-track engineering faculty at a rural, public college in Oregon. Starting out as faculty, I was interested in becoming involved with projects that I could work on with my students, but found it somewhat difficult with my location and being limited to undergraduate lab equipment. Then, I had the good fortune to attend the NAIC/NRAO Single-Dish & NAASC Interferometry School, which is their summer workshop on radio astronomy – it was a fantastic experience, and a great way to meet a lot of wonderful people who work in the field of radio astronomy. I've kept in contact with one of the staff scientists at the Green Bank Observatory, Richard Prestage, ever since, and he's been a tremendous encouragement towards my getting undergraduate students involved with research projects. His guidance has helped me to get undergraduate students at the college where I teach involved with developing an inexpensive radio telescope, and helped me to get enough student interest to restart our campus amateur radio club – this club is currently booming, and is going to be a strong support for our department in graduating students who are prepared to work on the Internet of Things.</p> <p>What I've found working with undergraduate students is that a lot of them bring a tremendous interest in space, possibly from watching a lot of sci-fi as children – radio astronomy is a natural bridge between space and engineering. When you tell students that you'd like to build a radio, they're somewhat interested – when you tell them that you'd like to build a radio that can measure storms on Jupiter, or galactic hydrogen, they're suddenly very interested. Then, once you've built one radio with them, they're suddenly much more interested in other types of radios, and have possibly already started thinking about branching out into antennas, sensors, signal processing, and the Internet of Things.</p>	Against Closure	Email	11/25/2016	GBO_support_letter_Oregon_Tech.pdf
167		JoAnn	Gladson		<p>Please continue to fund the Green Bank observatory. There are so many people whose lives will be forever changed if it were to close.</p> <p>Continued NSF investment for science-focused operations (No-Action Alternative)</p>	Against Closure	Email	11/25/2016	
168	a	Jennifer	Wood	Architect	<p>Due to time restraints I am copying you a preliminary submittal I recently sent to the architectural board because it has many science studies, references and historical information in it on EM Radiation and health effects, as well as ideas & guidelines for housing and facilities for persons suffering from EM Radiation Sickness. Some of this report is not pertinent to the current Environmental Impact Statement for GBO but in the interest of time I am attaching it to my brief comment as back up information. It is not my intention to offend any industry or government leader but to work both with scientists, industry members and others in my cause of providing areas which can be accessed by persons disabled by what is called Microwave Illness, EM Radiation Illness and many other names. It is an almost universally misunderstood condition and many sufferers have moved to the Green Bank area because of this debilitating condition. The World Health Org declared wireless devices and cell phones a class 2B carcinogen in 2011 and the recent US Gov. Toxicology report confirmed that wireless radiation is cancerous along with thousands of other studies showing various health effects. (See attached preliminary submittal.) For those of us that are ill, living in Green Bank or similar partial "quiet zones" is not a "fun life-style choice" based on cranky beliefs but a necessity and in many cases a matter of survival. I myself arrived here at death's door weighing only 77 pounds; my doctors did not think I would live. Persons with my condition are a rapidly growing population and some of us are now constantly interviewed by the media. Estimates have been that we are from 3 to as high as 20% of the world population. The need for specially built housing is extreme and smart developers that understand our needs could make enormous profits if only a few would come forward. This is happening in various parts of the world.</p> <p>The emerging scientific work regarding EMR and the public health needs a small area that could act as a "ground zero" base for epidemiology and other complex comparative studies, on health effects and the environment. Perhaps a portion of this area could be used for that. Some scientists in this area have begun to read the work of various EMR scientists but there is still much to learn which will impact our future not only in GB but throughout the world. Keeping the observatory open for its present uses as well as perhaps using it for a greater variety of scientific studies (such as the effects of wireless technology on humans, animals and plant life) is one possibility. A place for international scientific conferences on this subject is another possibility. Thank you for taking the time to read my comments.</p>	Against Closure	Email	11/25/2016	GBO COPY fof SUBMITAL without email.docx
168	b	Jennifer	Wood	Architect	<p>But the Green Bank area is unique today in that it is considered the only, last "Quiet Zone" on earth. For this reason I feel it should be the first of its kind as a UNESCO world heritage site or a protected heritage site or perhaps other designation. I also want to state that the growing population of professionals with various skills that are now disabled by EM radiation sickness could contribute tremendously to creative and other projects if only they could remain in an area that is predominantly wireless-free where they can function without torturous symptoms and other handicaps.</p>	Against Closure	Email	11/25/2016	GBO COPY fof SUBMITAL without email.docx

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
169	a	Phil	Korngut	Scientific Researcher	The technical combination of a 100m aperture, sub-mm surface rms, and sensitive bolometer arrays provided by the GBT, constitute a uniquely powerful tool for my work in the study of the pressure substructure in galaxy clusters (http://adsabs.harvard.edu/abs/2011ApJ...734...10K). The loss of such an instrument would mark a tragic decrease in the scientific capabilities for US observational astrophysics.	Against Closure	Email	11/25/2016	
169	b	Phil	Korngut	Scientific Researcher	In addition to its powerful observational capabilities, the GBO provides a unique platform to train the next generation of scientists, with hands-on education at a range of levels. My career would not have been possible without the extensive time I spent observing and engineering at Green Bank as a graduate student. It alarms me to think that future students would not have the same opportunities to learn the field there as I did. I therefore strongly support the "No-action alternative" to continue open skies observations with the Green Bank Observatory.	Against Closure	Email	11/25/2016	
170		Xaq	Rzetelny		I'm a former student with Rutgers University (And current NJ resident) who visited the Green Bank site as part of a student trip in my senior year. I understand the site's future is under consideration, and I just wanted to express my enthusiastic support for its funding to continue. I understand the Green Bank Telescope holds an important place within the scientific endeavor, and has made incredible contributions to our knowledge of the Universe. This is an exciting time for astrophysics, when we stand to learn so much. We should not slow the pace of that learning by depriving the scientific community of such a powerful tool. Doing so would force researchers to compete for already limited time at other facilities, decreasing the volume of discoveries that could be made. There are also tasks for which the GBT is uniquely suited, which other radio observatories could not perform as well or at all. My own visit to the site as a student was a magical experience in many ways. It was visually amazing and provided a visceral sense of astrophysics - not only by seeing the telescope, but also by getting the chance to work with other students on a smaller telescope at the site to actually make measurements ourselves. I now write for the website Ars Technica, where I cover new discoveries in astrophysics. I've covered fascinating work done by the GBT, so I have a sense of its import to science. I hope you'll continue funding for the site.	Against Closure	Email	11/25/2016	
171		Christopher	Konen		It has come to my attention that the Green Bank Observatory is under threat. I am firmly standing for the continuation of science-focused operations with NSF investments, or bearing the need for compromise, collaboration with interested parties. I have visited the facility several times as a high school student in an astronomy club who was truly inspired by the operations. Visiting the facility has been a catalyst for my development as I continue my pursuit in the sciences today as a university student. I also know several peers who were involved in the same group and are also continuing their careers in the scientific field. I strongly believe that future operation of this facility can help to embolden future generations of students and continue the line of tomorrow's scientists. Therefore, I believe that the Green Bank Observatory should continue science-focused operations. However, if a compromise is needed, collaboration with other parties is an acceptable alternative.	Against Closure	Email	11/25/2016	
172	a	Jason	Hessels	Associate Scientist	This letter is in response to the Federal Register Notice of an EIS evaluating the potential environmental effects of proposed changes to operations at the Green Bank Observatory (GBO). I strongly request NSF to choose Alternative 1 of its "Notice of Intent to Prepare an EIS...", namely "Continued NSF investment for science-focused operations (No-Action Alternative)." As background, I have been an active scientific user of the GBO for the last 15 years, and have visited the observatory many times. I currently work in the Netherlands, where I am an Associate Professor at the University of Amsterdam and at ASTRON (Netherlands Institute for Radio Astronomy), which is the Dutch version of NRAO. The GBO is a unique and world-famous scientific facility, as well as a powerful educational tool. I have been lucky to be involved in several of the GBO's major discoveries. To give a few examples: 1) Ter5ad: the fastest-spinning pulsar known (Hessels et al. 2006, Science, 311, 1901; 306 citations). This discovery broke a 23-year-old record, and has stood for more than 10 years as the new record holder. This pulsar teaches us about the maximum spin rate that a neutron star can reach and suggests that the accretion process that spins up pulsars may be the limiting factor, as opposed to the neutron star equation of state. 2) PSR J1614-2230: the first 2 solar mass neutron star (Demorest et al. 2010, Nature, 467, 1081; 1339 citations). Another record-breaking pulsar, this system has created an enormous flurry of activity both within the astrophysics community and the nuclear physics community because of the strong constraints it places on the neutron star equation of state. In fact, this is one of the most highly cited and impactful papers in all of astrophysics in the last few years! 3) PSR J0337+1715: the first pulsar in a stellar triple system (Ransom et al. 2014, Nature, 505, 520; 81 citations). This unique system is allowing us to test the strong equivalence principle of general relativity in a powerful, and previously inaccessible way. The GBO was crucial to these high-impact discoveries, and the GBO's potential for continued ground breaking science is enormous if it is appropriately funded and remains an open access instrument in which scientific programs are competitively selected based on their scientific merit. For example, in the new era of gravitational wave astronomy, the GBO is one of our most important tools for using pulsars to access the gravitational waves created by supermassive black hole binaries. This probes an astrophysical regime that beautifully complements the ongoing work done by LIGO. This is without question one of the most exciting prospects in astrophysics in the coming decade, and the GBO can play a major role in making this happen!	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
172	b	Jason	Hessels	Associate Scientist	Besides being a cutting edge science facility, the GBO is also a critical educational tool. Through its visitor center, the GBO provides the type of educational experience that can only come from an active research facility. The telescope represents a rare opportunity for West Virginia students to come into contact with a cutting-edge scientific instrument. Keeping the GBO funded as a purely educational facility or "landmark to visit" does not make sense in my mind. The power of the facility to inspire and educate - in a way that cannot be done in a classroom - stems from the fact that there is ground-breaking research being done at the telescope. The sense that "this is where things are happening and discoveries are being made" is electrifying for students and motivates them in a way no textbook or classroom lecture can. I find this critical, because I strongly believe that improving the quality of education, challenging young students to think critically, and fostering their innate curiosity can go a very long way to building a better society.	Against Closure	Email	11/25/2016	
172	c	Jason	Hessels	Associate Scientist	In summary, the GBO is a landmark scientific facility and the short-term savings that could be made through closure are greatly outweighed by the long-term cultural, educational and socio-economic impact for West Virginia and the United States.	Against Closure	Email	11/25/2016	
173	a	Darrell	Smith, Jr.		I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on October 19, 2016. I am a proud West Virginian who is upset over the proposal to yet again see a government effort to reduce the advancement of our state. It is bad enough that our major industry -- Coal has been decimated by the political climate in this country. Now we are staring down at the loss of funding for a major scientific facility, the Green Bank Radio Observatory (GBT). It has historically hosted major world scientists. Its operations account for only 3% of the astronomy budget at NSF, and only 0.1% of the total NSF budget. Annually it hosts 50,000 visitors and 3,500 who are inspired by its science and technology opportunities. In the past 12 months, 54 different groups spent the night in Green Bank and used the 40 foot radio telescope as part of their hands-on educational experience. My granddaughter has been blessed to have had this opportunity. Discontinuing operations would negatively affect the careers of over 900 astronomers, many of whom are just entering the field, and could wipe out up to \$30 million in economic benefits for the state of West Virginia.	Against Closure	Email	11/25/2016	Ltr to NSF.docx
173	b	Darrell	Smith, Jr.		The GBT is one of NSF's newest large telescopes that remains at the cutting edge of astronomy. Its incredible flexibility has made ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond Earth. This effort by the NSF reminds me of the movie "Contact" based on the book written by Carl Sagan (a frequent visitor to the GBT) that features the same environment wherein science is overruled by a "political" decision-- ironically by the NSF. Reducing or eliminating the funding of the GBT hurts not only our state but our country and the world wide science community in their search for defining the fundamental structure and evolution of our universe. Please continue the funding of this facility.	Against Closure	Email	11/25/2016	Ltr to NSF.docx
174	a	George	Miner	Professor Emeritus, Department of Physics, and Director, Chautauqua Field Center University of Dayton	My primary connection to the GBO is that for the past 30 years I have brought, on an annual basis, groups of college and university faculty to Green Bank for three-day short courses on radio astronomy. Most of those years we also offered a second course on the teaching of astronomy at the college level. Many of the participants attended both courses. The above courses were a portion of a larger program I have run at the University of Dayton since 1980, a series involving a variety of the natural sciences. The program, called the Chautauqua Program, was initiated by the National Science Foundation in 1971. I was selected by NSF to run the Dayton Field Center in 1980, and have done so ever since. The Dayton Center was supported by the NSF directly or indirectly for 22 of the last 37 years, most recently in 2007 via the University of Massachusetts. During the 37 year period the Dayton Center offered some 400 short courses with over 10,000 participants. Approximately 750 of those participants were in the GBO radio astronomy courses, with a slightly lesser number in the GBO teaching courses. I am aware of some obligations of the GBO for outreach and training for future astronomers. The short courses provided for us by the GBO are right on target for these needs. The various lectures and tours are high quality presentations on the basics of radio astronomy, and on various research projects conducted on the GBT. Our participants get formal and informal interaction with resident and visiting astronomers. From evaluation forms and comments, it is clear that the participants are extremely well pleased with their Green Bank experience. In addition they often recommend the courses to their colleagues. Often the GBO has maybe a dozen summer students working at Green Bank. On many occasions they have joined our radio course to experience an introduction to their summer work. Thus they also gain from these excellent presentations. Our courses are usually offered near the beginning of summer. While I am not directly involved, I see the high level of interest from the general public. I am told that some thirty to forty-thousand members of the public take a tour of the GBO each year. I assume that this is very helpful for the public attitude toward science, an attitude that needs attention.	Against Closure	Email	11/25/2016	
174	b	George	Miner	Professor Emeritus, Department of Physics, and Director, Chautauqua Field Center University of Dayton	My secondary connection to the GBO is as a physicist who has been in academia for 52 years. I understand that Green Bank was established in the 1950s to provide top level telescopes for the astronomers in our country. The Green Bank Telescope is a world-class instrument that provides excellent data for the study of major topics in radio astronomy. It has a very large collection surface, an active surface, high frequency possibilities, and can see 85% of the sky. Our nation has provided for the planning, design, and building of the scope. Its track has been redone and the scope has been tweaked. It is now producing in its prime; now is not the time to shut it down. The GBT should have another thirty to forty years of top level service available for our nation. The larger expenditures are past; what remains is the simple operation. Most nations and/or observatories would love to have such a telescope. We have it. To be very clear, I strongly favor option one: Continued NSF investment for science-focused operations.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
174	c	George	Miner	Professor Emeritus, Department of Physics, and Director, Chautauqua Field Center University of Dayton	A comment on option two. What if a large unfriendly nation offered full funding of the GBO in exchange for 100% use by their astronomers? Would we consider that a success, as in we solved the funding issue? I think not. Option one is consistent with the initial plan. It achieves the initial goals. While ten million dollars a year is real money, it is hardly a major chunk of a federal budget. Let us not think small here! I appreciate the opportunity to comment.	Alternatives Consideration	Email	11/25/2016	
175	a	Gibbs	Kinderman		Recommendation: Option 2 - Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope The NRAO Green Bank Observatory has been at the forefront of radio astronomy for almost 60 years, and with the operation of the GBO as a stand-alone entity into the future it still has great potential as a cutting edge scientific facility. While I realize NSF is under tremendous budgetary pressures, abandonment of funding for the GBO would be penny wise and pound foolish. <ul style="list-style-type: none"> The GBT still has many years of useful life as a premier scientific tool GBO is moving as rapidly as possible to develop public and private partnerships with other institutions in a movement toward true mixed-funding operation, but it is not yet near the ability to operate on a totally self-supporting basis as a standalone. Cutting all funds in the near future could render all this positive effort moot. As government funding for scientific research continues to languish, the GBO can serve as a model of mixed funding and collaborative operation for other fields which heretofore have been exclusively NSF funded. The recent emergence of mixed public/private/international efforts in the space program are an example of this type of development. It is in NSF's interest to continue to support the GBO as it moves in this mixed-source funding direction. There may be many other NSF supported operations that could benefit from this type of development; monitoring the progress of the GBO over the next several years and reporting on its successes and failures could be of considerable value to overall NSF operations. 	Against Closure	Email	11/25/2016	NSF comments 1116.docx
175	b	Gibbs	Kinderman		<ul style="list-style-type: none"> The move of GBO into increased emphasis on STEM education opens new horizons for utilization of the facility and its unparalleled human resources into another field of significant interest to NSF. Last, but certainly not least, the GBO has helped train several generations of top notch radio astronomers. It has an extensive and dedicated "alumni cadre" throughout the world who will help the facility survive and prosper - but this valuable resource can't be brought fully into play on a crash basis. 	Against Closure	Email	11/25/2016	NSF comments 1116.docx
175	c	Gibbs	Kinderman		I'm sure you have received many comments on the tremendous impact of the GBO's failure to survive would have on the surrounding community - economic, educational, cultural and social. As a Pocahontas County resident for over 35 years, manager of the county's radio station and long-time member of both the Board of Education and the public libraries board of trustees, I can second everything that has been said along these lines. Loss of the GBO would be a tragic blow to the local community, indeed. I feel it would be equally harmful to the international radio astronomy community and the continuing core mission of the NSF as well. NB These comments are attached as a WORD docx	Against Closure	Email	11/25/2016	NSF comments 1116.docx
176	a	Kim	Hundley		Green Bank Observatory is a West Virginia institution that serves many purposes. It isn't just a place where valuable research is conducted but it is a destination where families can make life long memories. Personally I have visited Green Bank several times. My first visit was on a date! We thought what a neat day trip to make. I fell in love and have taken my three children several times over the years and we have made some great memories at Green Bank. Green Bank Observatory is a special place that serves multiple purposes. It is priceless. I hope that every effort is made to keep it open. I have more memories to make there and I'd like my younger two children to get the opportunity to attend the same field trip as my oldest. Thank you for taking the time to read my words.	Against Closure	Email	11/25/2016	
176	b	Kim	Hundley		Recently my oldest son got the opportunity to visit the observatory as part of a field trip with his physics class. This experience was an eye opening one for my 17 year old. Almost two years of physics finally made sense after getting to spend time at Green Bank and see the theories he's been studying in action.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
177		David	Thorne	WV Division of Natural Resources	<p>Please record these comments for the dEIS as a matter of public record. These comments represent the opinion of the Coldwater Fisheries and Stream Habitat Restoration Biologist of the Fisheries Management Unit of the WV Division of Natural Resources (DNR) Wildlife Resources Section pertaining to aquatic resources on GBO property.</p> <p>General setting: • Per USGS topographic maps, there are nearly 10.5 miles of streams on the GBO property; some are perennial, others may or may not be perennial. All streams on the property are expected to have excellent water quality and fair to excellent habitat for aquatic species. High quality springs may also be present, given the existence of known springs in the vicinity of GBO. • Actual survey data on the GBO property is very limited. In fact, the DNR fish survey database shows only a single survey from 1963 in Deer Creek within the GBO boundary. Any further inferences in this document are suppositions based on the conditions found in adjacent stream systems within the Deer Creek watershed. • Aquatic Species of Greatest Conservation Need (SGCN) as defined in the 2015 WV State Wildlife Action Plan (SWAP) for the Conservation Focus Area (CFA) encompassing the GBO include the following species that may occur within the boundary of the GBO: Kanawha Sculpin Cottus kanawhae --- observed --- a New River endemic species Candy Darter Etheostoma osburni --- observed --- a New River endemic species Tonguetied Minnow Exoglossum laurae --- observed New River Shiner Notropis scabriceps --- observed --- a New River endemic species Brook Trout Salvelinus fontinalis - observed Appalachia Darter Percina gymnocephala --- likely --- a New River endemic species Eastern Hellbender Cryptobranchus alleganiensis - likely Greenbrier Crayfish Cambarus smilax --- observed --- a New River endemic species New River Crayfish Cambarus chasmodactylus --- observed --- a New River endemic species • In addition to the SGCN, there are at least 20 other more common fishes known to be native to the Deer Creek watershed. Many more have been introduced for various reasons. • The Brook Trout is a charismatic species with a long heritage background in the Central Appalachians. It has been well---studied as an indicator of landscape changes. In the 2005 assessment for the Eastern Brook Trout Joint Venture (EBTJV), the Deer Creek watershed was rated as "Greatly Reduced" compared to its expected historical range. A finer---scale assessment from the EBTJV with more recent data considered the Brook Trout to have been extirpated from all catchments within the headwaters of Deer Creek. Each of the five proposed alternatives provides opportunity for partnership between GBO and WVDNR for best management of the natural resources occurring within the boundary of the GBO. Proposed alternatives as described in the Federal Register Notice of Intent: • Continued NSF investment for science---focused operations (No---Action Alternative) • Collaboration with interested parties for science--- and education---focused operations with reduced NSF--- funded scope (hereinafter Alternative 1) • Collaboration with interested parties for operation as a technology and education park (hereinafter Alternative 2) • Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) (hereinafter Alternative. 3) • Deconstruction and site restoration (hereinafter Alternative 4)</p> <p>Possible opportunities for collaboration for management and conservation as well as some specific management action possibilities are offered in the table on the following pages:</p>	Resource Considerations	Email	11/25/2016	GBO draft EIS aquatic resources comments letterhead final.docx
178	a	Christopher	Salter		<p>I would like to raise a number of points in respect of the NSF-mandated Environmental Impact Statement for the Green Bank Observatory (GBO). I was a member of the scientific staff at the GBO between 1990 and 1992, a period during which Green Bank was reawakening through the promise of the Green Bank Telescope's (GBT's) arrival. The GBT was the most carefully designed telescope that I have ever encountered in a long career that has included working with a number of new telescopes. This is borne out by the voluminous memo series that documents its development and commissioning, and runs to several hundred individual documents. It could really only be considered a fully commissioned instrument by about 2003, and it seems unthinkable, not merely short-sighted, that the world's leading fully steerable radio telescope could be divested by the NSF. Despite also having a large portfolio of observational facilities, the German Max-Planck-Gesellschaft continues to fund the 100-m Effelsberg radio telescope generously.</p> <p>Given the threat of NSF divestment that also hangs over the Arecibo 305-m radio telescope, it appears that the NSF is "washing its hands" of investment in the unique properties offered by single-dish radio telescopes? I recently served as PhD examiner for a doctoral thesis concerning observations with one of the world's leading synthesis radio telescopes. From a sizable 120 hours of pulsar searching close to the Galactic plane, the candidate discovered just a single new (common-or-garden) pulsar. Pulsar searches at Green Bank and Arecibo within the past decade have discovered several hundred previously unknown pulsars. Many of these new discoveries are millisecond-period pulsars that augment the target list for the NANOGrav project, which moves ever closer to a detection of the long-wavelength (red) end of the gravitational-wave spectrum, at a cost that is infinitesimal compared to the cost of instruments such as LIGO and LISA that investigate only the blue end of that spectrum. To divest the telescopes that not only provide NANOGrav with its target objects, but which are fundamental to its observations, will surely put the success of this endeavor in jeopardy just as it nears a triumph that will bring US science the worldwide credit that will accrue from this remarkable achievement.</p>	Against Closure	Email	11/25/2016	
178	b	Christopher	Salter		<p>In addition, Green Bank plays a prominent part in the US's "global scientific image". This is nowhere truer than in the case of Very Long Baseline Interferometry (VLBI). VLBI is a truly intercontinental venture, and provides the highest angular resolution available in astronomy. Both Green Bank and Arecibo regularly participate in this venture as part of "High Sensitivity Array", (the HSA; an array formed together with the 10 telescopes of the LBO, and the Effelsberg telescope.) They also take part in numerous "Global VLBI Array" observations using radio telescopes situated around the world.</p> <p>In addition, over the past 5 years both the GBT and Arecibo have collaborated with the RadioAstron project, exploiting the Russian orbital radio telescope to achieve interferometric baselines approximately as long of the Earth-Moon distance! Why cannot such unique VLBI projects be continued without the large US single-dishes? The HSA would, of course, disappear as it relies totally on the presence of the two large telescopes to enable detection of the weakest of targets, e.g. weak radio-emitting stars, the mysterious fast radio bursts, and the properties of interstellar turbulence though the VLBI of pulsars; the LBO telescopes have diameters of only 25-m, and collect insufficient photons by themselves to allow objectives that require the highest possible sensitivity. Equally relevant, RadioAstron, (as will its orbital successors), has a very small diameter of just 10-m, and again the two huge US dishes are crucial to its exploitation.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
178	c	Christopher	Salter		<p>On the level of local culture in Pocahontas County, WV, Green Bank Observatory makes an overwhelming contribution to local life. A number of teachers in the local state schools have been the spouses of GBO staff members. I, myself, well remember serving as volunteer librarian on a regular basis at the Green Bank Public Library assisting that important center of local culture in operating a regular schedule. In addition, the Observatory and its staff organize both an ambulance and fire service, both of which have saved local lives over the years. I would also add that the GBO Science Center is not only a wonderful resource for nationwide visitors but, for example through its regular star parties and special events, provides an enormous broader impact for the local population. This population, from the very young to the elderly, would otherwise be bereft of access to a unique resource.</p> <p>Summing up my remarks from above, I strongly believe that the Green Bank Observatory and the GBT represent an invaluable asset for US science. In addition, The GBO has vast importance for the local life of the isolated area that is Pocahontas County, WV. I hope that the present exercise represented by this Environmental Impact Study will not interfere with the Observatory's ability to make its remarkable scientific instrument available, as at present, to the scientists of the United States of America (and, through its long-standing "open skies" policy, to the best scientific ideas of the wider World.)</p>	Against Closure	Email	11/25/2016	
178	d	Christopher	Salter		<p>I also presume that the proposed Environmental Impact Study will fully explore the effect that loss of the Observatory would have on the flora and fauna of the area? The Observatory is that rare thing in WV, a sanctuary for the deer population. I also well remember the thrill of observing a range of remarkable salamanders on the banks of the Deer Creek stream, where it runs through the Observatory.</p>	Against Closure	Email	11/25/2016	
179		Zak	Schroeder		<p>(Comments from Zak Schroeder and Mel Light)</p> <p>I'm writing on behalf both myself and my partner, Mel, to urge you to consider continuing to fund the Green Bank Observatory. To defund, mothball, or dismantle this facility would be a loss of a valuable resource.</p> <p>From 2003 to 2007, Mel and I traveled to the Green Bank Observatory (then NRAO) with our high school radio astronomy team. The exposure to this observatory, meeting with the astronomers, and performing work on the 40ft radio telescope helped shape us into the scientist and engineer that we are today. These experiences inspired us to conduct astronomy research in high school, obtain scholarships, and pursue schooling in our respective science and engineering fields. It is also where the two of us met and started our life together, twelve years ago.</p> <p>These experiences are not unique to us, as this facility has provided years of opportunities to other students across the nation. To remove funding would be detrimental for the field of radio astronomy as well as rid generations of students of the shot to be exposed to science and engineering immersion.</p> <p>We hope that you take our concerns into consideration to determine the future of this immensely valuable observatory.</p>	Against Closure	Email	11/25/2016	
180		Alyssa	Goodman	Robert Wheeler Willson Professor of Applied Astronomy, Harvard University Edward, Frances, and Shirley B. Daniels Fellow, Radcliffe Institute http://www.cfa.harvard.edu/~agoodman	<p>As I sit comfortably at home this Friday of Thanksgiving weekend, quietly working away on the wonderful new Green Bank Telescope data you see in the screen shot below, I find myself thinking back on the incredible discoveries the Green Bank Observatory has made over my 30 years in Astronomy, and I strongly urge your group to choose "Continued NSF investment for science-focused operations (No-Action Alternative)" in your deliberations, and to allow the GBT to shine on as the unique treasure it is within Astronomy. The GBT is literally the only large (100m+) single steerable telescope that can make observations at short radio wavelengths in operation today.</p> <p>My collaborators, postdocs, students and I have all contributed to the thousands of scientific papers published based on data from Green Bank, and I am sure others have explained to you why the results are so important. In the case of the particular example shown below, the "GAS" Survey (Green Bank Ammonia Survey) data are showing that stars do not, as most people have thought, form from relatively spherical blobs of dense gas, but instead that they form in networks of filaments that are constantly forming and dissolving. The Green Bank GAS data are critical to our ability to determine the time scales and physical mechanisms that lead to star formation—and in particular to the formation of stars like our own Sun. It is not an exaggeration to say that without Green Bank, our quest to understand how our Solar System formed would be set back decades in terms of understanding the motions of the material needed to form the Sun and accompanying planets. I have visited Green Bank many times, and I know that it sits in a very special, unspoiled part of our country. I have always been impressed at just how careful NRAO has been to preserve not just the surrounding area around the facilities, but also the great relationships they have with the people of Green Bank and West Virginia—many of whom they also employ. I am proud of our country for having built and for continuing to host this premier facility. Please preserve it for science, and vote "No Action."</p>	Against Closure	Email	11/25/2016	GBT+Goodman.pages.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
181		Peter	Timbie		<p>We are writing this letter in response to the request for public comments on the Environmental Impact Statement and proposed changes to the operations of the Green Bank Observatory. We understand that alternatives to be evaluated in the impact statement will be refined through public input, with preliminary proposed alternatives that include the following:</p> <ul style="list-style-type: none"> • Continued NSF investment for science-focused operations (No-Action Alternative) • Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope • Collaboration with interested parties for operation as a technology and education park • Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) • Deconstruction and site restoration <p>As long-term users of the GBT we strongly urge you to pursue the first alternative, continued NSF investment for science-focused operations. The Green Bank Observatory is a unique facility that has allowed measurements that could not have been made in any other way. We'd like to share a few examples from our own work. Over the past 8 years, members of our team have used the GBT to open up a new window on the Universe. We use the unique radio signature of neutral hydrogen gas to survey the distribution of matter on the largest scales. By observing the evolution of these 3-D maps as a function of cosmic time we can learn about dark energy, the mysterious component of the Universe that causes the universal expansion to accelerate, as well as other cosmic constituents. These GBT measurements have been published in high-impact journals... and have inspired the construction of a variety of new instruments that use similar techniques to probe the epoch when the first stars formed and to survey the largest volumes of the cosmos. Without these pioneering GBT measurements, construction of these new instruments and the rapid expansion of this new field could not have been justified. The first high-redshift detection of neutral hydrogen radio emission occurred at GBT because of its unique features: it is the largest, fully-steerable, unblocked single aperture radio telescope in the world. The large size is necessary to achieve the angular resolution to map the cosmic structures. Steerability allows us to track and stare at small portions of the sky for hundreds of hours, long enough to uncover the small signal. The unblocked aperture produces a smooth angular response on the sky that makes instrument calibration feasible and the faint cosmic signal detected. Alternative approaches, using radio interferometers, are considerably more challenging to calibrate. Finally, the GBO's location in the National Radio Quiet Zone allowed us to observe at the relatively low radio frequencies where the highly-redshifted signal appears. Even 8 years after our team's initial work at GBT..., no other radio telescope has detected this signal. Observing time at GBT has allowed us to make and follow up on two serendipitous discoveries that occurred during our neutral hydrogen survey. These systems trace the constituent material for star formation; detection at different redshifts would provide a new tool for studying galaxy evolution. Their narrow linewidth could also facilitate direct measurements of the cosmic acceleration (dark energy). The GBO has been able to respond to these discoveries by providing us with follow-up observing time. The GBO has pursued cost-effective partnerships with universities and other institutions worldwide to train young researchers and develop new radio instrumentation. Our observations at GBT have been led by graduate student PIs, who have written the proposals and led the observations and analysis. They have also participated in building the next generation of tools that the field of radio astronomy requires to progress. Our team is developing a new set of low-frequency receivers for the GBT at almost no cost to the GBO. This partnership allows universities to do what they do well - to train new scientists with the skills necessary to develop innovative techniques - by having access to world-class instrumentation which no university could afford to build or operate alone. In our program over a half-dozen graduate students and over a dozen scientists, many from overseas, have trained at the GBO. The GBO and the Radio Quiet Zone are, quite simply, national treasures. We urge you to continue to make them available to the scientific community.</p>	Against Closure	Email	11/25/2016	
182	a	Christine	Marganian Goldman	Boston College Chemistry	<p>My name is Dr. Christine Marganian Goldman. I have been a member of the Chemistry Department Teaching Faculty here at Boston College for seventeen years. I write in support of continued NSF investment for science-focused operations at the Green Bank Observatory in Green Bank, West Virginia. My family members have played important roles at the Green Bank Observatory for many years. My brother, Paul Marganian, has a Master's Degree in Physics and is a Software Engineer at the telescope. Paul's wife, my sister-in-law, is Dr. Karen O'Neil, the Green Bank Site Director for the NRAO's site at Green Bank and the Assistant Director for Green Bank Operations.</p> <p>We have a family history of strong support for science and science education. My brother Paul whom I mentioned, holds a Master's degree in Physics; his wife Karen has a Ph. D. in Physics; I earned a Ph.D. in Chemistry in 1995; our father holds a Ph.D. in Chemistry; our mother holds a Master's degree in Chemistry; my husband holds a Ph. D. in Chemistry. We have all devoted our professional lives to scientific endeavors and to educating tomorrow's scientific leaders. The fact that a facility like the Green Bank Observatory in Green Bank West Virginia can attract scientists from all over the world who vie for precious telescope time and at the same time educate schoolchildren and adults tells me that it is highly deserving of continued NSF investment.</p> <p>In addition, it also serves as a national educational resource for the many who live in and visit the site in Pocahontas County, West Virginia. It is my sincere hope that the National Science Foundation will continue to invest in the science-focused operations at the Green Bank Observatory in Green Bank, West Virginia.</p>	Against Closure	Email	11/25/2016	GREENBANKOBSERVATORY.pdf
182	b	Christine	Marganian Goldman	Boston College Chemistry	<p>When I visit the website of the Green Bank Observatory, I am immediately impressed with all that the Green Bank Observatory encompasses. The services the observatory provides to the community along with the world-class science that takes place there is something to feel proud about. When I visit the GBO in person, I am even more impressed. One only need drive there, through the rolling hills of West Virginia, to be suddenly struck by the view, seemingly out of nowhere, of the majestic structure of this largest steerable telescope in the world. This telescope is not only visually majestic but is stunningly impressive in scientific capabilities.</p> <p>Indeed, the Green Bank Telescope (GBT) represents 'a unique scientific resource' as 'no other observatory has the capabilities of the GBT'. Importantly, no other telescope has 'open access to US investigators to the degree offered by GBT' (reference: 'The Case for a Publicly Available Well-Instrumented GBT Operating at 20-115 GHz').</p> <p>The GBT is also a vital component of University-Observatory-NSF collaborations. As scientists, we know the value of scientific collaboration and the important role it plays in today's cutting-edge - research. I view the GBT as a national resource that is central to the success of future high frequency scientific observations and investigations.</p>	Against Closure	Email	11/25/2016	GREENBANKOBSERVATORY.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
183		Galen	Watts	Engineer, Green Bank Observatory Volunteer Firefighter, Bartow-Frank-Durbin Fire and Rescue Volunteer Production Manager, Pocahontas County Opera House Volunteer Audio Consultant, Pocahontas County High School	<p>Many comments preceding mine state the many ways some of the options for the future of the Green Bank Observatory and the Green bank Telescope in particular would negatively affect the local community, the local economy, possibly the state economy and certainly the academic opportunities of students up to the undergraduate level to be exposed to actual research and mentoring by scientists of world renown. I refer to options three, four and five - Three, the technology and education park</p> <p>- Attendees of such a park would not have the opportunity to participate in actual research with a world-class instrument. Four, mothballing of facilities - Momentum in such matters is difficult to change and realistically it is highly doubtful that the facility would ever come out of mothball status before the end of its useful lifetime. Five, the deconstruction of an instrument built with over 100 million dollars of taxpayer money - It is likely the cost of such deconstruction and site restoration would likely be more than actually operating the GBT to the end of its useful life.</p> <p>This leaves options one and two. Obviously, option one, continued full-funding by the NSF would be the most desired by all associated with the GBT and the GBO as this would keep the instrument a cutting-edge, world leader in radio astronomy for research that simply cannot be done with other, existing instruments. I suspect option one is listed simply to give those concerned false hope, as progress toward option two is already ongoing.</p> <p>Option two, reduced funding by the NSF to be covered by collaborations with non-NSF interested parties sounds quite plausible without delving in to the details. One of the details that makes option two difficult are the rules regarding non-federal use of federal facilities that, in short, make the required cost rates for use of the GBT prohibitively high. In one case already, these high rates led to a potential collaborator taking their business to a Canadian facility.</p> <p>An even more unpredictable factor is the federal budget. Potential collaborators that are federally funded typically cannot enter in to new collaborations until a federal budget is actually passed. As recent history shows, Congress has great difficulty passing federal budgets and relies on continuing resolutions. With the evolving political climate at the federal level this problem is likely to get much worse.</p> <p>So what to do? Possibly a combination of options one and two, Option 1.5, where the NSF makes minimal supplements to the Observatory's budget to insure minimum operation and prevent furloughs and layoffs, until a federal budget is passed and the GBO begins to receive funding from the new collaborators.</p> <p>I thank you for the opportunity to make these comments, and urge serious and full due consideration of all factors affecting the GBO and its communities, from local to global.</p>	Alternatives Consideration	Email	11/25/2016	
184		Jennifer	Wood		<p>Thank you for encouraging us to comment on your:</p> <p>Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operation (from Public Meeting Nov 9,2016</p> <p>More Information to follow</p> <p>Deadline for comments today Nov 25, 2016</p>	General	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
185	a	Natalia	Lewandowska		<p>During the summer of 2016 I attended the ""Physicists Inspiring the Next Generation"" (PING) camp for high school students. I had the privilege to meet many young students from different parts of the United States who were eager to learn as much as was possible during their time at the Green Bank Observatory. The program of the camp consisted of lectures and observations which the students carried out themselves with one of the radio telescopes of the observatory. My task was to help them with the scientific questions they had. Nowadays, most observations with professional telescopes do not offer this opportunity to observers anymore and everything related to that is carried out automatically by computers. The GBO offers therefore unique opportunities to the PING camp students. Apart from some necessary preparations, most of the questions come into mind when the actual experiment, or observations, are carried out. It was a pleasure for me to see this development also in the case of the PING students and to help them out with the questions they had. They had the opportunity to talk to professional researches and this way also to work with them. Similar to carrying out observations, this is a rare opportunity nowadays. The GBO offers such unique opportunities to the younger generations who this way get the possibility to decide on their own if they are interested in science, or not. I think it is very important to make this decision based on personal experience, rather than on opinions of other people, or prejudices. This way also students who belong to minorities get the chance to carry out research. I would like to add that I know of at least one PING student (from the group I was working with) who has become so interested in fast rotating neutron stars, commonly referred to as pulsars, that she is joining the Pulsar Search Collaboratory (PSC). This is a joint project between theGBO and the University of West Virginia (WVU) which gives high school students the opportunity to actively search for new pulsars and this way gain professional research experience. The PSC offers further unique possibilities for young students to get involved into active research at a young age. TheGBO is the pillar for both projects. Closing the facility would mean taking away crucial possibilites for younger generations to get involved in science. Gaining professional research experience is also based on a good relationship with the mentor. The researches who work at the GBO are eager to mentor the younger generations and help out with their projects, thus creating a unique work atmosphere which I did not observe in this form at other institutes. Please understand that the described forms of collaboration between researches and students are not self-evident. They are the result of curiosity, enthusiasm and the will to learn new things about the Universe even if they seem obscure at first. Research is based on asking questions and one of the essential insights which students gain at the Green Bank Observatory is that professional researches are also doing what the students do: They ask questions... and this way they never stop learning. Especially at high school level peer pressure can be extremely high, leading sometimes to the belief that asking questions is not appropriate. At the Green Bank Observatory students learn that asking questions is regarded as highly positive and crucial as a researcher. This way they might feel encouraged to pursue a career in science in the future. With the described programs the Green Bank Observatory offers unique research and educational options for students which I have so far not seen at any other observatory where I worked during my academic career. Deconstructing, or mothballing the facility would cause long period damages in both areas possibly creating the overall opinion that science is not worth pursuing. As mentioned earlier, the Green Bank Observatory is also highly involved into outreach work. The science center offers public tours, but also special tours which are related to the search for extraterrestrial life, commonly referred to as SETI tours. In the latter case the astronomers from the GBO help out as astronomers who the participants of the tour can ask questions. During the times I was the astronomer to ask I realized the participants were very eager to ask questions about different branches of astronomical research. It is crucial for an observatory to open its gates to the public in this form and to give people who are eager to learn new things the possibility to see that astronomers/researches are also normal human beings. This might encourage especially younger generations to get involved in science.</p>	Against Closure	Email	11/25/2016	eis_nlewandowska_II.pdf
185	b	Natalia	Lewandowska		<p>The Green Bank Observatory organizes also annual visits of the Garth Newel Musicians who give a free concert at the observatory. Since the musicians reside in Virginia, this is a rare opportunity for the local community to attend the concert. Let me emphasize that this is only one of numerous occasions with which the Green Bank Observatory includes local community, providing opportunities for people to attend events which otherwise they might not be able to due to various reasons. As a postdoctoral fellow at the Green Bank Observatory my science is focused on the study of fast rotating neutron stars, or pulsars. The signals which pulsars emit are usually very weak. Therefore large radio telescopes are needed for their study. In addition, with its unblocked aperture the Green Bank Radio Telescope (GBT) is able to detect very faint signals from pulsars, providing possibilities which at the present time cannot be given by any other radio telescopes world wide. Since my research is focused on a special form of irregular pulses which are only emitted by a small number of pulsars due to currently unknown reasons, I decided to continue my research with the GBT.</p>	Against Closure	Email	11/25/2016	eis_nlewandowska_II.pdf
185	c	Natalia	Lewandowska		<p>The Pulsar Search Collaboratory (PSC) mentioned earlier in this letter, uses data taken with the GBT and is therefore actively involved into one of the many research branches carried out at the Green Bank Observatory. The discoveries related to pulsars with the GBT are numerous and have influenced pulsar science all over the world. Even before the construction of the GBT crucial discoveries of pulsars were made with the 300 foot radio telescope. The Green Bank Observatory is therefore a significant pillar of pulsar research. Deconstructing, or mothballing the site would mean a serious drawback and set researches world wide back in the understanding of pulsar physics.</p> <p>I would like to add that the collaboration between the scientific, educational and outreach work works out that well at the Green Bank Observatory because all three parts are active. Turning the facility into a pure educationa one, would take awayt the possibility for students to carry out actual research.Due to the described reasons, I strongly encourage the National Science Foundation (NSF) to select the No-Action Alternative (continued NSF investment for science-focused operations) for the future of the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	eis_nlewandowska_II.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
186	a	Jennifer	Donovan Meyer		<p>In response to the call for input regarding the Environmental Impact Statement for the Green Bank Observatory, I am writing to express my strong support to enable the Observatory to continue its science operations. My name is Dr. Jennifer Donovan Meyer, and I am a radio astronomer residing in Virginia working to support world class radio telescopes in the United States and abroad. As detailed below, the Green Bank Observatory provides the instrumentation, protection from radio frequency interference, and essential accessibility to scientists and engineers that make it unique in the world among radio astronomy facilities. As such, I humbly request that the NSF take "no-action" rather than decreasing operations or, worse, deconstructing the Observatory.</p> <p>Many science cases uniquely served by the Green Bank Telescope (GBT) exist, but my primary interest in the Green Bank Observatory is in the capability of the GBT to detect faint gas between galaxies. A major ongoing debate in the astronomical community focuses on the way that galaxies, like our own Milky Way, come to look the way that they do in the present day universe. Observers and theorists alike predict that some kind of accretion of material onto galaxies, which must come from the space between them, is necessary to grow the massive systems that we see today, but there is still much debate over the manner in which this accretion occurs. Being able to detect this material directly is extremely difficult; the most advanced (and expensive) instruments currently available and here, the Expanded Very Large Array (EVLA) and Atacama Large Millimeter/sub-millimeter Array (ALMA) come to mind (can largely only provide observations of the smaller scale emission coming from the galaxies themselves. Sensitivity to extremely faint and diffuse material, as this intergalactic material is believed to be, requires a huge single beam, fantastic sensitivity, and very limited radio frequency interference. The only such instrument available is the GBT. Though with the EVLA and ALMA we can probe light coming from within galaxies, putting them into a larger cosmological context is impossible without being able to study the light emitted from the material between galaxies.</p>	Against Closure	Email	11/25/2016	gbo_jdonovanmeyer.pdf
186	b	Jennifer	Donovan Meyer		<p>The importance of the location of the Green Bank Telescope cannot be understated. The world we inhabit is getting louder at radio frequencies; GPS satellites, cell phones, and other sources of technological comfort increasingly drown out the faint astronomical signals that astronomers strain to record. As technological advancements all over the Earth plus those orbiting it increase their reach, the protection of the National Radio Quiet Zone (and the telescopes contained within it) will only continue to increase in value and opportunities provided for observing galaxies and other astronomical sources.</p>	Against Closure	Email	11/25/2016	gbo_jdonovanmeyer.pdf
186	c	Jennifer	Donovan Meyer		<p>Finally, the accessibility of the entire Green Bank Observatory is crucial to the creation of the next generation of radio astronomers, not to mention a scientifically literate society in an otherwise underserved area with regard to STEM. World class facilities like the EVLA and ALMA are impossible to use as hands on learning tools; the GBT, as well as the rest of the instruments available on site at the Observatory, provide this opportunity for the training of both scientists and engineers. Especially in a climate where accessible "learning" instruments like CARMA are being closed, investing in our future by maintaining the entire GBO is even more important. As a scientist, I remember traveling to the GBT as a first year graduate student for my first "real" observing run, where I could get my feet wet running a world class radio telescope with the help of the skilled operations staff. Such experiences are shared by observers ranging from West Virginia high school students to eminent scientists across many fields of astronomy. On the engineering side, just as important, university groups and engineers regularly build new instrumentation for the telescopes at the GBO to enable groundbreaking science, then apply the technology at other, less experimental, sites. If not for the kind of experience that can be gained at observatories like the GBO, the next generation of radio astronomers my generation will not be able to build the next major radio astronomy observatory in 30 years when the current facilities will have become inadequate.</p> <p>To summarize, the Green Bank Observatory is unique among world class radio astronomy facilities in the world. Among many other science cases, it provides information about light coming from faint, diffuse gas in the universe that other instruments simply cannot and will never be able to see. This sensitivity is due to its size, its construction and maintenance, as well as its location in the National Radio Quiet Zone. Finally, the accessibility of the GBT and the telescopes on the entire GBO site provide opportunities for scientists and engineers at all stages of our careers that we cannot find elsewhere. Please take "no-action" and allow the Observatory to continue its science operations.</p>	Against Closure	Email	11/25/2016	gbo_jdonovanmeyer.pdf
187	a	John	Herrold		<p>I have had the unique opportunity on several occasions to visit the Green Bank Observatory. Each time I witnessed eager young people being immersed in the learning experience associated with the science of Radio Astronomy.</p> <p>It seems to me, a now retired high school science teacher, to be an extremely unique and challenging experience for young minds. Even mine.</p> <p>So whatever your budget constraints may be, the GBT should remain active. Continuing NSF investment in this worthy endeavor is of high priority. I have been honored to witness how NRAO at Green Bank has been a major motivation to channel young minds into science careers adding to our needed pool of American science students.</p>	Against Closure	Email	11/25/2016	
187	b	John	Herrold		<p>The GBT has added pure research into science which is an invaluable asset to the body of knowledge. This is data that cannot be obtained elsewhere.</p> <p>It is also a valuable tool in keeping the public aware of the extent of this kind of pure science research. Keeping the electorate apprised of such important data has an upside we all in science want to nurture.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
188	a	Karen	O'Neil		<p>I am writing in support of the Green Bank Observatory. Already you have received many letters in support of the facilities and the many programs which are run or sponsored on the site. Nonetheless I would like to list a number of the facilities and activities which could be affected by any decrease in funding to the facility. The list below is not complete, but hopefully capture at least a significant part of the way Green Bank Observatory contributes to the region. This list is broken into five categories – educational activities, economic impact, community development, radio telescopes, and site buildings and facilities.</p> <p>Educational Activities: The Green Bank Observatory has a rare combination of assets: 1) a laboratory where frontier research is an ongoing activity; 2) a professional staff of scientists and engineers who are also heavily involved in education and outreach; 3) facilities such as the Green Bank Science Center, radio telescopes, housing and food services, all available for formal and informal educational programs. The site staff use these assets to develop and present programs that would not be possible at other institutions. Green Bank is also a partner to the local school district, offering mentoring, coursework, and educational opportunities to the local youth. The Science Center is a multi-purpose building that draws 50,000 visitors each year, a remarkable number for so remote a location. Visitors experience the many interactive displays in a 4000 sq ft. exhibit hall, hear presentations about radio astronomy from the Science Center staff, and take a guided bus tour around the site. The 25,000 square foot facility also contains the Catching the Wave Exhibit Hall, 150-seat auditorium, StarLab Classroom, gift shop, and even a café. The Science Center is also used for monthly star parties, an annual 4-day Star Quest gathering of amateur astronomers, the annual meeting of the Society of Amateur Radio Astronomers, community days, and so on. It serves as the focus for school field trips throughout the year. The 40-Foot telescope is a working radio telescope outfitted specifically for use by students and teachers. It is the centerpiece of a hands-on research experience offered by the Observatory staff. Each year between 2500-3000 scouts, students and teachers visit Green Bank, typically in small groups of a few dozen students with their teachers, for sessions lasting several days. They are housed in the site "bunkhouse" and take meals in the cafeteria. They receive in-depth tours of the electronics labs, training, use of the 40-Foot Telescope, and interactions with the site staff.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	b	Karen	O'Neil		<p>Throughout the year the Green Bank hosts numerous programs for teachers. The Residential Teacher Institutes provide a research experience for K-12 teachers and pre-service teachers through projects on the 40 Foot Radio Telescope under supervision of the Green Bank staff. Begun in 1987 and supported initially by the NSF and NASA, this program has trained over 1000 teachers in the fundamentals of research. Each year a Chautauqua Short Course Program for undergraduate college faculty is held to update their content knowledge. In the several dozen years of the program over 650 undergraduate faculty members have participated.</p> <p>The Pulsar Search Collaboratory is a unique program in partnership with West Virginia University that enables middle and high school students to participate in active pulsar research using data from the Green Bank Telescope. In a summer residential program, high school teachers and their students work with astronomers to learn how to analyze data produced by the telescope, and then form PSC teams back at their schools. Funded by the NSF, the Collaboratory has so far engaged more than 100 teachers and roughly 1,000 students from 18 states in pulsar research. Student teams have thus far discovered 6 new pulsars and three transient object, increasing their interest in science and technology and has gained national recognition.</p> <p>The Earth/Space Science Passport is a new, amazing professional development program for West Virginia science teachers to prepare them to teach Earth and Space Science. Through a two-year program, teachers learn ESS content, WV Next Generation Science Standards (WV NxGen & NGSS), engineering design, and best pedagogical practices. During the two years teachers are provided with classroom materials and activity guides to assist in the implementation of activities. Teachers attend two summer workshops (Green Bank Observatory with Earth and space science content specialists and Fairmont State University with NASA IV&V Educatory Resource Center). In the first summer workshop, they participate in West Virginia field geology, the Junior Skynet Scholars program, and become GLOBE certified teachers. The second summer workshop incorporates engineering design and certifies teachers to check out NASA loaner kits on space weather and robotics. Through the school year teachers participate in monthly web meetings, present at WVSTA (West Virginia Science Teachers Association), attend a spring geology field trip, and conduct action research in their own classroom!</p> <p>SPOT, the Space Public Outreach Team, is a partnership between the Green Bank Observatory, NASA, and the West Virginia Space Grant Consortium to bring space-science into West Virginia schools! Trained college ambassadors visit K-12 classrooms with interactive presentations and hands-on activities through the West Virginia SPOT program. WVSPOT increases K-12 student and teacher awareness of and interest in astronomy and space-related STEM research, programs, and careers in West Virginia, and students gain valuable exposure to college role models. They train college ambassadors at the Green Bank Observatory in the immersive environment of the Quiet Zone. They learn in-depth astronomy and space science content knowledge, and they gain important "21st century skills," such as science communication, public speaking, autonomy, and ability to adapt.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
188	c	Karen	O'Neil		<p>The 20-meter telescope, originally built by the US Naval Observatory for studies of the Earth's rotation, is now part of Skynet, a distributed network of robotic telescope for education. Currently, a few thousand students take advantage of the SkyNet network of telescope annually.</p> <p>Numerous opportunities also exist for visiting school and other educational groups. These activities include, but are not limited to:</p> <ul style="list-style-type: none"> • Radio Astronomer for a Day: Work in research teams investigate cosmic objects with the Green Bank Observatory's 40-foot diameter radio telescope. During an overnight stay, participants learn how to operate the telescope and complete inquiry-based projects, becoming, in fact, radio astronomers. Research level can be varied and is geared to the education level of participants. • Solar Viewing (weather permitting): On sunny days the special H-alpha telescope can be used and participants can safely view sunspots, solar flares, filaments and plages. • Star Party: Monthly star parties take place on the star patio. Star parties can also be arranged for visiting groups staying on site, and are often included in other site events, such as the Space Race Rumpus. • Hands-on Science: There are a variety of educational activities suitable for ages, from pre-K through adult. These include: <ul style="list-style-type: none"> o Exhibit Hall Concept Quest: Participants complete a scavenger hunt to answer science and engineering questions as they interact with the hands-on exhibits. o Be an RFI Detective: Green Bank Observatory technicians use high tech equipment to hunt down Radio Frequency Interference. Students can join in the hunt as they search the Science Center for sources of man-made radio sources. o Exploring Our Solar System: Participants investigate the size and scale of the solar system, with three hands-on activities to choose from: Pocket Solar System, Worlds in Comparison, and Moon and Earth. o GBT Engineering Design Challenge: Participants investigate engineering by designing, building and testing a support structure that can hold up a "radio telescope dish". Best structure wins! <p>Numerous other programs exist on site, and a full description of current offerings can be found at http://greenbankobservatory.org/education/.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	d	Karen	O'Neil		<p>Finally, the Observatory is a partner with the Pocahontas County School System, providing a vast number of services to the local schools. Support for the local school system comes two ways – through programs which are hosted by the observatory as well as through local staff participation in school activities and planning. A few of the ways staff help the local schools include:</p> <ul style="list-style-type: none"> • School Board Members • Business Partner Scholarships - Annual donation to the PCHS Science Scholarship, Organizer and host of primary fundraiser for the William Dilley Track Scholarship • Serving on school and school board committees - Levy Committee, School Calendar committee, 10 year planning committee, 5 year strategic planning committee, Superintendent's Advisory Committee, Local School Improvement Council (GBEMS, PCHS), Title IV Committee (GBEMS) • Providing tutoring for local students as part of their in-school lessons • Annual support and volunteers - GBEMS and PCHS Career Days, Read Aloud, Literacy Fair judges, Socials Studies Fair Judges, Science Fair help and mentoring, Math Tutors, School Treasurer (MMS) • Math Field Day - County Math Field day is hosted at the Observatory, Tutors for Green Bank Elementary Middle School • Pocahontas County Science Fair - Pocahontas County Science Fair is run and hosted by the Observatory, Mentoring for all county science fair participants • Hour of Code - Annual hour of code with PCHS is run by the Observatory • Science Bowl - Judges, moderator, scorekeeper for RESA IV bowl • High School Athletics - Observatory staff have been coaches and assistant coaches in the past for the high school soccer, basketball, and baseball teams; Timekeeper/Scorekeeper for PCHS athletics; Radio Announcer for PCHS athletics 	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	e	Karen	O'Neil		<p>Economic Impact</p> <p>Over 100 people are employed at the Green Bank Observatory year round, and another 40 seasonal jobs are added each summer. Based on the most recent census, this means roughly 5% of the total work force in Pocahontas County is employed by the Green Bank Observatory.</p> <p>Green Bank Observatory's employees contribute greatly to the State, from working as emergency service personnel in the region through coaching school sports, but living in Pocahontas County they directly influence the economy there on a daily basis. Green Bank's salary base exceeds \$14 million, and State economic studies have shown that, of this amount of base wage, the average expenditure of base wage used for all living expenses is 79%. Therefore, Green Bank employees directly contribute nearly \$11.1 million to the economy. Taking into account the ripple effect, that number reaches an amazing \$17.76 million.</p> <p>Those familiar with Green Bank Observatory know that education and public outreach are at the center of this strong research-oriented facility, and 50,000 visitors each year come to take part in the many tourist and teaching opportunities provided by the staff. In addition to spending time at the facility, these visitors also contribute considerably to the West Virginia and Pocahontas County economies. It is estimated that the visitors to the site spend approximately \$150 per day for items such as transportation, lodging, meals, entertainment, and recreation. The Observatory guests, therefore, spend roughly \$7.5 million dollars per year in West Virginia for their visits. But the effect doesn't stop there. Every dollar a tourist spends in West Virginia creates a ripple of economic activity. The multiplier used in West Virginia is 1.6 to estimate the total impact of tourism dollars. Employing this multiplier increases the annual contribution of Observatory's visitors to roughly \$12 million.</p> <p>Combined, it is easy to see that the Green Bank Observatory contributes a staggering \$29.76 million to the County and State economies.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
188	f	Karen	O'Neil		<p>Community Development</p> <p>The Green Bank site has tight links to the local community, the region and the State. In addition to the mentorship experiences offered to local secondary school students, the site staff has significant outreach into the community. Staff members often teach STEM classes in the local schools, mentor science and math students, serve as science fair mentors and judges to the county and are on county and state educational committees and boards. Site facilities are used for community meetings and by organizations such as the Boy Scouts and National Forest Service, and are a vital part of the county emergency services plan.</p> <p>Below is a partial list of the various community activities in which Green Bank Observatory staff actively participate, broken into two main categories – emergency services, and local and community organizations.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	g	Karen	O'Neil		<p>Community Organizations: Observatory staff serve on a wide variety of community organizations and boards. These include, but are not limited to:</p> <ul style="list-style-type: none"> • Pocahontas Dramas, Fairs and Festivals Board • Opera House Foundation • Pocahontas County Convention and Visitors Bureau • Pocahontas County Chamber of Commerce • First Citizens Bank Board of Directors • Pocahontas County Parks and Recreation • Pocahontas County Prevention Coalition • Providing sound and lights for Pocahontas County Opera House • Pocahontas County Democratic Executive Comm. • Northern Pocahontas Community Wellness Board • Elkins YMCA Board of Directors • 4-H Foundation • Allegheny Mountain Radio • 8 Rivers Amateur Radio Club • National Weather Service, Cooperative Observer • Air Weather Association • Boy Scouts Scoutmaster, volunteers • Pocahontas County Youth Soccer – coaches, board members, schedulers, referees • Pocahontas County Youth Baseball League, volunteers • Adopt-A-Highway Program, volunteer • ExploreWV Geocaching, volunteer • Dunmore Community Center, volunteer • Pocahontas County Drama Workshop • Elkins Pilots Club • Durbin 5K Run • Seneca Woodlands Women's Club 	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	h	Karen	O'Neil		<p>Emergency Services: Green Bank Observatory staff are members of the local emergency services crews, serving in the following capacities:</p> <ul style="list-style-type: none"> • Deputy Fire Chief • Treasure • EMTs • Firefighters • Ambulance Drivers • County Search and Rescue • Local Emergency Planning Board members • Amateur Radio Emergency Services – Pocahontas County • Amateur Radio Civil Emergency Services <p>Green Bank Observatory also provide the helipad for medical evacuation services within Northern Pocahontas County. The Observatory also provides water for the emergency tanker truck for the fire departments in the northern half of the county.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
188	i	Karen	O'Neil		<p>With over fifty years of experience in radio astronomy and uniquely located within the National and West Virginia Radio Quiet Zones, the Green Bank Observatory is home to seven large radio telescopes ranging in size from 14m – 100m in diameter. The site also has significant infrastructure which allows for the installation of any instrument which may benefit from the radio quiet location of the site, as well as an excellent test range for receivers and other hardware and a large anechoic chamber outfitted for testing antenna beam patterns and radio emissions from all types of equipment. The primary function of the Green Bank site is for scientific research of all types. As a result, the facility telescopes have been used in a wide variety of ways, including satellite tracking, spacecraft tracking, atmospheric studies, monitoring of astronomical and planetary phenomenon, and educational programs. A full description of the telescopes, and their uses, is below.</p> <p>13.7m Telescope: The 13.7m diameter telescope was built in 1995 as a tracking station for NASA's Very Long Baseline Interferometry (VLBI) satellites. With an aperture efficiency of 38% at 15 GHz the telescope is designed to work well at the common up and downlink frequencies for satellite systems. As a tracking station the 43m transmitted a maser referenced timing tone to the orbiting satellites and also received astronomical data sampled by the orbiting space crafts. Per the preference of the NASA mission, the tracking stations recorded the received data on wideband magnetic tape and ship it to correlators for further processing. Once the NASA VLBI mission was complete the telescope found subsequent use monitoring the sun for solar activity, offering publicly available research quality dynamic spectra of the sun during daylight hours. ... The by far most sensitive of the telescopes in Green Bank, the 100m Robert C. Byrd Green Bank Telescope is the largest fully steerable telescope in the world. The telescope's unblocked aperture and excellent surface result in an extremely sensitive telescope from 0.1 through 100 GHz. While its primary purpose is radio astronomy research, the GBT is designed to enhance many types of scientific pursuits. The telescope's high sensitivity allows it to receive direct communications from small spacecraft exploring the solar system. Recent use of the telescope for this activity includes monitoring the direct signal from NASA's Mars Phoenix lander as it entered descended through the Martian atmosphere to successfully land. The telescope is also often used as a receiving station for the planetary radar experiments performed with the Arecibo 305m telescope and Goldstone 70m antenna. The 100-m telescope is the main telescope for the facility, and is under operation currently for a variety of scientific experiments.</p> <p>Reber Telescope: This telescope was constructed by Grote Reber in 1937 in his back yard in Wheaton, Illinois (a suburb of Chicago). He built the telescope at his own expense while working full time for a radio company in Chicago. The mirror, made of sheet metal 31.4 feet in diameter, focuses radio waves to a point 20 feet above the dish. The cylinder contains the radio receiver which amplifies the faint cosmic signals by a factor of many million, making them strong enough to be recorded on a chart. The wooden tower at the left is used for access to the receiver. The telescope is registered with the National Registry of Historic Places and received an award in 2016 from the West Virginia Division of Culture and History as one of the primary landmarks within the state.</p> <p>Jansky Antenna: The Jansky Antenna replica serves two different functions. First, of course, it provides visitors to the site with a working demonstration of the antenna used by Karl Jansky when his scientific endeavors first created the field of what is now known as radio astronomy. Secondly, at least once a year SARA, the Society of Amateur Radio Astronomers, use the Jansky antenna for their own studies of the Universe.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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188	j	Karen	O'Neil		<p>Site Buildings and Facilities</p> <p>Below is an incomplete list of the buildings on site and their various uses.</p> <p>Jansky Laboratory: This houses the majority of the scientific, software, and engineering staff as well as administrator for the Green Bank Observatory. It includes a full electronics laboratory, the anechoic chamber, conference facilities, and a large auditorium. It also includes much of the equipment required to run the site telescopes and the site telescopes' control rooms.</p> <p>Residence Hall, Dormitory: The site dormitory and residence hall provides housing for the astronomers, engineers, and many school groups and organizations which take advantage of the site educational programs and workshops. The occupancy is high, typically 65-85% annually.</p> <p>Cable Building, Warehouse, Metrology Lab, Interferometry Control Building: These buildings provide storage space for the equipment and projects on site, materials purchased for site use, etc. They also house the equipment used for the smaller science projects on site, such as the HERA and LoFASM experiments. They are in use daily.</p> <p>Science Center: The Science Center houses the exhibit hall, classrooms, gift shop, café, and basement workshop which are in use by both the general public and the education groups and programs hosted on the site.</p> <p>Works Building: The works building hosts the Green Bank Machine shop, carpentry shop, plant maintenance division, etc. and is of importance to the site activities.</p> <p>85-1 Control Building: This is an historic building and is used regularly by the education and public outreach group for their SETI tours.</p> <p>40foot Control Building: This hosts the instruments required for the 40ft telescope and is the room in which the students run the 40ft telescope for their educational projects.</p> <p>Indoor-Outdoor Test Facility: This facility is used regularly for the testing of receivers and similar instruments for all Green Bank Telescopes as well as for the testing of receivers planned for other radio telescopes around the country and the world.</p> <p>Paint Shop: Painting of all components takes place within the paint shop, as well as the painting of other instruments on site.</p> <p>Farm Buildings: The original farm buildings on site are used as storage facilities for that equipment which can handle some weathering but which remains of potential use to the facility. This has allowed for the storage of, e.g. receivers for mothballed telescopes which can then be brought out from storage when a new contract is agreed upon for the use of that telescope.</p> <p>Residences, Town House: With the exception of the Hannah House, which is used only in the summer months, the site residences are used year round both by local staff and visitors staying for anywhere from a week to a few months to work on site. Occupancy is typically 90-100%, with a waiting list not uncommon for their use.</p> <p>Recreation/Picnic area: The picnic and recreation area is the only such facility for central Pocahontas County. It is used by not only the Observatory for staff morale activities, but also by community groups throughout the county, including the local Lions Clubs, the county soccer, baseball, and other sports teams, boy scouts, etc. It is also used by county residents for large family reunions. When not reserved by groups, the facility is also used as a playground, soccer field, and driving range by individual county residents.</p> <p>Pool: The Green Bank Observatory pool is the only semi-public pool within 100 miles. Employees and retirees of the Green Bank Observatory and their families have learned to swim in the pool. It is also used by the county wellness organization for swim training, local triathalons, swim meets, etc. Finally, it provides the primary location for the training of lifeguards in the county, as it is one of only two pools in the county with sufficient depth for the testing of lifeguards.</p> <p>In summary, while the Green Bank Observatory is a vital part of the scientific community within West Virginia, the United States and the World, it is also a vital resource to the citizens of West Virginia and Pocahontas County.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
189	a	Elizabeth	Adams	Postdoctoral Fellow	<p>This letter is in response to the Federal Register Notice of an EIS evaluating the potential environmental effects of proposed changes to operations at the Green Bank Observatory. I strongly request NSF to choose Alternative 1 of its "Notice of Intent to Prepare an EIS...", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>The Green Bank Observatory is a world-class facility due to its location in the National Radio Quiet Zone. This provides a unique environment in which sensitive experiments can be carried out.</p>	Against Closure	Email	11/25/2016	
189	b	Elizabeth	Adams	Postdoctoral Fellow	<p>The flagship telescope, the 100m Green Bank Telescope, is only beginning to reach full scientific potential. The new receiver, ARGUS, provides competitive and complementary scientific abilities to ALMA. Importantly, as Green Bank is located in the Northern Hemisphere, it can observe systems not visible to ALMA.</p>	Against Closure	Email	11/25/2016	
189	c	Elizabeth	Adams	Postdoctoral Fellow	<p>The Green Bank Observatory also plays a key role in the local community, from providing employment to training the next generation of scientists to supporting Health and Safety for the community.</p> <p>In summary, I believe the continued scientific operation of the Green Bank Observatory has a strong positive impact.</p>	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
190	a	Olivia	Harper Wilkins	NSF Graduate Research Fellow	<p>In this letter, I want to share my story with you in support of the Green Bank Observatory, its scientists and staff, its telescopes (including the Robert C. Byrd Green Bank Telescope, or GBT), and the wider radio astronomy community. Throughout my life and especially my academic career, I have been profoundly influenced by the science at Green Bank, and I know that I am not alone. Whether from other people who have seen the GBT for themselves or from those who have read about the National Radio Quiet Zone, Green Bank has opened up an area of public outreach unmatched by most other institutions. The broader impacts of Green Bank have no limits; I can talk about Green Bank anywhere—in Pennsylvania (where I grew up), in California (where I am now), even in Germany (where I lived last year)—and people often have some knowledge of the Pocahontas County research facility. For those who do not, after learning about it, they are always amazed and eager to learn more about radio astronomy. This widespread interest in radio astronomy and science generally rooted in Green Bank is why I write you today.</p> <p>I was six years old the first time my family traveled through the Blue Ridge Mountains in West Virginia. Rising above the tall trees that filled the landscape were massive satellite dishes. Even at six, I knew there was something peculiar about these white giants. I remember crudely outlining two or three of the large dishes in my sketchpad, imprinting the awe-inspiring image in my mind. Twelve years later, my family returned to the area to investigate the complex that had caught my gaze so many years before.</p> <p>This recollection of experiencing seeing the GBT for the first time opens every personal statement I have written in recent years because it is the story of how I fell in love with radio astronomy. It is a story that, even 17 years later, is at the core of who I am as a scientist. Green Bank is inspiration, not only for the general public as I mentioned before, but for me on a very personal level. Both the personnel and telescopes in Green Bank have rooted me in astrochemistry research and have encouraged me to be active in public outreach.</p>	Against Closure	Email	11/25/2016	LetterToTheNSF_Re-GBObs.pdf
190	b	Olivia	Harper Wilkins	NSF Graduate Research Fellow	<p>After my initial visits at Green Bank, I was eager to learn more. As a chemistry and mathematics undergraduate, Green Bank did not seem a likely place to pursue summer research. And yet, they gave me a chance. In 2013, I worked in Green Bank as the only summer student without a physics, astronomy, or engineering background. It was in Green Bank that I learned invaluable skills, like how to write computer programs for data analysis. It was also in Green Bank that I learned to appreciate international collaborations and global outlooks, and by the end of the summer, I was convinced I wanted to study abroad (and see some more radio telescopes) in England the following spring.</p> <p>It was also in Green Bank that I first learned of a small but growing discipline called astrochemistry from a talk by Anthony Remijan of the National Radio Astronomy Observatory. I was so intrigued that there was a field that incorporated by interest in astronomy with my skills in chemistry that I knew then I had found my scientific calling. I stopped by Jay Lockman's office near the end of my summer in Green Bank to ask him about how I could stay in my field, and Jay gave me resources to connect with astrochemists and learn more about the field. Using these tools, I contacted several scientists, including Karin Öberg at the Harvard-Smithsonian Center for Astrophysics, where I worked in a more astrochemistry-oriented research project, learning more about the chemistry of space.</p> <p>After my summer at Harvard, I pursued a Fulbright in Germany to do research at the Universität zu Köln, working on the premier astronomy molecular database in the world. Again, this experience was rooted in the connections I made in Green Bank.</p> <p>Now, I am an NSF Graduate Research Fellow at the California Institute of Technology, where I plan to continue my astrochemistry pursuits. Alongside this, I plan to engage in public outreach, especially at the high school level, to share radio astronomy and astrochemistry with the public. During and after my time in Green Bank, I have given various talks to groups of high school students and collegiate audiences, all of whom are mesmerized by radio astronomy, the field of discovering the invisible universe, using Green Bank as a proxy.</p> <p>But my drive to engage in public outreach is more than equipped by my experiences in Green Bank; my public outreach involvement is deeply inspired by it. Of every observatory and science center I've visited, Green Bank is the most involved in teaching its visitors about astronomy, and particularly radio astronomy. The people there are passionate about the field and are excited to teach people about the GBT. I will never forget my first visit to the Green Bank Science Center. Although I was 18, I felt as excited as a small child would. The science exhibit had everything I could possibly dream of seeing in the way of astronomy, there were captivating demonstrations (including one with liquid nitrogen and a balloon), and there was a phenomenal tour of the site including a close-up view of the GBT.</p>	Against Closure	Email	11/25/2016	LetterToTheNSF_Re-GBObs.pdf
190	c	Olivia	Harper Wilkins	NSF Graduate Research Fellow	<p>I hope I have convinced you that Green Bank Observatory is more than the telescopes and the scientific discoveries; it is inspiration. While the GBT has been essential to the discoveries of many complex organic molecules in interstellar space (most notably the recent discovery of propylene oxide, the first chiral molecule in space), it has also been essential to the development of people's interest in astronomy (like me) and science generally.</p> <p>I implore you to consider not only the intellectual merits of Green Bank Observatory, including the GBT, but also to consider its broader impacts. Green Bank is crucial not only to furthering our understanding of the universe but to inspiring others to learn and be passionate about it as well.</p>	Against Closure	Email	11/25/2016	LetterToTheNSF_Re-GBObs.pdf

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191	a	Robert	Minchin	Group Lead for Radio Astronomy and REU Program Manager, Arecibo Observatory	As manager and co-PI of the NSF-funded Research Experience for Undergraduates (REU) program at Arecibo Observatory, I see many applications for our REU program every year. A significant fraction of these applicants mention that they have been inspired to an interest in radio astronomy, and to major in physics or astronomy at college, by an experience of Green Bank Observatory during their time at high school or earlier in their college career. The outreach work done by the Green Bank Observatory (GBO) is intimately linked to, and informed by, the research carried out there. Programs such as the NSF-funded Pulsar Search Collaborator, which gives local high school students research experience, could not occur if the GBO were not an active research institute as well as a major educational center. This would not simply impact high school and undergraduate education. We are fortunate at Arecibo Observatory to employ, in the radio astronomy group that I lead, a scientist from West Virginia who was inspired to his career by the GBO. Had it not been for this, the scientific community would have been robbed of a productive scientist who has been active recently in cutting-edge investigations of fast radio bursts.	Against Closure	Email	11/25/2016	
191	b	Robert	Minchin	Group Lead for Radio Astronomy and REU Program Manager, Arecibo Observatory	It cannot be doubted that if the GBO were to cease to be focussed on science, its impact on education would suffer, affecting not only the inspiration of local students to study science but also the productivity and social diversity of the scientific community. This impact would fall disproportionately on the lower-income population of West Virginia, making this a matter not just of education but of environmental justice.	Against Closure	Email	11/25/2016	
192	a	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). As a graduate student, I spent a significant amount of time in Green Bank at the observatory working on my own research, but also mentoring high school students as part of a program called the Pulsar Search Collaborator (PSC). The PSC is an outreach program that trains high school students to analyze pulsar survey data to make their own discoveries and inspires them to pursue science, technology, engineering, mathematics (STEM) and related career paths. The program started in 2008 and over the first five years, the PSC had involved more than 2,500 high school students and 100 teachers! Now PSC students are trained online, but can still visit the observatory for a week in July. The PSC inspired many high schoolers to come to WVU and get a degree in Physics or Engineering. Because the gender ratio of PSC participants is equal, this also served to improve that of WVU's Physics & Astronomy Department. New pulsars discovered by PSC students have also proved interesting – a wide, double neutron star system, a nearby millisecond pulsar, a rotating radio transient, a disrupted recycled pulsar, a long-period nulling pulsar and several others. Results coming from these discoveries inspire students with the lasting effect their hard work has on the field of astronomy; use of the Green Bank Observatory – the most sensitive, fully steerable telescope in the world, situated in a radio quiet environment – and support from its staff are essential to produce these results.	Against Closure	Email	11/25/2016	jks_nanograv.pdf
192	b	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	I am also one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 15 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves. Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many scientists like myself are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at University of Wisconsin–Milwaukee, and at scientific institutions across the United States.	Against Closure	Email	11/25/2016	jks_nanograv.pdf
192	c	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	Here are the impacts of each proposed scenario, as I see it: No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.	Alternatives Consideration	Email	11/25/2016	jks_nanograv.pdf
192	d	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.	Alternatives Consideration	Email	11/25/2016	jks_nanograv.pdf
192	e	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers; they would incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.	Alternatives Consideration	Email	11/25/2016	jks_nanograv.pdf

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192	f	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	<p>In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher tech areas of the country. The people of Pocahontas County are proud of the observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO.</p> <p>As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.</p>	Against Closure	Email	11/25/2016	jks_nanograv.pdf
193	a	Lee and Diane	Gage		<p>We are writing to support the Green Bank Observatory and the No-Action Alternative. The National Science Foundation should continue to vigorously support the GBO and science in our society.</p> <p>We only visited Green Bank for the first time in the last year, but it had such an impact on us that we felt compelled to show our support when we heard that NSF was considering decreasing its funding for the observatory. Our visit taught us more about astronomy, and radio astronomy in particular, than we had ever learned before.</p>	Against Closure	Email	11/25/2016	
193	b	Lee and Diane	Gage		<p>It gave us a greater appreciation for the ways that science and technology can impact us, and even more importantly how it can impact rural parts of our country, like West Virginia, that are struggling and need our help.</p> <p>The NSF should work for the common good and should be investing in our communities, especially those communities that are most in need. This is especially important in our country today, because we can all appreciate the wonders of the universe that the Green Bank Observatory uncovers.</p> <p>Places like the Green Bank Observatory unite us, and what greater mission can there be?</p>	Against Closure	Email	11/25/2016	
193	c	Lee and Diane	Gage		<p>It also educates us about science and improves science literacy, which are even more important in our society today.</p> <p>For all these reasons we believe that NSF should continue to fully support science at the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
194	a	Richard	Prestage	Scientist, GBO	<p>I am a Staff Scientist working at the Green Bank Observatory (GBO). I am writing to you to vigorously urge that the National Science Foundation select the No-Action Alternative (continued NSF investment for science-focused operations) for the future of GBO. There are a host of reasons why this is by far the best alternative for the NSF, and the US and world astronomy communities, and many of those have been made by others more eloquent than I. So as well as supporting those arguments, I would like to emphasize here just two explicit areas where the GBO is currently a world leader, but where these capabilities would be lost were an alternative option chosen: large antenna metrology and control, and radio astronomy instrumentation development. Large antenna metrology and control: When the GBT was delivered to NRAO in 2000, as required in the specification it was only capable of working at frequencies up to 10 GHz (wavelengths longer than 3cm). Since then, due to the talent, effort and dedication of NRAO – and primarily GBO – staff, the antenna performance has been extended up to 115 GHz (wavelengths as short as 2.7mm). ...This last technique has been implemented for routine, real-time operation, allowing us to measure and remove in real time large-scale thermal deformations in the antenna, a capability not available at any other radio telescope. These capabilities have been documented in published, refereed papers in the astronomical and antenna engineering literature, as well as numerous presentations at major conferences organized by URSI, IEEE and SPIE.1 As a result of our capabilities, GBO staff have been asked to consult with many other large telescope projects, including the 100m Effelsberg Telescope in Germany, the 50m US/Mexican Large Millimeter Telescope (LMT), the 64m Sardinian Radio Telescope (SRT), and the Chinese 500m Spherical Aperture Telescope (FAST), 65m Tian-Ma Telescope and planned 110m Qitai Telescope (QTT). The techniques developed at GBO, and elsewhere, coupled with computing advances in the areas of finite element modeling, computational fluid dynamics and multi-sensor fusion, are allowing a new round of major gains to be made in antenna performance. Perhaps more importantly, the increased precision requirements of radio antennas, and the increased size of optical “extremely large” telescopes (ELTs), means that the radio and optical techniques for telescope metrology and control now have considerable overlap. In recognition of this, I organized and chaired an international workshop “Metrology and Control of Large Telescopes”2 held just this September in Green Bank. The workshop boasted over fifty attendees, from essentially every large radio telescope, as well as US and European ELT projects, and the US and ESA Deep Space Network (DSN) antenna operations groups. The outcomes of the workshop included the recognition that the GBO is indeed a world leader in this field, and that both the US and European DSN groups are now actively researching use of some of the techniques we have developed. Large radio antenna construction began in the US in Green Bank, over fifty years ago. Many critical innovations, including for example the key concept of homology3, now used in every scientific and commercial antenna of any size, were developed here. We have developed skills and expertise which are unique in the world, which would benefit all future large radio and optical telescopes, and we have a proven track record of sharing this expertise with the community. Should any option other than the No-Action Alternative be chosen, this expertise will be lost. Once lost, it will never be recovered.... The GBT boasts state of the art single-pixel heterodyne receivers, which lead the world in performance, at all frequencies from 300 MHz to 115 GHz. The GBT is equipped with frontends including multi-pixel feed-horn arrays, a phased array feed, a multi-pixel bolometer array, and continuum, spectral line, pulsar, VLBI, radar and SETI backends. The newest GBT backend, VEGAS, is built upon a state of the art heterogeneous computing platform, and is capable of processing 10 GHz of instantaneous bandwidth, with dual-polarization inputs. ...Again, if any option other than the No-Action Alternative is chosen, these capabilities will be lost to the US astronomy community. While these skills can be mastered working with the GBT, they will be vital for the construction of the next generation of telescopes, such as the ngVLA. Given the major decline of the University Radio Observatories, without facilities such as the GBO, the US will lose the next generation of instrument developers, and thus will cede leadership in this field to other countries. I urge you to weigh these arguments along with the many other cogent reasons why the No-Action Alternative should be selected. Please do not hesitate to contact me if you would like further information.</p>	Against Closure	Email	11/25/2016	Richard_Prestage_GBO_EIS_Comments.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
194	b	Richard	Prestage	Scientist, GBO	Numerous Astronomy and Engineering undergraduates, graduate students and post-docs have been intimately involved in the development and construction of these instruments, and as such, they provide an outstanding example of the broader impact of the GBO. In addition, while they are pushing technology development at their home institutions, collaboration with GBO has taught these students innumerable skills in the areas of software development, quality control, and the construction of common-user instrumentation required to reliably operate in a production environment. Perhaps most importantly, the GBT is one of the last US telescopes available where students and other young researchers can, themselves, install their instrument on a telescope, and be directly responsible for the characterization and commissioning of that instrument.	Against Closure	Email	11/25/2016	Richard_Prestage_GBO_EIS_Comments.pdf
195	a	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I urge the NSF to choose the no-action alternative for this excellent research, education, and outreach facility. I am a NANOGrav Physics Frontiers Center postdoctoral fellow at Lafayette College, Pennsylvania; my interest in the future of the GBO includes, but also extends beyond, the gravitational-wave science made possible by the GBO. I am very passionate about the education and outreach that is made possible by this observatory, and I am very concerned about the impact that choosing any other alternative would have on (1) the local economy in Green Bank, WV, (2) the scientific environment of the many institutions that use the GBO for research as well as EPO activities, and (3) the future role of the US in leading the world in ground-breaking scientific research.	Against Closure			
195	b	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	As an undergraduate student, an education and research opportunity at the GBO provided my first exposure to radio astronomy. I use the GBO extensively in my research, starting in graduate school and continuing through my current position. As a postdoc, I also use the GBO to educate new STEM students through student research, as well as educating high school students through outreach related to GBO studies of pulsars and neutron stars. I come from a small town in rural Pennsylvania, and consider myself lucky to have discovered that I could have a career in a STEM field despite limited resources in my home town. I was very interested in astronomy, and took advantage of an opportunity to attend the "ERIRA" program at the GBO, and then to begin doing research as a sophomore in college, which together cemented my desire to be an astrophysicist. Without these experiences I may not have continued as a STEM student, simply because I did not feel that I "belonged" until I started doing research—a common experience for students, especially those from underrepresented backgrounds. For this reason, I know first-hand how important it is to provide research opportunities for high school and college students. I also know how important astronomy is for bringing students into STEM fields, whether they ultimately continue to work in astronomy or go on to be employed in other STEM fields. The projects that my collaborators and I work on, using the GBO, are excellent for involving many students from all backgrounds in STEM research, giving them a feeling of belonging and increasing the likelihood that they will continue on with STEM careers. First of all, a lot of outreach, both for the public and for students, is done at the GBO. For example, several years ago I taught at a 10-day-long GBO astronomy summer school for undergraduate students, some of whom are still involved in radio astronomy; and currently, the most influential outreach/education programs in which I am involved are related to large pulsar surveys being done with the GBO. These programs include: Pulsar Search Collaboratory (PSC): This program began as a way to engage West Virginia students from rural high schools in STEM research. The students were given their own data in which to search for pulsars, and found eight pulsars so far (one student was even honored for his discovery by attending a White House Star Party!). The PSC has now grown to include thirteen institutions to date, thus providing opportunities for a larger number of high school students to get involved in astronomy research, as well as for undergraduate students to do outreach—undergraduates go into the high schools to talk about astronomy and recruit students for the program. The PSC requires that 50% of the high school students are female, and has already had a significant effect on the number of women entering STEM majors in college. I am currently working to involve Lafayette College in the PSC. Green Bank North Celestial Cap (GBNCC) pulsar survey: I am a member of the GBNCC pulsar survey, which has found over 140 new pulsars to date and has provided a means for students at various levels of skill and experience to do STEM research. Undergraduate students learn to run observations and to search for pulsars. The more advanced undergraduates are learning how to time pulsars, and are becoming more involved in other aspects of GBNCC as well as NANOGrav. Roughly ten undergraduates learned to time pulsars at UW-Milwaukee last year (through a new program run by Joe Swiggum), and I have started several undergraduates on pulsar timing at Lafayette College (while we have a smaller pool of students, I am working toward a similar timing program as at UW-Milwaukee). Other pulsar searches: I am leading several new pulsar searches, two of which will be done with the GBO, which will be used to teach PSC students to search for pulsars and undergraduate students to both search for and time pulsars. Several new student projects, beyond searching and timing, are expected to come out of these search programs. One of the projects is a targeted search for millisecond pulsars, which is directly related to NANOGrav's science goal of gravitational wave detection. Without continued support for astronomy with the GBO, these opportunities for introductory-level student research—so important for bringing underrepresented students into STEM fields—will be lost.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	c	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	I believe that this aspect of NANOGrav is of crucial importance for our field, and it is one of the biggest reasons that I personally feel it will be a real loss if NANOGrav can no longer do its science with the GBO—if that happens, we will be working full-time on trying to find other possible telescope resources, and work toward inclusive practices that has begun in the collaboration will almost certainly be pushed aside. Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists, like myself, are just beginning their STEM careers. In addition, education and outreach programs like those I mentioned above will take away opportunities for many high school and college-age students to participate in professional-level STEM research which has been so successful in encouraging students from underrepresented backgrounds to enter STEM majors in college. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County; at my former institution, the University of Wisconsin- Milwaukee; at my current institution, Lafayette College; and at scientific institutions across the United States. I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by these gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. The GBO is also a crucial facility for finding new millisecond pulsars, which is absolutely necessary if we are to make a gravitational wave detection in the next few years. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
195	d	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	A very important aspect of NANOGrav is that it has become active in combating abuses of power, especially sexual harassment, within our collaboration, which is slowly starting to influence the larger pulsar community and will eventually influence the even larger astronomy community. The pulsar community has had real problems in this area in the past, with many young women having been sexually harassed. In recent years, NANOGrav senior personnel contacted the people who were known to behave in this way and told them in no uncertain terms that this needed to stop. Since then, I have not experienced any further harassment, nor have any of the other women with whom I've spoken. NANOGrav developed an anti-harassment policy and elected several member advocates, to whom any of us can talk if we experience or witness an abuse of power of any kind. One or more serious cases are being investigated, initially through the collaboration's member advocates, and now formally through individual universities' Title IX offices. We also hold 1-1.5 hour long seminars about these issues at every NANOGrav collaboration meeting, which has allowed collaboration members to have meaningful conversations about these issues.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	e	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	Here are the impacts of each proposed scenario, as I see it: No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.	Alternatives Consideration	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	f	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.	Alternatives Consideration	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	g	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade. In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to high-tech areas of the country. The people of Pocahontas County are proud of the observatory.	Alternatives Consideration	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	h	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
196	a	Greg	Black		I'm writing in strong support of option 1, the "No-Action" option, in the EIS for the Green Bank Observatory. The GBO continues to produce cutting edge, important scientific results, which I'm sure others have already described in better detail than I could. The recent and continued investment by non-government groups in new receivers and equipment for the instruments is evidence for its relevance and importance to current science, and the expectation of contributions for future advancements. Reducing or removing a start-of-the-art astronomical facility like the GBO with the unique sensitivity, spectral, and sky coverage capabilities of its instruments from the US scientific portfolio would have a lasting negative impact on US as well as global science, and reduce the potential that could be achieved from the significant investment that has already been made there. If history is any guide, with less than two decades of operation of the GBT so far, important research and achievements are still to come from the GBT. As scientific understanding progresses, the studies performed at the GBT in the future may very likely include advances and discoveries in areas that aren't even anticipated at this point in time. In addition, many other existing and likely future observing facilities are designed with the intent to operate cooperatively with other facilities, such as the GBT, and the importance of any single facility cannot be considered in isolation.	Against Closure	Email	11/25/2016	
196	b	Greg	Black		For context, I have been a past user of the facility and the GBT in particular, and spent time on-site as a post-doc. While I've moved into a different area of work since then, I keep aware of progress in the field and as a resident of WV I'm also aware of the important and pro-active STEM role that the GBO fills in the state and region. Thank you for the thoughtful consideration of this issue and working to maintain a strong US astronomical program.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
197		Lawrence	Rudnick	Distinguished Teaching Professor Minnesota Institute for Astrophysics School of Physics and Astronomy University of Minnesota	<p>I am writing in strong support of the "No Action Alternative" for the Green Bank Observatory, allowing it to remain as a premier resource for scientific discovery through internationally competitive research proposals. Since the bulk of my own scientific career is behind me (having first observed at Green Bank in 1973), my support is not self-serving but in the interests of seeing the fantastic discoveries that have been made at the Observatory continue into the future.</p> <p>I just finished service as the Chair of the Time Allocation Committee that provides advice to the Director of the GBO as to which proposals are the most meritorious. As an outside panel, we contribute our best unbiased judgements based on the forefront scientific questions. The choices we make are hard ones, with lots of exciting science left on the cutting room floor because of competition for precious telescope time.</p> <p>With the decreasing time available for "open skies" observing, we are losing important opportunities to answer science questions that keep us all up at night. We are also losing critical opportunities for training future generations of skilled observers who will go on both in astronomy but into a wide range of technical professions where their problem-solving skills will benefit all of society.</p> <p>You have received extensive documentation on the unique capabilities of the GBO that will be very hard, if not impossible to recover in the foreseeable future worldwide. From the standpoint of leveraging the enormous investments already made in high-end electronics, trained personnel at the observatory and around the country and world, and even the steel, it makes enormous sense to me that the NSF should preserve this unique resource for open-skies observing.</p> <p>I don't know how many more projects I personally can do at the GBO, but I'm looking to the future, and hoping that the students that we have trained over the decades will continue to be able to make inspiring discoveries and technical achievements that will benefit us all.</p>	Against Closure	Email	11/25/2016	
198		Darren	Honaker	Scout Master Stonewall Jackson Area Council Southern District Boy Scout Troop 2	<p>Boy Scout Troop 2 of Clifton Forge, Virginia visited the Green Bank Observatory in September 2016. The Boy Scouts of Troop 2 earned the Astronomy Merit Badge which was taught by the Green Bank Observatory. The mission of the Boy Scouts of America is to prepare young people to make ethical and moral choices over their lifetimes by instilling in them the values of the Scout Oath and Law. In addition to instilling good character qualities of our nation's youth, the Boy Scouts strive to promote our scouts to STEM (Science, Technology, Engineering and Mathematics) activities to encourage our youth to follow careers in STEM.</p> <p>The Green Bank Observatory provides our youth with a unique opportunity to study astronomy. The adult leaders of Boy Scout Troop 2 could not have given the scouts of Troop 2 the opportunity to earn the Astronomy Merit Badge without the help of the Green Bank Observatory. I can report to the National Science Foundation that after our trip to the Green Bank Observatory, the scouts of Troop 2 can identify constellations. The scouts understand the purpose of a star wheel which aids identifying constellations as the night sky changes. No member of Troop 2 could identify a constellation prior to visiting Green Bank Observatory.</p> <p>During a Troop 2 campout after our visit to GBO, Scouts that completed the Astronomy Merit Badge from GBO instruction taught other scouts astronomy including identifying constellations and the Milky Way. Green Bank Observatory is a treasure. I sincerely hope the National Science Foundation will continue to support the Green Bank Observatory such that GBO can support the Boy Scouts and Girl Scouts of America.</p> <p>If you have any questions or concerns. You can contact me by e-mail at Darren.Honaker@ieee.org.</p>	Against Closure	Email	11/25/2016	Troop 2 - Green Bank Observatory.pdf
199	a	John	Nobile		<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email	11/25/2016	
199	b	John	Nobile		<p>Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.</p>	Against Closure	Email	11/25/2016	
199	c	John	Nobile		<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
200		Debra	Nieuwenhuis	Water's Edge Scientific LLC	I am writing this letter in support of continued NSF investment in the Green Bank Observatory and Science Center (GBT). As amateur astronomers and 4-H leaders, my husband and I have directly benefitted from the GBT both through in-person visits and remotely through its affiliation with the Skynet Junior Scholars program. Our 4-H club, like many others, promotes participation in STEM programs for youth. Thanks to the Internet, facilities such as the GBT provide our youth with opportunities to learn radio astronomy remotely. This enables the educational reach of GBT to stretch far beyond the borders of West Virginia. As part of our interest and involvement in the 4-H astronomy program, we have personally traveled from Wisconsin to WV to visit the GBT. The facilities for research and education at the site are unique and provide a great background for radio astronomy. The GBT provides a unique opportunity for professionals and students alike to participate in educational programming and research. Please continue to provide funding for this valuable facility.	Against Closure	Email	11/25/2016	
201	a	Richard	Fleming		<p>Hello, this is Richard Fleming. I live in Chelsea, Alabama. I have been following the happenings at NRAO in Green Bank since I retired from NRAO in October 1998. I recently was reading about the Green Bank Observatory public comment period concerning future operations and funding by NSF, among others</p> <p>I offer the following facts and observations concerning the meaningful impact and contributions NSF/AUI/NRAO has had on Pocahontas County and the people there. These observations easily extend to the State of West Virginia, the USA and scores of foreign countries.</p> <p>I am an electrical engineer and project manager. After graduating from college I spent some time as a naval officer on active duty, an engineer for a NASA contractor in the space race and joined NRAO in Green Bank, WV as a radio astronomy electronics engineer.</p> <p>After about 6 years as an engineer I became the Business Manager in Green Bank. I served as the business manager for about 23 years before retiring in 1998. I returned to Alabama to join my two grown children and a handful of grand kids.</p> <p>So, how does this background fit into the importance of the Green Bank Observatory? I was there for 28 years and personally saw the observatory and the county grow. The observatory employed more than 100 people.</p> <p>Since the observatory is situated in a rural setting the employees at the observatory come from local people and technical/professional people from many other areas. The observatory was very careful in selecting professional staff by a two part interview procedure. We found that this yields a well-informed future employee who is very likely to stay at the observatory and contribute to the science effort and serve the community.</p> <p>I was one of the many I know that stayed for a long time. My wife and I raised two very happy and smart children who finished college with advanced degrees and have been married to the same persons for over 25 years. I am proud of this and contribute a lot of this to living in a great environment such as NRAO/Green Bank.</p> <p>During my time at NRAO I participated in Cub Scouts, Boy Scouts, youth soccer, school committees, volunteer fireman and EMT and more. My wife was a Girl Scout leader and taught school for many years. We benefited from these community organizations and the community was better for it as well.</p> <p>During the growth period at the observatory a private medical clinic and dental clinic was established in the community and is operating today. There are now two service stations, a general store, a branch bank and a Dollar Store.</p> <p>I have seen the benefits to the community and the operation of the observatory as they worked and grew together. The NSF can be justly proud of this relationship between advancing science with community support.</p> <p>Thank you for reading my comments.</p>	Against Closure	Email	11/25/2016	
201	b	Richard	Fleming		Other documents are available listing the scientific importance of the telescopes in Green Bank as well as the tens of thousands of visitors from all over the USA and many foreign countries. The impact to science education alone is humongous. The Green Bank Observatory is very famous and well known. The impact to the community and county is huge and there are no negatives to the arrangement. This national science center is world known and extremely important to the community and employees.	Against Closure	Email	11/25/2016	
202	a	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I am a high-energy astrophysicist at the University of Maryland in College Park, Maryland. I regularly utilize the GBO's unique capabilities to search for low-frequency electromagnetic counterparts to gamma-ray sources of unknown origin. There is no other observatory with sufficient sky coverage, frequency coverage, and scheduling flexibility in the northern hemisphere that could replace the GBO in my observing portfolio.</p> <p>I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. Together, we are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes – a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars – precise astrophysical clocks – to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.</p>	Against Closure	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
202	b	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at University of Maryland, and at scientific institutions across the United States.	Against Closure	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
202	c	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>Here are the impacts of each proposed scenario, as I see it:</p> <p>No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBO would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.</p> <p>Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful science conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.</p>	Alternatives Consideration	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
202	d	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.</p> <p>In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher-tech areas of the country. The people of Pocahontas County are proud of the observatory.</p>	Alternatives Consideration	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
202	e	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO.</p> <p>As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.</p>	Against Closure	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
203		Marg	Friesen		<p>I am responding regarding possible actions for the Green Bank Observatory.</p> <p>I support the first listed option: Continued NSF investment for science-focused operations (No-Action Alternative). This facility provides unique, invaluable scientific information and merits the ongoing support of the National Science Foundation.</p>	Against Closure	Email	11/25/2016	
204	a	James	Cordes	Professor of Astronomy Cornell University	<p>I am an astrophysicist who relies on the Green Bank Observatory (GBO) for research on neutron stars, gravitational waves, and fundamental physics. More important are the collaborations I am involved with that involve scientists across the U.S., Canada, and Europe (including the U.K.). Members of these range from undergraduates getting their first taste of research, Ph.D. students, post-doctoral researchers, faculty at universities, and researchers at institutes such as the Jet Propulsion Laboratory.</p> <p>The research enabled by the GBO includes high-visibility, long-term efforts in gravitational wave detection in the nanohertz band. A discovery in this band would parallel this year's Nobel-worthy discovery of black-hole mergers with the Laser Interferometer Gravitational-Wave Observatory and is as necessary for an understanding of the universe as radio waves complement visual observations for electromagnetic astronomy. The nanohertz band requires sustained monitoring of 50 to 100 millisecond pulsars with samples obtained at least once a month for more than ten years. Loss of the GBO would be a major blow to the NANOGrav project (North American Nanohertz Observatory for Gravitational Waves) and its leading role in the worldwide effort to detect nanohertz gravitational waves. It would jeopardize the fulfillment of the large investment already made in telescope time for this project and diminish the status of U.S. astronomy in this area.</p> <p>The greatest benefit to the nation is the first option listed on the NOI web page: Continued NSF investment for science-focused operations (No-Action Alternative) with the clarification that "Continued NSF investment" includes increases in investment in new instrumentation that exploits the unique aspects of the telescope.</p> <p>Current political discussions across the U.S. are placing high value on infrastructure investment in order that the U.S. economy be optimized through modern bridges, railroads, and airports; it must also include science infrastructure. Science is the basis for better lives for all and basic research is the foundation for new technology. The premise of the Proposed Changes to Green Bank Observatory operations is diametrically opposed to this. Infrastructure investment is for the benefit of future citizens and those who choose to be scientists. Indeed entirely new telescopes are needed that the proposed divestment is allegedly going to enable; but the divestment process may very well destroy facilities that someday soon we would want to have again, not the very least because we see our foreign competition doing so. The current situation emanates from a problem in the budget of a division of a federal agency. Solving this should not be at odds with what is best for the nation.</p>	Against Closure	Email	11/25/2016	GBO_JMC2016Nov.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
204	b	James	Cordes	Professor of Astronomy Cornell University	<p>Another new area is that of enigmatic radio bursts, lasting only a millisecond or so, that originate from outside our galaxy but are not understood. They may be caused by entirely new physical processes or by known kinds of objects that exist in unusual astrophysical circumstances. Either way, the bursts themselves are unique probes of the intergalactic medium and their host galaxies. They were barely known at the time of the 2012 Porfolio Review. The GBO has been central to studies of these bursts and, if anything, should be enhanced with new instrumentation in order to fully exploit this area of exploration and discovery.</p> <p>A third broad area where the GBO is important is in fundamental physics, including the most powerful tests of General Relativity through monitoring of a double-pulsar binary system and through precise determinations of the masses of neutron stars, which constrain the properties of nuclear matter in ways that are completely inaccessible to terrestrial laboratories. The Porfolio Review (as summarized in the Supplementary Information for the NOI) stated about the Green Bank Telescope: "...its capabilities are not as critical to New World New Horizons [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." This statement does not reflect the current scientific situation and is not consistent with any complete reading of NWNH, which placed high value on gravitational wave astronomy and astrophysics as well as on studies of the time-domain. The GBO is central to both of these.</p>	Against Closure	Email	11/25/2016	GBO_JMC2016Nov.pdf
205		Sumitra	Joy		<p>Please accept my public submission regarding the Green Bank observatory.</p> <p>Please choose: 1) Continued NSF investment for science-focused ops (no-action alternative).</p> <p>Green Bank is too important to limit, mothball or close.</p>	Against Closure	Email	11/25/2016	
206	a	Viraj	Pandya		<p>I am writing to express my support for continued funding of the Green Bank Observatory (GBO) by the NSF. I had the privilege of visiting the GBO during the spring of 2013 as part of a class field trip led by Prof. Andrew Baker at Rutgers University. That was during a time when I had no idea that astronomy was even a viable career path for me (I got my B.A. in mathematics and economics, not physics or astronomy). More than three years later, I now find myself as a graduate student in the Department of Astronomy & Astrophysics at UC Santa Cruz, where I have the honor of being a Regents Fellow, Osterbrock Fellow, and NSF Graduate Research Fellow.</p> <p>My non-traditional journey toward graduate school was not an easy one, and the trip that I took to GBO with Prof. Andrew Baker's class helped me understand that I might actually one day be able to become a professional astronomer. In fact, as one of the first two post-baccalaureate students in astronomy at Princeton University, it was my experience with radio astronomy at the GBO and in Prof. Andrew Baker's class that compelled me to become Principal Investigator of two observing programs with the Jansky Very Large Array (16A-382 and 16B-315). In the future, I hope to use GBO facilities for my own research and outreach, and I therefore do not want to see the GBO be shut down or be turned into a museum.</p>	Against Closure	Email	11/25/2016	
206	b	Viraj	Pandya		<p>Of the five different options that you are considering for future NSF funding, I support options (1) and (2): the so-called "No-Action Alternative" and "Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope." Both of these options would allow professional astronomers to continue to use GBO facilities (and the Green Bank Telescope in particular) for their research. Continued NSF support would also allow non-traditional students, perhaps those like me who are still confused about whether astronomy is even a viable career path for them, to visit the GBO and gain some hands-on beyond-the-classroom observing experience.</p> <p>As someone who has a degree in economics, I understand that the NSF must carry out cost-benefit analyses to split their limited resources among different research and outreach facilities. However, as a person who also has a background in scientific outreach and research, I think it would send a sad message to the astronomical community, and the world of science more broadly considered, if an institution as iconic and venerable as the GBO had to be shut down or be turned into a museum.</p>	Alternatives Consideration	Email	11/25/2016	
207		Jolie	Jones		<p>Please accept my public submission regarding the Green Bank observatory.</p> <p>Please choose: 1) Continued NSF investment for science-focused ops (no-action alternative).</p> <p>Green Bank is too important to limit, mothball or close.</p>	Against Closure	Email	11/25/2016	
208	a	Jaime	Pineda		<p>I need to express my strong support for your committee to choose "Continued NSF investment for science-focused operations (No-Action Alternative)" in your deliberations. This is the only option that would ensure the next generation of American astronomers to be adequately trained in important science and technical skills. I have been a user of the GBT since my years as a PhD student. It is thanks to the observational training obtained at the GBT that I gained enough expertise to get my first big breakthrough: The direct observation of the transition between subsonic and supersonic turbulence (Pineda et al. 2010, http://adsabs.harvard.edu/abs/2010ApJ...712L.116P). Without the visits, observation preparations, and discussion with the GBT staff I would not be the scientist I am Today. Moreover, the new instrumentation available (KFPA and VEGAS) has allowed us to carry out the first part of the "GAS" Survey (Green Bank Ammonia Survey, for which I am one of the co-PI), which has shown how stars are formed in the pockets of subsonic turbulence inside filamentary networks. The first round of papers are about to be submitted to the journals. The Green Bank telescope data are crucial to our ability to study the physics regulating star formation. Although I have access to Effelsberg, it is impossible to carry out the same science than the GBT, because the mapping speed of the GBT is more than 10x faster than Effelsberg and at higher angular resolution, showing the great importance of GBT in star formation in particular. Please support the open sky science with the GBT, and vote "No Action."</p>	Against Closure	Email	11/25/2016	Jaime_E_Pineda_GBT_Letter.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
208	b	Jaime	Pineda		Every time I have visited Green Bank, I have always been greatly impressed by the fantastic relation between NRAO and the local community, and by the committed effort to support and train students.	Against Closure	Email	11/25/2016	Jaime_E_Pineda_GBT_Letter.pdf
209	a	Danielle	Holstine		<p>I am writing in regards to the proposed scope changes to the National Science Foundation's continued funding of the Green Bank Observatory. I understand there are five proposed options: two that continue funding and operating the GBO through the NSF or partnerships and three that close it down in varying degrees of severity. In short, I find it appalling to consider any of those latter three options. The impact of closing the GBO is catastrophic on a global scale and that impact is something I will expand upon below.</p> <p>Let's first consider the local impact. I grew up in Pocahontas County and, for most of my life, lived within steps of the Observatory. From a social standpoint, the Observatory provided a resource for us, as children, that is rare to come by in this day and age: a simultaneously safe and educational place to spend our time. I would spend hours with my sisters and friends riding our bicycles down past the telescopes, stopping to watch as one would shift to its next point of observation. We spent just as much time in the old Tour Center, what has now become a world-class Science Center and visitor's complex, learning about radio astronomy and what our families did while there.</p> <p>The Observatory also provides resources to the community such as facilities to hold Red Cross swimming lessons. I took those lessons when I was young and then became a Red Cross swimming instructor once I got older, passing on the knowledge I had learned and teaching the next generation how to swim. Pools are few and far between in Pocahontas County, but local swimming holes are common. It's vital that kids learn how to swim in a safe and controlled environment before venturing into a creek or river with friends. Without the Observatory opening its doors to the community to provide the proper facilities for those lessons, access to Red Cross instruction would be completely gone for many.</p> <p>Expanding our impact bubble from the very local to a broader state-wide (or beyond) perspective, the Observatory provides educational benefits for people throughout the state of West Virginia and beyond. As a host of the Governor's School for Math and Science, as well as the host of events like star parties and festivals throughout the year, the Observatory touches the lives of students and adults from all around. Visitors are welcomed and taught the ropes of astronomy. Local teens are given opportunities to work at these events or in seasonal roles throughout the Observatory. Combine all those visitors with all the visiting astronomers mentioned above and the Observatory has a significant economical impact to the local community as well. Add the benefit of employing local high-school students and that economic impact grows.</p>	Against Closure	Email	11/25/2016	
209	b	Danielle	Holstine		<p>As I got older, the educational impact that the Observatory had on me shaped who I am today. As students, we were invited to use the 40' telescope to observe gases in space and I was able to connect the dots between textbook knowledge and practical application of scientific concepts like the Doppler effect. In high school, I spent 40 hours doing "on the job" training at the Observatory, where I wrote a computer program for the very first time. It was because of that mentorship that I decided to major in Computer Science when I went to college. That's right, the Observatory encouraged a woman to enter a STEM field, something that is desperately lacking today. But that reaches beyond the local impact, so we will return to that point shortly.</p> <p>Beyond the hard-skills of education, though, the Observatory offered an opportunity to build soft-skills that I find to be incredibly unique, especially here within the United States, in that it drew astronomers from all around the world. Growing up there, I had exposure to people not only from different places within the United States, but people from different countries all around the world! I was introduced to different cultures and learned the importance of sharing in those cultures. This paid off in spades when I attended a graduate program whose population was less than 50% American. I was already comfortable with being open around people whose backgrounds were different from my own and again, in a day and age where we are quick to speak and slow to listen, those skills could not be more valuable.</p>	Against Closure	Email	11/25/2016	
209	c	Danielle	Holstine		Let's expand our lens even further. As I mentioned above, I decided to major in computer science solely because I had spent a week programming a simulation for the Green Bank Telescope in high school. I was the only female student in the Computer Science department at my college. However, I spent a summer internship during college at the Observatory writing a program for collecting and displaying Radio Frequency Interference and both of my bosses at the Observatory, programmers themselves, were women. The director of the GBO is a woman. It's huge to have successful role models of women in science and engineering and the Observatory is a beacon for women who are interested in any STEM field. To shut it down would be yet another slap in the face for any woman in this country considering these fields of study.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
209	d	Danielle	Holstine		<p>Today, all we hear about is how the United States is falling behind in STEM fields. That we aren't training enough people and have a shortage of solid American engineers, which is especially crucial in the Defense industry where American citizens are necessary to help ensure the safety of our country. The Observatory provides a place to train those people. It provides a place of employment for those people. I find it absolutely absurd that we would shut down a scientific research facility of such importance located on American soil in favor of funding facilities outside our own country. In a day when it is so hard to find and train Americans in STEM, shutting down access to a scientific facility like the Observatory sounds unjustifiable.</p> <p>Expanding to the global scale, now, I've already touched shortly on the visitors that come to the Observatory, but the tourists from other countries are only part of the story. The Observatory provides a vital scientific resource for researchers around the world. The first signal from Cassini as it flew past Titan was received by the Green Bank Telescope and relayed to NASA. NASA! SETI continues to make use of the Observatory's instruments. Russian Universities make use of the telescopes to expand humankind's knowledge of the sun. That's right - this research isn't just about a single person, a single entity, a single country. It's about humanity. The more we understand space, the more we will understand ourselves.</p> <p>Closing the Green Bank Observatory, mothballing a precise scientific instrument like the Green Bank Telescope, will mean closing the doors on humanity's understanding of our radio universe. I have provided but a brief glimpse into the impact that the Green Bank Observatory has had on my life. There's so much more to be said, but I have highlighted a few points that I feel demonstrate the necessity of the GBO locally and beyond. And so I will repeat, the impact of closing the GBO is catastrophic on a global scale and that's a catastrophe we can ill afford.</p>	Against Closure	Email	11/25/2016	
210	a	Aaron	Evans	Professor, University of Virginia Astronomer, National Radio Astronomy Observatory	<p>this email is in response to the Notice of intent to prepare an Environmental Impact Statement (81 FR 72124) for the Green Bank Observatory (GBO). I support the "no action" option - the 100m Robert C. Byrd Green Bank Telescope (GBT) is a unique facility, and it provides opportunities for education and hands-on training in radio astronomy - an area of astronomy that NSF has invested in in terms of international projects, but which has seen the closure of multiple facilities within the U.S. in recent years.</p> <p>The size and "steerability" of the GBT make it a unique and powerful instrument. Further, it complements radio interferometers which, by definition, lack information at zero spacing. My colleagues and students have submitted emails in response to 81 FR 72124 focussing on specific science, so the main point I want to stress here is that there are a number of astrophysical phenomena which can be explored over the wavelength range covered by the GBT. More importantly, due to the optically thin nature of radio wavelengths, certain astronomical objects can only be studied using radio diagnostics.</p> <p>The GBO is also a unique in terms of its strength in EPO. Much time and effort have gone into making the GBO visitor center top-notch, and the amazing engineering accomplishment which is the GBT itself is breath-taking to visitors. I can remember the first time I drove out to Green Bank to see the telescope - the telescope is so large that when you first see it on your drive, you have the sense that you are much closer to the telescope than you actually are. Then when you arrive at the telescope, you are in awe of its actual size. I point this out by way of stressing the important role astronomy plays as a gateway to STEM - everyone is, to varying degrees, fascinated with astronomy. The GBT will have a lasting impression on anyone who visits the site. Indeed, I have seen many telescopes as a professional astronomer, and even I was taken aback - and inspired - by the GBT.</p> <p>It is also worth stressing that the GBO has been a regular part of astronomy REU programs at the University of Virginia and NRAO. In particular, visiting the GBO and observing with the GBT has been an important component of our summer programs which have strong participation from undergraduates enrolled in Historically Black Colleges and Universities.</p>	Against Closure	Email	11/25/2016	
210	b	Aaron	Evans	Professor, University of Virginia Astronomer, National Radio Astronomy Observatory	<p>The U.S. is reaching a crisis point in terms of educating the next generation of professional astronomers. The construction and operation of ALMA by NSF and its international partner organizations has provided a major step forward in radio/submillimeter astronomy - this international collaboration was essential to building a ground-breaking facility no single country could afford to build and operate. However, a casualty in this endeavor has been the falling number of radio facilities where students are able to conduct observations on-site and learn to problem-shoot technical issues that may arise. Further, radio telescopes like the GBT provide a platform on which new instrumentation or techniques developed by a small group of people (perhaps a professor and a student) can be tested. The U.S. is ultimately in danger of having no radio/(sub)millimeter facilities in North America where students can be educated. The decommissioning of CSO and CARMA have been major blows to the education of tomorrow's professional radio astronomers. The community cannot afford to lose the GBO as well.</p> <p>The NSF really needs to consider how it will support the growth of radio and submillimeter astronomy in the U.S.. It is not enough to pay for the construction and continuing operation of international facilities such as ALMA - NSF needs to provide the U.S. the means of inspiring the K-12 students through phenomenal technical and scientific instruments such as the GBT, and the tools necessary for college and graduate students to receive hands-on training. If these two issues are neglected, then the most likely future is that the U.S. will continue to fall behind in radio astronomy, and the next generation radio telescopes will serve as scientific tools primarily for astronomers residing in partner countries.</p>	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
211	a	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	<p>Email: I am writing in response to the call for comments in support of the Green Bank Observatory. In the attached documents (a Word Document and a PDF), I express my thoughts on this matter focusing on the influence the Green Bank Observatory and its staff have had on my personal career as an observational astrophysicist. I apologize that this letter has arrived late on the day of the deadline and hope that it is not too late to be included for consideration. I read for the first time in a reminder this morning (on the West Coast) that there may have been a time cutoff for comments of 4pm on the East Coast and did not have sufficient time to accommodate this deadline. If I am too late, then I hope this letter could be used in other ways to promote the extraordinary work at the facility. Please do not hesitate to contact me if you have questions or there is a problem with the submission.</p> <p>Letter: I am writing to express my support for the continued operation and full funding of the Green Bank Observatory as a science and education focused operation in Green Bank, West Virginia. In this letter, I will use my own experiences as an example to demonstrate the impact this facility has had on my career as an observational astrophysicist. Having grown up in a rural, socio-economically depressed area of South-Central Virginia, it is unlikely that I would have been prepared to pursue this career had it not been for the astronomers at the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
211	b	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	<p>One month ago, I accepted the Robert J. Trumpler award from the Astronomical Society of the Pacific for a dissertation 'unusually important' to astronomy for my graduate research conducted at the University of Virginia. This is the highest award given in the United States for dissertation research and one of only a handful of awards given to early career researchers. The journey that led to this accomplishment started sixteen years ago with an email blast sent from my high school research methods teacher at the Central Virginia Governor's School for Science and Technology (Lynchburg, Va) to all the astronomers in the Central Virginia region (largely focused on the University of Virginia Astronomy Department and the National Radio Astronomy Observatory headquarters in Charlottesville, Va). That email only received one reply, which came from a Green Bank Observatory staff astronomer. In the months after the email was answered, I pursued my Junior Research Project supervised remotely by this same staff astronomer. The results of that project took me as far as the Intel International Science and Engineering Fair (Intel ISEF), where I my project represented the best high-school student research conducted that year from South-Central Virginia. My research project paled in comparison to some of the first-rate (even publishable) work being conducted by students who had the privilege to grow up in a more technically literate area and these students spent much longer on their projects working in close company with their scientist mentor. Regardless, I remained proud of what my mentor and I had accomplished via short-term remote mentoring and, as had occurred throughout my high school experience when I compared my opportunities to those of students in more urban areas, my eyes were more open to the disadvantages of my K-12 education imposed due to physical location. To even be eligible to attend the Central Virginia Governor's School for Science and Technology, I had to register for school in a different county and I traveled nearly 60 miles one way each day to attend to this specialized school for STEM education for my junior and senior year. Far from despondent in this realization, I was overwhelmingly thankful for the opportunity I had been given by an astronomer being willing to work with me at all.</p>	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
211	c	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	<p>While I did not place at the Intel-ISEF, I came home with something far more valuable; I found amongst those rows of posters a deep love for science and a sense that scientific research was that to which I would devote my life. While I had inklings that science was my passion, this was my first chance to be so fully immersed in research as a potential career. That fall, I wrote my application to the University of Virginia where I would eventually obtain a B.A. in Astronomy-Physics and Mathematics (2007), a M.S. in Astronomy-Physics (2008), and a Ph.D. in Astronomy-Physics (2014). While student loans paid the bulk of my tuition, I worked as a research assistant in astronomy from my first semester in college to pay my living expense, having been hired over older students due to my high school experience. In short, I owe my career to a scientist in Green Bank who affirmatively answered an email to support a high school student. That same astronomer, F. Jay Lockman, asked me to write today to demonstrate my support for the Green Bank Observatory, which I do without hesitation.</p> <p>While our specific charge for submitting comments is to speak to the research capabilities of the Green Bank facilities (which I will do), I would be amiss to not take a moment to express the impact of these facilities on the people who do or will do that research. Green Bank is a unique community. The scientists who choose to live there, deep within the National Radio Quiet Zone (NRQZ), choose to do so because they love their research and they are willing to make a sacrifice of convenience to pursue that love. They are also individuals who are willing to work and inspire young astronomers in rural areas, where access to the facilities necessary to do cutting-edge research (and thereby to learn from cutting-edge researchers) is severely limited due to proximity. The scientists in Green Bank send their children local schools and participate in their local community at a level that I have not seen at other observatories across the globe; these efforts do not stop in Green Bank itself, but rather extend broadly across all of rural West Virginia and Virginia. Indeed, while visiting schools across southern Virginia for science outreach events and in my own personal travel, the Green Bank Observatory is the most recognizable astronomical observatory behind the Hubble Space Telescope. An entire generation of high school students across the rural counties of West Virginia and southern Virginia, including myself, have been given access to the Universe through the educational and outreach programs initiated by motivated scientists in Green Bank. Many of these programs were funded as the broader impacts components that accompany larger scientific endeavors (an example being the Pulsar Search Collaboratory). If the Green Bank Observatory is given completely to commercial or classified pursuits, such programs would most likely decline in concert with the astronomical research activities.</p>	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
211	d	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	As someone who considers herself equally a scientist and an educator, I believe strongly that the most innovative and inspiring outreach programs accompany the most innovative and inspiring research. Moreover, I believe that the greatest impact on the attitudes and motivations of students is made by putting innovative and inspiring physicist-educators as directly into the classroom as is feasible. As a graduate student at the University of Virginia, realizing the impact of a single motivated scientist at Green Bank on my own development, I worked to promote broader access to astronomy in rural communities through the 'Dark Skies, Bright Kids!' program and via founding a continued partnership between University of Virginia graduate students, National Radio Astronomy Observatory astronomers, and high school students at the Central Virginia Governor's School for Science and Technology (my alma mater in Lynchburg, VA). The latter program mimics the event described at the opening of this letter and provides the access and mentoring required for five high school students to complete high-level astronomy research projects each year. The bulk of these projects directly use data from the Green Bank Telescope, most notably the PRIMOS astro-chemistry program that works to understand how molecules crucial to life on Earth form in interstellar environments (where the material that formed our solar system was formed) and the Megamaser Cosmology Program (MCP) that uses the environments around supermassive black holes at the centers of galaxies to measure the expansion rate of the Universe. The mentoring program was directly inspired from my own experiences and I was honored to have been a scientist-educator for the Second Astronomy Night at the White House in 2015 in recognition of my education and outreach activities (one of only two full-time scientists, the other also being a NRAO astronomer). The first high school student I mentored is now a second year graduate student in the Department of Astronomy at the University of Virginia and is a prestigious Jefferson Graduate Fellow. Thus, that email answered in Green Bank sixteen years ago continues to reach rural high school students and encourage their participation in the scientific community.	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
211	e	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	<p>After my high school project, my path in astronomy has largely led me away from radio frequency observations. I did however spend eleven years in Charlottesville, Virginia pursuing my degrees and I can speak directly to the impact of the Green Bank Observatory in the astronomical research undertaken by my mentors and peers. The large, steerable, single-dish facility is unique amongst international facilities; these aspects permit very sensitive observations over the full sky visible from West Virginia in short amounts of time that is not replicated by other multi-dish facilities. In particular, the sensitivity permits time-domain applications, most notably searches for and the timing of millisecond pulsars (e.g., GUPPI) that allow astronomers to probe the extreme physical conditions of matter. The setup of the focal plane permits the development of new technologies, most notably the the MUSTANG instrument that can be considered a hybridization of radio and optical based technologies that permits detailed study of the distribution of matter in the Universe on large galaxy cluster scales (it is effectively a "camera" that uses radio detectors unlike traditional radio-frequency instrumentation that effectively have only 1 pixel). In a society increasingly reliant on consumer technologies that rely on radio-frequency transmission, the existence of the National Radio Quiet Zone (NRQZ) makes Green Bank a unique in its reduced reliance on ex post facto radio frequency interference (RFI) removal techniques. For all of these reasons, the current and future capabilities of the Green Bank Observatory are not matched by other facilities either in the United States or across the globe.</p> <p>As an astronomer that largely relies on optical and near-infrared facilities, the NSF has already divested from numerous small-aperture telescopes previously under the care of the National Optical Astronomy Observatory (NOAO). This divestment includes the bulk of the facilities on which my dissertation work was based. While the loss of these facilities has deep consequences for access to such facilities for institutions without privately funded facilities, many of the specific technical capabilities are feasible elsewhere (though largely on privately funded facilities with dramatically less 'open' application policies). Thus, the loss to the body of knowledge produced by the scientific community is somewhat mitigated by the existence of comparable facilities (i.e., the investigations can happen, just pursued by a different set of scientists). This is simply not the case for the Green Bank Observatory, whose full capabilities are unmatched by any other current facility, private or public. For technical reasons, multi-aperture facilities that boast similar (or even larger) total collecting areas are simply not comparable in sensitivity to the Green Bank telescope owing to how the signals from these distinct telescopes are combined. For many scientific experiments -- including all of those on which I have participated directly with Green Bank observations and those that most strongly inform my own work -- these technical differences are sufficient to make the projects infeasible with any other telescope.</p>	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
212	a	Robert	Strong	<p>Director: Near Earth Object Foundation http://www.neofoundation.org/</p> <p>Director: SMART-Center http://www.smartcenter.org/</p> <p>Curator SMART Centre Market 30 22nd Street Wheeling, WV 26003 http://www.smartcentermarket.com</p>	<p>I am astounded and bewildered that we are even having this conversation. As far as the proposed changes for the Green Bank Observatory Operations I ask that you DO NOT Negatively Change the present Funding.</p> <p>Please choose the 1st action: Continued NSF investment for science-focused operations (No-Action Alternative)</p> <p>The Green Bank Observatory Complex at Green Bank, West Virginia is without a doubt one of the shining jewels in the crown of the National Science Foundation, and there is little doubt that the Green Bank Telescope (world's largest fully steerable radio telescope) is THE largest and shiniest of these jewels.</p> <p>The six-decade long commitment to the Green Bank Observatory by the National Science Foundation towards fundamental, pure, basic scientific research is the hallmark of a civilized country's responsibility to the future of basic science and to citizen scientists and professional scientists domestic and international. This commitment is not just to equipment, instrumentation, staff, and facilities – this commitment should be given to the flagship of NSF astronomical research. The National Science Foundation needs to take the Green Bank Observatory seriously as a permanent funding line item rather than gradually cut it off. Basic science never – ever pays for its way in the world. Everybody knows that – why would the Green Bank Observatory be any different?</p> <p>It is unnecessary to reiterate the scope and scale of importance that the Green Bank Observatory has for the pride of both West Virginia and the rest of the Nation. Please consider beyond what is best for the next fiscal year, or a quick fiscal fix to ease a faceless bureaucratic bean-counter in some nameless office in Washington, DC. Do the right thing and leave the Green Bank Observatory Complex just as you found it. If you must change anything, anything at all – please increase funding to the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
212	b	Robert	Strong	<p>Director: Near Earth Object Foundation http://www.neofoundation.org/</p> <p>Director: SMART-Center http://www.smartcenter.org/</p> <p>Curator SMART Centre Market 30 22nd Street Wheeling, WV 26003 http://www.smartcentermarket.com</p>	<p>This commitment is additionally to a way of life that only comes from living in the shadow of the Green Bank Observatory Complex as a world-class astronomical research facility. It would be difficult to impossible to estimate the inherent scientific and cultural "value" of the Green Bank Radio Quiet Zone that surrounds the Green Bank Observatory facility and the Green Bank community. Equally, it would be difficult to place a dollar value on the value-added nature of having a world-class radio-quiet-zone to do radio astronomy in within driving distance of two-thirds of the population of the United States.</p>	Against Closure	Email	11/25/2016	
213	a	J.T.	Arbogast	FILMMAKER + PERFORMER + DIGITAL STRATEGIST	<p>I am writing to voice my support for the continued NSF investment for science-focused operations in the Green Bank Observatory.</p> <p>While I grew up in Pennsylvania, most of my family still resides in Pocahontas County. My mother and father met at Green Bank High School and, growing up, most of my summers and all holidays were spent back "home" in Cass, WV.</p> <p>I grew up in the 80s at a time when space exploration was hugely popular. Every kid wanted to be an astronaut. And, as a child, I always thought of the observatory as this incredibly special and secret place in my family's backyard with "a telescope the size of a football field". It wasn't until it came up as part of the discussion in my 5th grade science class that I began to realize just how famous it was.</p> <p>I remember so many moments...seeing the flashing light at the top of the scope at night or noticing the position change or taking bike rides with my cousin down to the base of the telescope...each time looking up into the sky and thinking, "I wonder what they're hearing today?" At a time when more and more devices are forcing our children to look downward into a small screen, it's more important than ever to provide opportunities for them to look up...to think beyond the world that they see in front of their eyes.</p> <p>Having had the chance to really get to know the team over there as an adult and hearing about the incredible things that they are doing, meeting some of the visiting scientists from around the world who chose this place to advance their research because of the tools and technology at their fingertips. I think that speaks volumes to the GBO's importance to the global science community.</p> <p>Therefore, it is my opinion that the NSF must continue funding the Green Bank Observatory to allow for the continued groundbreaking research and discoveries by some of the world's greatest minds, for the continued growth and prosperity of a community nestled away in the mountains of West Virginia, and for the continued inspiration of every young person who sees that telescope for the first time and asks the question, "I wonder what they're hearing today?"</p>	Against Closure	Email	11/25/2016	
213	b	J.T.	Arbogast	FILMMAKER + PERFORMER + DIGITAL STRATEGIST	<p>But, it's more than that. The Green Bank Observatory is a vital part of the local community and the impact that closing this facility would have on the region from the loss of jobs, Health and Safety, educational programs, community organizations and development would be devastating.</p>	Against Closure	Email	11/25/2016	
213	c	J.T.	Arbogast	FILMMAKER + PERFORMER + DIGITAL STRATEGIST	<p>Not to mention the economic impact of losing one of the areas most popular tourist attractions. Revenues generated from tourism in the state of West Virginia would suffer as over 45,000 people visit, purchase tickets, food, and fantastic gifts and educational resources in the gift shop – all purchases providing additional tax money to the bottom line for West Virginia's income. It is estimated that the Green Bank Observatory contributes close to \$30 million to the local and state economies.</p>	Against Closure	Email	11/25/2016	
214	a	Gregory	Gallagher	Writer, Filmmaker & Executive-Producer	<p>To Whom It May Concern - As a partner with the legendary Jean-Michel Cousteau and his Ocean Futures Society program called "Ambassadors of the Environment", we aim to inform and educate the next generations about how our world works, and more specifically, how to stay healthy and happy while we do this tricky work.</p>	Against Closure	Email	11/25/2016	
214	b	Gregory	Gallagher	Writer, Filmmaker & Executive-Producer	<p>Science is a complex and controversial domain, filled with a variety of heroic standard-bearers, dedicated troops, and charlatans financed by business interests ignorant of the larger picture for the planet's citizenry.</p> <p>It is absolutely critical therefore to continue science-based operations, keeping the Green Bank operational, and the important work already underway.</p> <p>Our children's children depend on our good sense and smart moves going forward.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
215	a	James	Moran	D. H. Menzel Professor of Astrophysics, Harvard University, emeritus	I write in support of option 1 (Continued NSF investment for science-focused operation) or option 2 (collaboration with interested parties for science and education focused operations with reduced NSF-funded scope) in the NSF notice about the GBO issued on October 19, 2016. I believe I can bring a rather broad perspective to this issue having been involved in astronomical research, albeit mostly radio astronomy for more than fifty years, chair of the Astronomy Department of Harvard University for five years, and a member of the National Academy of Sciences. I understand the dilemma that the NSF faces in trying to provide the best instruments available for astronomical research while dealing with the burden of operational expenses, which requires redundant and less productive facilities to be phased out. However, in this case I firmly believe that the funds saved by divesting the 100-m telescope of the Green Bank Observatory (aka the GBT) is not a cost effective move in the attempt to maximize the impact of astronomical research in the United States. The GBT is often called the largest fully steerable telescope in the world. However, that description does not begin to convey the value of this technological marvel. It was only commissioned in the year 2001 and it still the most modern telescope in its wavelength range. It has two unique features among large telescopes. It has an offaxis optics system, which is a tour-de-force of mechanical innovation that provides a completely unblocked aperture. This feature allows the formation of a beam of extremely low sidelobe level that make the telescope unique in its ability to reject unwanted emission and achieve exceptionally high dynamic range in its image formation. The second feature is its laser metrology and the motorized independent control of its panels, which makes it one of the highest gain radio telescopes ever built, with beamwidths as small as 8 arcseconds. The GBT has not come close to its peak productivity because of the rapidly developing technology applicable to its detector systems. The synergy among the groups developing this technology is truly remarkable. Perhaps the most important of these technologies is the development of multipixel detectors by university groups. Unlike CCD technology at optical wavelengths, the mechanical and electrical difficulties of producing multipixel systems are only slowly being overcome at radio wavelengths, and with devices of much smaller scale. The 200 element system developed by a consortium led by the University of Pennsylvania and funded by the NSF-ASTI program, although small by CCD standards, makes the telescope x200 times faster than the single pixel telescopes available just a decade or so ago. This type of instrumentation will eventually be applied to interferometric arrays such as ALMA and JVLA, but it is technologically so complex that its implementation on such large instruments is at least a decade away. Until that time it is essential to have some large single apertures to complement these arrays. I would also like to mention that I am supportive of the concept that telescopes should deliver "user ready data products", but I also firmly believe that the US needs to maintain a pipeline of astronomers who really understand instrumentation. The GBT lends itself to this purpose much more readily than the major interferometric arrays, and the connection to the university instrumentation community is clearly in evidence, as mentioned previously. I strongly recommend that every effort be made to keep the GBT available as much of the time as possible for cutting edge astronomical research.	Against Closure	Email	11/25/2016	GBT_NSF_2016.pdf
215	b	James	Moran	D. H. Menzel Professor of Astrophysics, Harvard University, emeritus	I strongly endorse the white paper "The NSF's AST Portfolio Review of 2012 is Not Relevant to the GBT of 2017" by Lockman, Lynch, Frayer, Mason and Ransom. I will not repeat the cogent arguments made in that document. It demonstrates that the GBT has very broad applications, and is clearly in high demand and well oversubscribed. However, two areas particularly resonate with me, both involving black holes. Studying black holes has received several recent boosts from new types of observations: the detection of gravitation waves from merging black holes with LIGO, and the promise of being able to image the supermassive black hole (SMBH) in the center of our galaxy with the Event Horizon Telescope. In the first case, LIGO's fantastic discovery opens up just one "frequency range" of this new window on the universe. The GBT is a critical element of the network of telescopes doing pulsar timing which can be expected to detect gravitational waves from the stochastic background and, hopefully, the single event mergers of SMBHs in the relatively near future, and therefore anchor the field at "nanofrequencies." Thus there is a good chance that the GBT will have an important role in this nascent field of gravitational wave astronomy. Secondly, though the EHT will image nearby SMBHs on the scale of their event horizon, the global millimeter VLBI array (GMVA) will play an important role in figuring out how jets are formed and launched on slightly larger scales. Arrays such as the GMVA are critically dependent on have a few large apertures such as the GBT because the coherence times are so short that detection requires these large apertures to achieve adequate signal-to-noise ratio on baselines involving smaller apertures.	Against Closure	Email	11/25/2016	
216		Barb	Payne		This is my public submission regarding the Green Bank observatory. Please choose: 1) Continued NSF investment for science-focused ops (no-action alternative). Green Bank is too important to limit, mothball or close.	Against Closure	Email	11/25/2016	
217		Melissa	Chalmers		Please take my public submission regarding the Green Bank observatory. 1) Continued NSF investment for science-focused ops (no-action alternative) Green bank is too important to limit, mothball or close.	Against Closure	Email	11/25/2016	
218	a	Erica	Harvey	Professor of Chemistry	I am writing to express my support for keeping the Green Bank Observatory functional with NSF support. I teach Physical Chemistry at Fairmont State University. My upper-level chemistry students and I have been making 4 day research field trips to [then] Green Bank NRAO in the spring for the past 10 years, as part of CHEM 4412 Physical Chemistry II (Quantum Chemistry). We study the rigid rotor system and read about the types of spectroscopy available in the radio region of the spectrum. This culminates in the trip to Green Bank, where the students are able to join students from Glensville State University and team up on research projects to apply what they have learned. We were there one year when a team of researchers from Harvard was finding the first anions in space! Year after year, the chance to interact formally and informally with professional scientists from around the world and world-class scientific staff from Green Bank NRAO has been inspirational for my students and for me. A majority of my students are first generation college students, and most of them had no idea such careers even existed – including the professional support staff careers. We have no astronomy major at our college, so for many of my students this also is a first and treasured introduction to astronomy.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
218	b	Erica	Harvey	Professor of Chemistry	<p>On a personal level, my own children got their first exposure to astronomy from a homeschooling trip to Green Bank when they were 8 or 10 years old. They came back enthusiastic, as did their father (also a chemist). The Science Center that Sue Ann Heatherly has put together is really world-class example of informal science education, and tells the story of radio astronomy and the research in a way that is compelling to people of all ages and levels of science understanding. My students and I spend hours there each time we visit, and I learn something every time. Likewise, the tours of the site are always great. My entire extended family gets Christmas and birthday presents from the gift shop there, and many of my former students are still sporting geeky-cool tshirts they got on their trip.</p> <p>The degree to which this facility gives a different type of pride to West Virginia, a state which has not always been the most science-friendly, is very hard to put a dollar value on. My students from years past recall this trip as one of the highlights of their undergraduate career. I will be heartbroken if this treasure of West Virginia is no longer available.</p>	Against Closure	Email	11/25/2016	
219		Giles	Novak	Professor of Physics and Astronomy Northwestern University	<p>I am writing to express my support of the "No-Action" option for the Environmental Impact Statement for changes to operations at Green Bank with respect to the Green Bank Telescope.</p> <p>The Green Bank Telescope is the world's largest steerable radio telescope, and is at the cutting edge of a number of very exciting areas of astronomical research. For example, observations using this telescope may be able to follow up on the discovery of gravitational waves that the NSF's LIGO experiment made earlier this year. Gravitational waves were predicted by Albert Einstein about 100 years ago, so the LIGO discovery was truly historic. Gravitational waves can alter the propagation times of the exquisitely regular radio pulses from neutron star "pulsars", and such pulses can be observed by the Green Bank Telescope. I could provide many other examples of important work that will become possible if this precious national resource is allowed to continue operations.</p>	Against Closure	Email	11/25/2016	GBT.pdf
220		Miller	Goss		<p>I am writing about your EIS statement concerning the Green Bank Observatory. I am a former Assistant Director of the National Radio Astronomy Observatory and Director of the Very Large Array and the Very Long Baseline Array from 1988 to the end of 2001. Previously I had been a Professor of Radio Astronomy at the Kapteyn Astronomical Institute of the University of Groningen (Netherlands) in the 1980s. My PhD had been received from the University of California, Berkeley, in 1967. In the intervening years, I had worked at the CSIRO Division of Radiophysics in Sydney, Australia (Parkes) and the Max Planck Institute in Bonn (Effelsberg). I retired from the National Radio Astronomy Observatory in 2016 and am now an active member of the staff of NRAO in Socorro, New Mexico, with an emeritus appointment.</p> <p>I have been a user of Green Bank since the 1970s, with frequent use of the Green Bank Three-element interferometer, the 300 foot, the 140 foot and recently the Green Bank Telescope (GBT). My opinions about the continued use of the GBO are guided by compelling arguments for the maintenance of the current status of the GBT and the prospects for its future use. The GBT is and will remain the most successful large single dish radio telescope for some decades, well into the 21st century. From my point of view there are many reasons for this viewpoint. The most important are four-fold: (1) The demonstrated success as a high frequency instrument, up to 110 GHz, with multi-pixel receivers, (2) A key element in high frequency Very Long Base Line Interferometry (e.g. observations of the radio sources associated with the million solar mass black hole at the center of the Milky Way and high frequency observations of radio sources associated with black holes at the centers of external galaxies), (3) the use of the GBT as the key component of the NANOGrav community for pulsar timing at radio wavelengths (the connections with LIGO and the spectacular detection of gravitational waves published in February 2016) and (4) the successful technological collaborations between the GBO and a number of collaborations with US university groups in the NSF AST-ATI program.</p> <p>In summary, I strongly support the continuation of NSF support for the Green Bank Observatory, that is the No-action Alternative. The GBO will remain a vibrant part of the US astronomical community for many years.</p>	Against Closure	Email	11/25/2016	NSF.GreenBank.EIS.from.WM.Goss.25nov2016.docx
221	a	Deborah	Kopald		<p>"Continued NSF investment for science-focused operations (No-Action Alternative)"</p> <p>Green Bank Observatory needs to be kept open for exploration of the cosmos.</p>	Against Closure	Email	11/25/2016	
221	b	Deborah	Kopald		<p>A radio free quiet zone is also necessary for those who cannot tolerate wireless signals. It is the only "control area" left in the nation.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
222	a	Donald	Campbell	Professor of Astronomy	<p>Pulsar timing and gravitational waves: It is widely accepted that precision timing of selected pulsars has the potential to detect gravitational waves in a different frequency regime than the one that LIGO is sensitive to. The NSF Division of Physics (with a contribution from Astronomy) has provided significant funding for the North American Nano-Hertz Gravitational Wave Observatory for this purpose, a portion of which is "buying" time on the GBT. While the Arecibo telescope is more sensitive than the GBT, its restricted sky coverage means that the GBT is also a critically needed component of the North American Pulsar Timing Array (PTA). The PTA is important not just for its use to detect gravitational waves (the NANOGrav program) but also for detailed studies of the physics compact objects.</p> <p>Fast radio bursts: The 64 m Australian Parkes radio telescope has been a major player in the detection and study of the enigmatic Fast Radio Bursts (FRBs) and the GBT has capability for a similar, or larger, role in the northern hemisphere. However, this capability would be greatly enhanced by the addition of a multi-beam system at cm-wavelengths. The 7-element FLAG L-band phased array system being developed by Brigham Young University in conjunction with the GBO would satisfy this need greatly enhancing the GBT's role in the study of FRBs.</p> <p>Planetary radar astronomy: For the past 20 years or so the GBT has been a critical resource for solar system studies primarily through bi-static radar observations in conjunction with the NSF Arecibo and NASA Goldstone planetary radar systems. Current Arecibo-GBT studies are concentrated on 70 cm wavelength studies of sub-surface structures on the Moon plus some near-Earth asteroid (NEA) observations. Goldstone-GBT radar speckle interferometric observations provide instantaneous, high precision measurements of the spin state of some planets and satellites (e.g. Mercury, Venus, Europa) providing information about their internal structure. For Mercury these measurements led to the confirmation that it has a liquid outer core (Margot et al, Science (cover), Volume 316, Issue 5825, pp. 710, 2007) resulting in considerable publicity for the GBT. Similarly Goldstone-GBT bi-static radar studies of near-Earth asteroids can in many instances significantly improve the quality of astrometric and characterization observations for these scientifically interesting and potentially hazardous objects.</p> <p>The NSF needs to find a means by which the GBT can continue as a critically needed telescope for the nation's astronomers.</p>	Against Closure	Email	11/25/2016	GBO EIS statement Nov 25 2016.pdf
222	b	Donald	Campbell	Professor of Astronomy	<p>Astronomical community access: The Green Bank 100 m telescope (GBT) is the largest fully steerable single dish radio telescope in the world and its collecting area combined with high quality instrumentation is a valuable resource for astronomical observations. Into the future, at least 50% of the time should be available to the general astronomical community. Currently, the expectation is that NSF funding will be reduced to about 20% of the current budget and it is being stated that this means only 20% of the observing time on the telescope will be available to the general astronomical community. Every effort should be made to shed unnecessary parts of the sprawling Green Bank Observatory in order to minimize costs and maximize the time available for astronomical observations with the GBT.</p> <p>Breakthrough SETI funding: As I understand, the Breakthrough SETI funding is only a five year commitment. What are the plans for compensating for the loss of this funding at the end of this period?</p>	Alternatives Consideration	Email	11/25/2016	GBO EIS statement Nov 25 2016.pdf
223	a	Rachel	Osten	Associate Astronomer with Tenure Deputy Mission Head, Hubble Space Telescope Mission Office Space Telescope Science Institute	<p>I write concerning the NSF's review of possible changes to operations at the Green Bank facility in Green Bank, West Virginia. The Green Bank Observatory is at the forefront of astrophysics, observing at wavelengths spanning low frequencies to high radio frequencies. It would be disastrous for science to lose this facility. Crucially, since the NSF's portfolio review in 2012, the Green Bank Telescope now routinely operates in the 3mm band. This had not been completed at the time of the review, and is a significant enhancement of the GBT's capabilities which are unparalleled elsewhere. In the intervening years, results from the NSF's ALMA observatory have been pouring in, invigorating mm to sub-mm astronomy. The high frequency science that the GBT does extends what ALMA can do in unique ways because of its large single-dish, off-axis design, as well as the frequency range. ALMA is essential for deep probes of small-field regions of the sky, while the GBT can survey larger regions to pick out interesting objects. The GBT is incredibly sensitive to low-surface brightness phenomena, and can fill in the short spacing information at 3 mm needed for a complete interpretation of ALMA's interferometric data. The 3mm spectral region is rich with molecular lines, important for understanding the building blocks of life. This is fundamental to understanding how to answer the age-old question "How did we get here?". As the high frequency instrumentation and operations have only recently been able to proceed in earnest, and they are heavily oversubscribed indicating significant interest, it would be premature to ramp down this critical capability at this time.</p>	Against Closure	Email	11/25/2016	GBT_NSF.pdf
223	b	Rachel	Osten	Associate Astronomer with Tenure Deputy Mission Head, Hubble Space Telescope Mission Office Space Telescope Science Institute	<p>The GBT is the only large national observing facility that allows for university-based instruments to be installed, providing a vital opportunity for hands-on experience which is disappearing in the U.S. The high frequency receivers currently on the GBT, namely MUSTANG-2, ARGUS, and PHAROH, were built by collaborations between university groups and the GBT.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
223	c	Rachel	Osten	Associate Astronomer with Tenure Deputy Mission Head, Hubble Space Telescope Mission Office Space Telescope Science Institute	<p>Another scientific area in which the GBT excels is pulsar observing. With the discovery in 2015 of gravitational radiation from inspiralling black holes, the need to observe and understand sources of gravitational radiation is more compelling than ever. The GBT is an important component of detecting nano-Hz gravitational radiation through a pulsar timing array of millisecond pulsars. Because of its sensitivity and location in the National Radio Quiet Zone, the GBT is a foundational component of this North American Nanohertz Observatory for Gravitational Waves. These gravitational waves are distinct from those measured in the kilohertz frequency range by ground-based gravitational wave interferometers like LIGO, and the millihertz frequency range to be probed by future space-based gravitational wave missions. They arise from supermassive binary black holes in the early stages of inspiral, and possibly more exotic sources which would reveal new physics frontiers. The GBT's extensive sky coverage is needed to detect these correlated signals. Losing the GBT as well as possibly the Arecibo Observatory would cause the US to cede its ability to remain pathfinders in the detection and study of sources of gravitational wave radiation. The GBT is used for a wide range of astrophysics, from observing comets, to star forming regions, to gas in and around galaxies, and answers important questions about how the universe works. Bally et al. (2016 arXIV:1610.09014) details some of these areas. Its existence is also important for the purpose of training the next generation of radio instrumentalists.</p> <p>It is also important to have US investment in national observatories centered in the northern hemisphere. Many of the current and future large telescope projects are moving to the southern hemisphere, because of advantageous observing conditions (the high, dry site of the Atacama desert is necessary for ALMA; the LSST is being built on Cerro Pachón). Being able to study all parts of the observable universe is key to overcome cosmic variance; science happens in the northern hemisphere sky too. There are political as well as scientific implications to having a growing number of sensitive forefront observatories funded in whole or in part by the U.S. physically located in other countries. With the uncertain forecast for U.S. scientific funding in the incoming administration, it would seem common sense to be able to demonstrate the benefits to local communities as well as the U.S. and larger scientific communities of having these facilities working.</p> <p>In summary, I advocate for the NSF to continue its investment for science-focussed operations of the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
224		Bill	Shillue		<p>I am a current engineering staff member of the National Radio Astronomy Observatory (NRAO). I spent three years working in Green Bank for NRAO at the facilities which are now called the Green Bank Observatory (GBO). Since that time I have worked at other NRAO sites, but in the last three years I have once again had the opportunity to work in collaboration with staff members of GBO, and have work on the site for extended periods. I have always found the technical staff of the GBO to be exceptionally competent and professional, and I have also benefited from the skill and expertise of the machine shop and maintenance staff. My opinion is that the Green Bank Telescope (GBT) is a unique and world-leading instrument and constitutes a unique and important national asset for the accomplishment of ground-breaking science. An instrument of this quality and capability is just entering the most productive part of its lifetime. I therefore urge continued support of the site and the GBT for science operations.</p>	Against Closure	Email	11/25/2016	
225	a	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO).</p> <p>Last year, I completed my PhD in Astrophysics at the University of Oxford in England. I had previously spent time in West Virginia and had visited the GBO. These visits led to me deciding that I would like to continue my career at West Virginia University. I started work in the Astrophysics department of WVU in March of this year, and it's great to be part of such a dynamic and burgeoning group. The reason the group is so strong is in no small part due to having such fantastic telescopes in the state. I know that I am one of many scientists who are drawn from all over the world to West Virginia, for similar reasons. I am also one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.</p>	Against Closure	Email	11/25/2016	nano_template.pdf
225	b	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	<p>Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at West Virginia University, and at scientific institutions across the United States.</p>	Against Closure	Email	11/25/2016	
225	c	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	<p>Here are the impacts of each proposed scenario, as I see it:</p> <p>No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.</p>	Alternatives Consideration	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
225	d	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.	Alternatives Consideration	Email	11/25/2016	
225	e	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade. In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to highertech areas of the country. The people of Pocahontas County are proud of the observatory.	Alternatives Consideration	Email	11/25/2016	
225	f	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	
226	a	Cornelia	Lang	Department of Physics & Astronomy	I am writing to express my endorsement for continuation of NSF support for the Green Bank Observatory, which lies in the United States National Radio Quiet Zone in West Virginia. The Robert C. Byrd Green Bank Telescope (dedicated in August 2000) is a world class observing facility with opportunities for scientific researchers and staff, students, technical staff and the general public. The Green Bank Observatory is currently playing a major role in several international projects, including the search for gravitational waves using pulsar timing experiments. Many students at US institutions (including universities and high schools) are involved in this ground-breaking work which may be able to confirm other detections of gravitational waves (using an independent method) in the years to come. This research is possible because of the support that the Green Bank Observatory gets from the NSF. There is always a cost to maintaining such a state-of-the art research facility. However, the investment in such a facility leads to ongoing and transformative scientific research. I urge the NSF to continue funding and supporting the scientific endeavors at the Green Bank Observatory at the current level with no changes as this facility provides significant contributions to the landscape of scientific discovery in the US.	Against Closure	Email	11/25/2016	
226	b	Cornelia	Lang	Department of Physics & Astronomy	Investment by the NSF should be maintained to support the operations and scientific work of the staff of the Green Bank Observatory as this is a national facility that is used by many researchers in the US to carry out truly groundbreaking astronomical observations. Many users of the Green Bank Observatory are from colleges and universities who currently don't have observing facilities of their own. In this way, the Green Bank Observatory is an incredible resource for colleges and universities who can use data from the Green Bank Observatory to help train the next generation of students for scientific and technical careers.	Against Closure	Email	11/25/2016	
226	c	Cornelia	Lang	Department of Physics & Astronomy	It also is an important asset to the surrounding rural community, as it represents a source of jobs and technical training for many in the region.	Against Closure	Email	11/25/2016	
226	d	Cornelia	Lang	Department of Physics & Astronomy	In addition, the radio-quiet nature of the surrounding area is critical to making observations in important wavelength ranges that are elsewhere not nearly as highly protected. The scientific capabilities of the Green Bank Observatory are unique and are a significant contribution to the portfolio of the American astronomical community.	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
227	a	Andrew	Baker	Department of Physics and Astronomy Rutgers, The State University of New Jersey	I am writing in support of the continued operation of the Green Bank Observatory (including the Green Bank Telescope) as a scientific and educational facility. I am an associate professor on the faculty of the Department of Physics and Astronomy at Rutgers, The State University of New Jersey; the focus of my research and a significant fraction of my teaching is the use of radio telescopes to probe interstellar matter in distant galaxies, in order to understand how they form and evolve over cosmic time. The GBT has been an important facility for my research: its enormous collecting area, full steerability, and radio-quiet site allow it to observe distant, faint targets far more efficiently than any of its peers (e.g., the Effelsberg 100m Radio Telescope in Germany, which I know from personal experience to be inferior). The telescope is also crucial to U.S. leadership in radio astronomy because it can host guest instruments, giving university-based groups a platform for the development and deployment of novel instrumentation. A case in point is the ultra-wideband "Zpectrometer" for which I was a Co-PI (University of Maryland Professor Andy Harris was PI); this has allowed the GBT to determine "blind" CO redshifts for tens of distant galaxies too dusty to be localized with optical telescopes, and has supported the publication of more than 20 papers (as well as multiple Ph.D, theses) since 2010. Losing the GBT's scientific capability would be an especially damaging blow in a wavelength regime that has little overlap with NASA and DOE funding priorities, and where capacity lost at NSF is therefore capacity lost forever.	Against Closure	Email	11/25/2016	
227	b	Andrew	Baker	Department of Physics and Astronomy Rutgers, The State University of New Jersey	Green Bank has also played an important role in my spring semester "Observational Radio Astronomy" lab course, required for all undergraduate astronomy majors at Rutgers. Since 2008, I have brought 121 undergraduates (plus eight graduate students as teaching assistants and/or drivers) on three-day, two-night field trips to Green Bank as the course's capstone experience. Students enjoy a tour of the observatory's facilities, including a visit to the GBT control room and a close look at the GBT itself, and undertake a hands-on observing project with the 40-foot teaching telescope under the guidance of the observatory's education director. Student feedback every year has been overwhelmingly positive, and in many cases the trip has inspired or reinforced students' interest in pursuing graduate work in astronomy, physics, or another STEM field. For the Green Bank Observatory to turn into a non-research facility would deprive future Rutgers students of this sort of life-changing experience.	Against Closure	Email	11/25/2016	
227	c	Andrew	Baker	Department of Physics and Astronomy Rutgers, The State University of New Jersey	I'd like to close with two observations about the recommendation by the 2012 Portfolio Review Committee (PRC) that the GBT be divested or closed. First, the PRC's assessments of which technical capabilities are "critical" and ""supporting"" for tackling the science questions of the Astro2010 Science Frontier Panels (SFPs) clearly diverge from those articulated in the SFPs' own reports. A key GBT-relevant example comes from the Cosmology and Fundamental Physics panel, which identified gravitational wave astronomy as its area of discovery potential and co-ranked a pulsar timing array and fast "electromagnetic" followup of gravitational wave events as "needed capabilities," while the PRC mysteriously ranked a pulsar timing array as "supporting" and specifically *optical* followup as "critical." Second, the PRC's desire to boost the success rate of proposers to "aggressively funded" AAG and ATI programs would (if the GBT loses its funding) be realized by extinguishing a wide swath of radio-wavelength science and instrumentation research. These internal and external contradictions suggest that the PRC's conclusions should not be viewed as engraved on stone tablets. I urge NSF to maintain science-focused and education-focused activities at the Green Bank Observatory, via collaborative partnerships as necessary, in order to ensure that this vital element of the U.S. research infrastructure is not lost.	Against Closure	Email	11/25/2016	
228		John	Jardine Goss		Radio astronomy plays a vital and necessary part of studying the universe. The Green Bank facility is unique and can make significant contributions on an international level to 21st century astronomy. It must remain operating.	Against Closure	Email	11/25/2016	
229		Dennis	Lynch		I'm writing in regards to the NSF environmental impact statement for the Green Bank Observatory. I strongly urge the NSF to choose the No-Action Alternative and to continue to support full science operations for Green Bank. Science has always been a passion of mine, but it was usually something I experienced from afar. I would watch documentaries on television or read books or newspaper articles about discoveries being made by people who work in far-off labs using equipment that I would never be able to see. That changed when I first visited Green Bank. I met world-famous astronomers and talked to them about their science. I got to see one of the best scientific instruments in the world just a few hours from where I live. Being able to tour the observatory and actually climb the Green Bank Telescope was a once in-a-lifetime experience that brought science home for me in a way that I had never experienced before. It has given me a greater appreciation for science and educated me about radio astronomy — a field I didn't even know existed before hearing about the Green Bank Observatory. I can't believe that the NSF would consider closing down such an important place. It's hard for me to imagine how many other people would lose out on the experiences that I've had, but it would surely negatively impact our society as a whole. It is for these reasons that I NSF should continue to fully fund the Green Bank Observatory.	Against Closure	Email	11/25/2016	Dennis_Lynch_GBO_EIS_Comments.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
230	a	Anna	Scaife	Reader and Head, Interferometry Centre of Excellence Jodrell Bank Centre for Astrophysics University of Manchester	<p>I am writing to express my concern over the NSF Division of Astronomical Sciences' portfolio review committee's recommended divestment of the Green Bank Telescope (GBT) from the AST portfolio. I would particularly like to highlight the potential damage that such a divestment would cause to the US science community, as well as to the wider global community.</p> <p>It is for this reason that I strongly support the first of the potential alternatives to be evaluated by the EIS: Continued NSF investment for science-focused operations (No Action Alternative). The GBT is a unique scientific facility, not simply in terms of its sensitivity but also in terms of its flexibility - its frequency coverage, its availability as a testbed for new instrumentation, its polarization capabilities, its spectral and time domain capabilities. Historical investment in the GBT has not only provided the world's most sensitive single-dish radio telescope, but it has provided a wide-reaching and high impact astrophysical laboratory.</p> <p>If any of the alternatives evaluated by the EIS were accepted barring the first, it would be a tragedy for both the US and global scientific communities. It has been a privilege for me to use the GBT in the past and I sincerely hope that the proposed EIS will recognise the importance of continued science operations at the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
230	b	Anna	Scaife	Reader and Head, Interferometry Centre of Excellence Jodrell Bank Centre for Astrophysics University of Manchester	<p>The stated reason for divestment, that 'its capabilities are not as critical to New World New Horizons science goals as the higher-ranked facilities', is short-sighted and misleading. The very goals identified by such reviews are built on a strong and persistent foundation of ongoing scientific research that is underpinned by key instruments such as those provided by the Green Bank Observatory and in particular the Robert C. Byrd Green Bank Telescope (GBT).</p>	Against Closure	Email	11/25/2016	
230	c	Anna	Scaife	Reader and Head, Interferometry Centre of Excellence Jodrell Bank Centre for Astrophysics University of Manchester	<p>Furthermore, the results of this investment extend beyond the hardware of the telescope itself - the National Radio Quiet Zone is a fantastic resource for radio astronomy, as are the scientific and technical staff of the observatory. Expertise such as this cannot be hired over night, but requires sustained specialist training over long periods. Once gone, this expertise is incredibly difficult to regain.</p>	Against Closure	Email	11/25/2016	GBT_LoS_Scaife.pdf
231		Ann	Barton Brown		<p>The Green Bank Observatory provides students, visitors and scientists with a much needed opportunity to study science, learn how to think critically and expand their intellectual horizons. It is the education component that makes for a healthy future for Americans. It supports and enriches the community around it and is a source of much needed pride for West Virginians. Please keep it funded</p> <p>Thank you,</p>	Against Closure	Email - Scanned	11/23/2016	
232	a	Joe	Igoe	KF5VIK (Amateur Radio) ARRL STX ARES District 14 NE Unit - Emergency Coordinator TX State RACES ID 16-201-L	<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email - Scanned	11/23/2016	
232	b	Joe	Igoe	KF5VIK (Amateur Radio) ARRL STX ARES District 14 NE Unit - Emergency Coordinator TX State RACES ID 16-201-L	<p>Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed.</p>	Against Closure	Email - Scanned	11/23/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
232	c	Joe	Igoe	KF5VIK (Amateur Radio) ARRL STX ARES District 14 NE Unit - Emergency Coordinator TX State RACES ID 16-201-L	Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise. Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email - Scanned	11/23/2016	
233		Melissa	Spry		I think it is a shame these coal miners work all their lives, gives the mines the best years of their lives, and now they just want to throw them out to the wolves. They shouldn't have to worry about their pension and insurance at their age	General	Email - Scanned	11/23/2016	
234		J.	Gonzalez		My father took me and my brothers and sisters to the observatory about once a year growing up and while I haven't been in a few years now, it's always held a special place in my heart. WV doesn't have a lot of employment opportunities, and while I'm also not a scientist, having this place in my home state always kept my interest and let me know that in America, I'm supposed to be able to do whatever I want. When I found out that there was a solid chance it was going to be closed down, I almost cried. I spent a lot of time here and hoped to be able to share the tradition with my children and grandchildren. We live in very, very uncertain times. Please, on all that is sacred, do not cut off funding or close down the Green Bank Observatory. I and many other Americans love this place with all our hearts and would be devastated to see it go.	Against Closure	Email - Scanned	11/23/2016	
235		Philip	Edwards		We note with concern the current environmental evaluation of the Green Bank Observatory which includes the option of closing the site. The R.C. Byrd Green Bank Radio Telescope (GBT) is the premier single-dish radio telescope, exemplifying the synergy between fundamental science and cutting edge technologies. It has produced a number of high impact results, most notably in the areas of astro-chemistry and pulsar astronomy. It is also a critical element of Very Long Baseline Interferometry (VLBI) arrays, both ground-based arrays and space VLBI. The Russia-led SVLBI mission RadioAstron, launched in 2011, is advancing our understanding of active galactic nuclei, interstellar medium, and cosmic masers. The RadioAstron satellite has an apogee height of ~300,000 km, fifteen times greater than previous space VLBI observations, and it has made a number of detections on baselines greater than 20 Earth diameters, in contrast to the expectations of many astronomers. Clearly these ground-breaking detections require the most sensitive radio-telescopes on the Earth, and the GBT is critical to the ongoing success of the mission. RadioAstron is also reliant on the use of the Green Bank 140-foot as a dedicated tracking station antenna - one of only two for the mission. This is operated by NRAO under contract with Roscosmos and loss of this capability would seriously impact the efficiency of the mission. On behalf of the RadioAstron International Science Council we express our resolute support to continuing operational status of the GBO.	Against Closure	Email - Scanned	11/23/2016	RISC-GBO-letter-signed.pdf
236	a	Kenneth	MacLeod	Amateur Radio Operator K15PM	It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions. Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.	Against Closure	Email - Scanned	11/23/2016	
236	b	Kenneth	MacLeod	Amateur Radio Operator K15PM	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/23/2016	
236	c	Kenneth	MacLeod	Amateur Radio Operator K15PM	Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email - Scanned	11/23/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
237	a	Jack	Burgess	Arizona Delegate to NaPonal Youth Science Camp '16	<p>I was a 2016 Arizona Delegate to the National Youth Science Camp. As part of the camp we got to visit the Green Bank Observatory and receive a lecture, tour the facilities, and see the exhibits. We spend camp in the National Radio Quiet Zone, and it was a great experience to come and see what the zone exists for.</p> <p>I greatly enjoyed our trip to the Green Bank Observatory, and I learned a lot as well. The lecture was very interesting, and it was special to get a chance to see into the inner working of such a great tool of science.</p> <p>I'm sure that my fellow campers would share a similar story; The GBO is a very popular out-of-camp experience. Some kids even got to stay at the GBO overnight and learn how to work the telescope! I hope that the Green Bank Observatory remains open for research, so that it can continue to teach and inspire us.</p> <p>I know that my visit to the Green Bank Observatory expanded my universe.</p>	Against Closure	Email - Scanned	11/23/2016	
237	b	Jack	Burgess	Arizona Delegate to NaPonal Youth Science Camp '16	<p>I very much hope that the observatory remains open for research, as the telescope allows for us to learn about the cosmos around us and the nature of our universe. Why halt the pursuit of knowledge when there is so much unknown, so much to learn? I appreciated the "open skies" program we heard about, which allows for community engagement from all over.</p>	Against Closure	Email - Scanned	11/23/2016	
238		Tim	Conklin		<p>I am a former summer student of the NRAO Research Experiences for Undergraduates (REU) in Green Bank, WV over the summers of 2010 and 2011. I have also worked on 2 other projects at the site as an undergraduate student at Rutgers University and as a graduate student at the University of Massachusetts. In total I have spent about 7 months in Green Bank working at the telescope site and the REU program has been one of the biggest contributing factors to my professional success outside of astronomy. While most of the focus should be on the science aspect, the teaching and outreach aspect should not be overlooked. The REU program I was involved in has enabled over 1000 students to get involved in research for nearly 60 years, there are countless projects for high school students every year, and the other telescopes on the site are used by students from middle school to graduate school. During my time in Green Bank two thirds of the REU projects were actively using telescope data and the other third were site related engineering. These outreach efforts exist in their current form because the GBT is an active research telescope. Without the telescope, these programs are likely to drastically change or end completely. It is my hope that the telescope will continue to operate in its current capacity.</p>	Against Closure	Email - Scanned	11/23/2016	
239	a	Camille	Beasley	Florida Department of Environmental Protection	<p>Thank you for the opportunity to comment. As a delegate of the National Youth Science Camp and a lover of all things science, I would be incredibly saddened to see the Green Bank Observatory mothballed or deconstructed. Every year, the delegates of the Camp take a field trip to the Observatory to learn about both its construction and the research done there. Imagine being a student just beginning to fully discover their passion for science, looking up at the world's largest fully steerable radio telescope --- in fact one of the largest moving structures on land! It really is awe---inspiring --- a marvel of engineering and an icon in the field of astronomy. Though I ultimately chose a career in ecology, touring this facility played a large role in sparking a lifelong interest in astronomy, a field that is becoming increasingly important as we look to the stars for potential explanations and solutions to the issues that we face on Earth.</p>	Against Closure	Email - Scanned	11/23/2016	
239	b	Camille	Beasley	Florida Department of Environmental Protection	<p>It may be that the GBO is no longer the most modern of facilities, but that fact that its scientists rallied to secure enough outside funding to make up the gradually decreasing NSF funding demonstrates it has not outlived its usefulness. While I understand that budgets are tight these days, I ask that the NSF please do not shut down or dismantle the GBO, or at the very least, not the Robert C. Byrd Telescope. Whether the decision is made to fully fund, partially fund, or create an educational park (I'm very strongly in favor of allowing continued research), I believe the GBO is a treasure of the scientific world and a source of inspiration, and to lose it simply because of budget constraints would be a tragedy. I very much hope you will avoid the mothballing or deconstruction options and find a way to preserve this marvelous facility, for the sake of its dedicated scientists and for aspiring scientists of the future, as I was 10 years ago.</p>	Against Closure	Email - Scanned	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
240	a	J. Bruce	McKean		<p>I am writing to comment on the proposed changes to the Green Bank Observatory Operations. I retired from NRAO Green Bank in 2011 after working thirty-six years for NRAO. I was an accountant and programmer in the NRAO Fiscal Division and then moved to the Management Information Systems Division when the administrative computer operations were pulled out of Fiscal. For many years I was a one---man operation handling both the programming and hardware updates of the IBM computer in Green Bank. I was technically under the Charlottesville, VA office, but our division was always located in Green Bank, and then some staff were added in Socorro, NM. I traveled often to Charlottesville, Tucson, Socorro and the Brookhaven Labs in New York. Our internal auditors were located at Brookhaven until AUI lost the contract to operate at that DOE site after 50 years of operation.</p> <p>After previously teaching junior high math while working on a graduate degree at Ohio University, I was hired by the Ohio Division of the North American Coal Company and given extensive training by IBM in both programming and hardware. I then worked for a division of Quaker Oats in their MIS division until taking a job at NRAO. I immediately loved the rural atmosphere, beauty and trails in the WV mountains. Employees have always worked together at Green Bank for the betterment of science and the community. Very quickly I was asked to be the volunteer treasurer of the county library system and a member of the county library board. Six new libraries would be built in the county since I arrived here, and our county system would be voted the top rural library system in the US in 2003. The county system was first run out of the Green Bank Library, and the head librarian and many board members and supporters were connected to NRAO.</p> <p>The entire county has benefited from the doctor and dentist office, fire department and rescue squad, and the first swimming pool that were all started at NRAO with NRAO employees and buildings. The community changed in such a positive way with the diversity and giving of NRAO employees.</p> <p>I lived in NRAO housing on---site for three years, and my neighbors were all from foreign countries. My children played with friends who did not speak English, and it was a great experience for them. Our county had the top French program in West Virginia, and our students traveled regularly to Quebec, France and to two other locations to live with French---speaking families.</p> <p>The people who came here to work from around the world introduced so many things to the community that still continue----- classes, concerts, huge annual picnics and EMT training, to name just a few. The many state and National forest and park employees use NRAO for their meetings.</p> <p>Spouses of employees have contributed so much to this community. My wife was a high school librarian at Wheeling High School, one of the top schools in West Virginia, and she eventually opened a new school library at the local elementary/middle school, and it was commended every year by the state. Her library looked out on the GBT, and her library was alive and fun. Another spouse, Mali Minter, went from being a lawyer to teaching Spanish here, and she took her students to foreign countries regularly and supported the students in so many ways. So many county leadership positions will be lost if NRAO closes.</p>	Against Closure	Email - Scanned	11/22/2016	
240	b	J. Bruce	McKean		<p>The NRAO airstrip that current county resident and former governor and US Senator, John D. Rockefeller IV (Jay), funded when NSF funds could no longer support the air strip that was often the only way to get injured residents to a major hospital. The site has also become a shelter and emergency hub when major storms affect electric power.</p>	Against Closure	Email - Scanned	11/22/2016	
240	c	J. Bruce	McKean		<p>My three children grew up here and had many opportunities at NRAO due to the close NRAO investment in the community and schools. Our son was offered one of the two slots for WV at the National Youth Science Camp that has always hosted US and foreign high school students in the county until a recent move to Tucker County, WV. Our son ended up taking one of the WV full---month DOE science experiences in Environmental Studies at a Washington State National laboratory. Our son would go on to study chemical, civil and environmental engineering at Princeton University and was an NRAO tour guide each summer and fall at the Green Bank site. He traveled the world consulting with Booz * Allen * Hamilton and also spent Time working for Homeland Security and at the White House. Our oldest daughter, now teaching science in NC, combined pre---med studies and environment science at Denison University and the University of San Francisco and was an NRAO life guard for many years. Our youngest daughter graduated from Marietta College in graphic design and journalism and did her graphic design internship at NRAO Green Bank while also life---guarding and teaching swim lessons at NRAO.</p> <p>This NRAO site has the best education programs and science center of any observatory, and part of that is due to former Senator Robert C. Byrd. We are one of the top tourist attractions in WV bringing money and jobs to this state. Amateur astronomers from around the country come here to use the telescopes. Students and teachers come here to study astronomy. I talked to a teacher from VA this summer who had a group of minority and low--- income students studying here with a National program, and the teacher was so impressed with the site and facilities and hospitality.</p> <p>Green Bank has always hosted college students year---round, and building sites in Chile are not as easily accessible for US students. It is so important to be hands on with learning. I listened to West Virginia University student after student speak at a previous meeting emphasizing how different Green Bank is in that regard, and how it helped them.</p> <p>I have always thought that a WV or US School of Science could be housed at this site as an expansion of the current education program already in place. Sue Ann Heatherly was a science teacher in Pickens, WV when she worked with Senator Byrd to expand the education program here. Two of my children were selected for Governors Honors Academies held at various colleges in WV, and NRAO has hosted those type programs. Green Bank does so much more to teach science to the public.</p>	Against Closure	Email - Scanned	11/22/2016	
240	d	J. Bruce	McKean		<p>The National Radio Quiet Zone is unique and a big plus to study radio astronomy with minimal interference. The locals have accepted ""no cell phones"" for many years because they value NRAO. The quiet zone has attracted people to move here to live due to health issues they suffer due to power lines and cell phone tower emissions. These people have also contributed to this community.</p>	Against Closure	Email - Scanned	11/22/2016	
240	e	J. Bruce	McKean		<p>The historical telescopes on this site must remain as a museum/ tourist attraction forever. Just as the Civil War battlefields in the area continue to draw visitors to this area, so do the historical telescopes. Local people gave up their farms and homes for this site to become a world center for radio astronomy, and the NSF should give back to their offspring.</p>	Against Closure	Email - Scanned	11/22/2016	

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240	f	J. Bruce	McKean		NRAO Green Bank was previously facing elimination in the past when the Green Bank Director was Dr. George Sielstad. His wife was a top---notch high school English teacher and added to the community as so many spouses have done. Dr. Sielstad worked to bring outside money here to save the operation, and he attracted close to ten outside public and private sources of money. The Green Bank Telescope was one of his successes of his efforts plus the addition to the Jansky Lab and some Naval contracts. Hard work with help from the state and Senator Byrd brought the first radio astronomy site back to life, and it should continue. So much has been invested and is in place here.	Against Closure	Email - Scanned	11/22/2016	
240	g	J. Bruce	McKean		I plead with you to not eliminate this valuable research center. So much will be lost for so many. Snowshoe Ski Resort attracts people from all over the Eastern US, and they regularly visit NRAO for the tours, trails, food and programs. Any reduction at NRAO will impact people far beyond this county and state.	Against Closure	Email - Scanned	11/22/2016	
241	a	John	Saunders		I have close family that are lifelong residents of Pocahontas County, and a few of those are in Green Bank. While the GBO is in fact an absolute critical employer in that area of the country it's sooo much more than that! It's an institution, with historical significance akin to any memorial of the Civil War, or the home Wilma Lee Cooper!	Against Closure	Email - Scanned	11/22/2016	
241	b	John	Saunders		"We" need to figure out a way to allow this institution to provide enough value that it can remain open. Perhaps Donald Trump can reach across the aisle and get together with Joe Manchin, and work something out?	Alternatives Consideration	Email - Scanned	11/22/2016	
242		Rachel	Shepard	Marlinton Presbyterian Church	I am writing to share my support for Green Bank Observatory. It is an asset to Pocahontas County, West Virginia, the United States, the science community, and the world. I understand that it may change, but I hope that the observatory will continue to operate as a telescope as well as a tourism spot. I hope it will continue to employ as many people as possible. Please move forward with the people of Pocahontas County in mind. Many thanks for all your hard work in discerning the future of the GBO. We appreciate your involvement and help.	Against Closure	Email - Scanned	11/22/2016	
243	a	Laura	Steiner Christy		I am writing to express my concern that the Green Bank Observatory may cease to exist in its current form. My family and I have been visiting the site for many years, since before the current information/science center opened. We have enjoyed the beautiful and serene setting, the awe--- inspiring experience of seeing the telescopes up close, and reading about the incredible discoveries made there. The science center has been a wonderful addition to this facility and, no doubt, has sparked an interest in science for many children who have visited, including my own son. My hope is that the National Science Foundation will continue its current level of funding, so research can be continued at this facility instead of having to be moved to sites outside of our country. While I am not opposed to the addition of more private funding to the current NSF support, I am concerned that competing motivations from different funding groups could jeopardize the main mission of the site, namely scientific exploration and education.	Against Closure	Email - Scanned	11/22/2016	
243	b	Laura	Steiner Christy		While I understand that the NSF is not primarily expected to be an economic engine for any community, what the NRAO has brought to West Virginia is immeasurable. It has brought money and jobs, of course, but also National exposure for WV in a positive way that we residents rarely experience. As residents of a state frequently at the bottom of every favorable ranking, we are very proud to have an internationally renowned science facility within our borders. When out---of---state (and out---of---country) visitors leave, they take with them positive images of our state and people. We will lose greatly if this ceases to exist. In closing, I hope that the NSF will find a way to continue support of this wonderful facility.	Against Closure	Email - Scanned	11/22/2016	
244	a	Jeff	Thrash	KF5ZAF	It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions. Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.	Against Closure	Email - Scanned	11/22/2016	
244	b	Jeff	Thrash	KF5ZAF	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

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244	c	Jeff	Thrash	KF5ZAF	<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email - Scanned	11/22/2016	
245	a	Bill	Hagebusch	KE5ZVF President Texas Emergency Amateur Communicators	<p>Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.</p>	Against Closure	Email - Scanned	11/22/2016	
245	b	Bill	Hagebusch	KE5ZVF President Texas Emergency Amateur Communicators	<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email - Scanned	11/22/2016	
245	c	Bill	Hagebusch	KE5ZVF President Texas Emergency Amateur Communicators	<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email - Scanned	11/22/2016	
246	a	Elizabeth	Jensen	Planetary Science Institute, Associate Researcher ACS Engineering & Safety, Ltd., Chief Engineer Referee PAC, Treasurer	<p>Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.</p>	Against Closure	Email - Scanned	11/22/2016	
246	b	Elizabeth	Jensen	Planetary Science Institute, Associate Researcher ACS Engineering & Safety, Ltd., Chief Engineer Referee PAC, Treasurer	<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email - Scanned	11/22/2016	
246	c	Elizabeth	Jensen	Planetary Science Institute, Associate Researcher ACS Engineering & Safety, Ltd., Chief Engineer Referee PAC, Treasurer	<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email - Scanned	11/22/2016	

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247	a	Kenneth	Braunstein	KE5AKC General Class Amateur Radio Operator	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	
247	b	Kenneth	Braunstein	KE5AKC General Class Amateur Radio Operator	Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email - Scanned	11/22/2016	
247	c	Kenneth	Braunstein	KE5AKC General Class Amateur Radio Operator	It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions. Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.	Against Closure	Email - Scanned	11/22/2016	
248		Kelly	Banton	County Commission Assistant	We are writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory. The Greenbrier County Commission is the administrative and governing body of Greenbrier County, WV which is Pocahontas County's southern neighbor. We feel that the Green Bank Observatory is a major asset to Pocahontas County, neighboring counties and to the State of West Virginia. In addition to the scientific aspects of the Observatory, it is also a key employer to the region, a vital participant of educational advancement to the local children and every visitor that walks onto the grounds, along with being a growing tourist destination. It is our intention to support of the continued operations and full NSF funding (NO-Action Alternative) of the Green Bank Observatory facility in Pocahontas County, WV which has proven its endless assets to the State of WV and the United States in scientific research, education, and economic benefits.	Against Closure	Email - Scanned	11/22/2016	SKMBT_C35161122101200.pdf
249		Mark	Morgan	Resident	Nearly everyone I know is shocked and confused about the recent decision by the National Science Foundation to even consider downgrading the Green Bank National Observatory. Why? 1) it brings in a tremendous amount of tourism and related revenue to the state and local community. 2) it has one of the largest movable telescopes in the world and the facility is capable of collecting extraordinary data. 3) huge investments have been made into this facility by local government, state government and federal government. 4) it is not an obsolete facility. 5) shutting down this facility will have devastating financial and cultural consequences for Green Bank, Artovale, Pocahontas County and the State of WV. 6) most of its employee will suffer greatly, and their lives and livelihood will be severely upset, possibly some will never recover. The above are just a few reasons I ask that there be a "Continued NSF Investment for Science" at the Green Bank Facility, and that "Collaboration with Interested Parties for Science" also be utilized!	Against Closure	Email - Scanned	11/22/2016	
250		James	Allman		I graduated from Elkins High School in 1965. From elementary school through high school, in the mid--1950s, our country strove to encourage our students to enter science and engineering. West Virginia was also losing our best and brightest students. I vowed to go into engineering and stay in West Virginia which I have done. While I am a graduate Civil Engineer, I have always had a great interest in science and astronomy. The Green Bank Observatory has always been a great asset for West Virginia and a major asset to our country through space research and science. It also brings some valuable academia and science investment to a state that is short changed on scientific endeavors. I am sure this valuable scientific observatory can be used not just to provide an economic investment to a rural county and state that real needs this scientific investment, but can also can also continue to provide invaluable scientific research for America. Please find a way to maintain Green Bank Observatory to allow it to continue to provide the this valuable research for America and provide a valuable economic asset to rural West Virginia. Thank you for your full support of this facility.	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
251		Chris	Bochenek	Student, California Institute of Technology	<p>My name is Chris Bochenek. I am a current first year astronomy graduate student at the California Institute of Technology, and I would not be where I am today without the Green Bank Telescope (GBT).</p> <p>I spent two summers participating in the NSF funded Research Experience for Undergraduates (REU) program at the National Radio Astronomy Observatory (NRAO). Each summer, the NRAO allows students to apply for reserved Time on the GBT. During my first summer, I applied for and received this Time to observe a newly discovered pulsar to get a better measurement of its position. This experience was invaluable to me. It taught me how to evaluate an idea and show that it is reasonable, and how to write a good proposal. Furthermore, I learned from start to finish how astronomers get data that is vital to our work, and gave me confidence to know I could get through this process. These skills and knowledge will serve me well throughout my career.</p> <p>My entire second summer at the NRAO was spent analyzing GBT data. I used a decade of GBT observations to try to understand how light is blocked during the eclipses of some pulsars. From this work, I found some interesting new clues to the story of eclipsing pulsars and presented this work at the 227th Meeting of the American Astronomical Society. Learning about the algorithms and statistical techniques needed to handle the large data sets in modern astronomy was also crucial to my development.</p> <p>I sincerely believe that the training I received at the GBT and from working with GBT data prepared me to be a successful astronomer. When applying to Caltech, I sold myself on the skills I learned because of the GBT. My application would not have been successful without these experiences.</p> <p>Without the GBT operating at the forefront of science, fewer students like me, especially those interested in pulsar astronomy, will not have the opportunity to develop the skills needed to succeed in science. Traveling to Green Bank to observe on the telescope made a big impact on me and my confidence in my ability to pursue science, and it would be a loss for future generations to not be able to have that same experience.</p> <p>I implore the NSF to continue to fund both science---focused and education---focused operations at the Green Bank Observatory. As it should be evident, these operations have had a large impact on my career and it would be a shame for future generations not to have the same opportunities I did. In addition, my work with GBT shows that there is still much frontier science that the GBT can do and should do. Mothballing the GBT or turning it into a technology and education park leaves so much untapped scientific impact and impact on the careers of young scientists. If I proposed to use a GBT that was part of a technology and education park, it would not have given me the same confidence to pursue science as a GBT that is a world---class facility. Finally, deconstruction and site restoration completely removes any potential for the GBT to have an impact on young scientists and should not be considered given the enormous impact I know the GBT has had and can continue to have.</p>	Against Closure	Email - Scanned	11/22/2016	
252	a	Jerry	Reasner		Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and thus instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	
252	b	Jerry	Reasner		Finally being the only radio---quiet territory in the US for performing research, its closure would eliminate entire spectral bands of research to the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average hammer.	Against Closure	Email - Scanned	11/22/2016	
252	c	Jerry	Reasner		<p>It would be foolish to eliminate the largest steerable radio dish from the USAs assets. The current facility and the dish prior served as invaluable resources to NASAs space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently prevented significant losses to the return from tax payer investments into space missions. Rebuilt as recently as the early 90s, it also has hardly been utilized long enough to return taxpayers investment into it. Around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days, and is unique among various radio telescope systems operating in GHz observing with its open proposal process.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource. Let me also add that as Time has gone by over the last few years, since President Clinton, actual real science has taken the backseat to other projects. I am one of those people who believe that since there are galaxies older than ours, and even within our own galaxy, there are million of suns many of them much older than our sun, and of the millions of suns, they are probably more planets. to me, the chances of an intelligent life form some place in either our or another galaxy are very high. Should there be such a civilization and if they have developed to the place where we are now, the chances of such a civilization being able to send and receive radio signals are very good. If we take any any asset where we may be able to receive a radio signal from a distant galaxy, to me that would be a grave mistake.</p> <p>I have worked in the field of electronic communications for over 50 years. First while in the Air Force, then at Los Alamos National Laboratory, then with Motorola in both digital and RF disciplines. Since I retired I currently help people with their Internet needs, and I am an Extra Class Ham Radio Operator. I teach Technician Class Ham Radio classes a couple of Times a year.</p> <p>Please feel free to contact me should you desire.</p>	Against Closure	Email - Scanned	11/22/2016	
253		Janet	Gunther		Please save the observatory for future generations to have this wonderful educational experience.	Against Closure	Email - Scanned	11/22/2016	

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254		Kathryn	Devine	Associate Professor of Physics	<p>I am a physics professor at The College of Idaho, a small, liberal arts institution. Since 2013, I have used the GBT with my students to obtain data. Because of support from the NRAO, I was able to take two undergraduates to Green Bank to be involved in observing and data calibration. Several other undergraduates have sat in on remote observing from the C of I campus. Nearly a dozen undergraduates have been involved in my research using GBT data, and at least six of these students are or will be co-authors on peer-reviewed journal articles resulting from our work. The research experience for my undergraduate collaborators has been crucial to their further career progress, and has helped them obtain internships, scholarships, and graduate school opportunities. The College of Idaho has extremely limited funding to support faculty and student research. The Time-allocation model of the GBT, in which Time requests are judged on scientific merit but do not require a financial contribution from the researchers' institution, made our projects possible.</p> <p>I hope to see the unique science available through the GBT continue, and for the GBT's focus to remain on astronomical research. I also hope that small colleges such as mine can remain competitive for Time on this phenomenal instrument. Thus, I want the NSF to continue its investment for science-funded operations of the GBT (the "No-Action Alternative"). However, I am sympathetic to the pressures of allocating a limited budget and the need to focus resources on the science goals identified in the New Worlds, New Horizons report. As such, I also reluctantly support reduced NSF-funded support and increased collaboration from external parties, as long as these external parties are also research driven and astronomical research will remain the primary objective of the GBT. I do not support a model in which external parties divert the GBT toward commercial activities, eroding the science staff and infrastructure at Green Bank and undermining the ability of the instrument to function for research.</p>	Against Closure	Email - Scanned	11/22/2016	
255		Madelyn	Frick		<p>I have visited Green Bank as a parent chaperone several Times and have enjoyed it as much as the students have. It is a beautiful thing to see the excitement and dedication toward learning this trip inspires. These are smart young women and men who work together throughout the night to experience science in action. The intelligent need places to exercise their minds.</p> <p>Please choose option 1 or 2. Don't let this opportunity slip away.</p>	Against Closure	Email - Scanned	11/22/2016	
256	a	D.J.	Pisano	Associate Professor WVU	<p>One of the projects that is funded by the NSF is to develop a new type of radio camera, called a phased-array feed, for the GBT. This is type of engineering project that cannot be done on an array like the VLA nor can it be done by US scientists and engineers on foreign single-dish telescopes due to the added costs and relative inaccessibility of these telescopes. These types of cameras are being developed in Australia and the Netherlands as well, but without the GBT as a test bed, the scientific and economic benefits of this technology would remain overseas.</p>	Against Closure	Email - Scanned	11/22/2016	gbo_leber_pisano.pdf
256	b	D.J.	Pisano	Associate Professor WVU	<p>In considering the five alternative funding options for the Green Bank Observatory, I can say that any option that takes away from scientific observation (deconstruction, mothballing, or converting it to a technological and educational park) would be devastating for astronomical research at WVU. Our connection to Green Bank is what makes WVU a premier institution for radio astronomy; without it, there would be little professional reason for any of us to remain in West Virginia. While WVU currently purchases some time on the GBT, giving us guaranteed access to the telescope, the amount of funding available to WVU and other universities and colleges is not sufficient for us to do the science that we are currently doing through the NSF open skies access. It is better than closing the site, but it is still a poor option. By reducing the amount of open access time on the GBT only radio astronomers at wealthy universities and colleges will be able to access the telescope. This limits the scientific impact of the GBT, but also limits the number and diversity of students who can benefit from the scientific training available in Green Bank. This will severely restrict the socioeconomic benefits of the site for underrepresented groups and disadvantaged students. As such, the no-action alternative will have the most benefit for the local and broader community in West Virginia and throughout the US.</p>	Against Closure	Email - Scanned	11/22/2016	gbo_leber_pisano.pdf
256	c	D.J.	Pisano	Associate Professor WVU	<p>My involvement with the Green Bank Observatory dates back to 1995, when I spent 10 weeks as a summer student conducting a research project using the old 140-foot radio telescope. At the time, the Green Bank Telescope was still under construction. While I was already planning to become an astronomer, that summer experience in Green Bank (one of three different summer research experiences I had) helped make me a radio astronomer. I have maintained the scientific connections I made that summer through the present day. I am currently an associate professor of Physics and Astronomy at West Virginia University in Morgantown, WV where I have been resident since 2009, and my students and I still actively work with the scientists in Green Bank. Most summers my students and I spend about one month in residence at the Green Bank Observatory contributing our time and money to the local community. Since arriving in Morgantown in 2009, I have employed five graduate students and four undergraduate students in conducting research using GBT data. These students and I have had over 1900 hours of GBT time since 2009 mostly studying how hydrogen gas is acquired by galaxies. This GBT time has comprised critical portions of all five students' PhD theses and led to over \$1.3 million in NSF funding. I can say without exaggeration that neither my students nor I would be at WVU or in the state of West Virginia in the absence of the Green Bank Observatory. In addition, the science we are doing is not currently feasible with any other radio telescopes in the world. With the closure of the GBT (and potentially Arecibo), US astronomers will be deprived of the ability to study faint hydrogen gas as we will have limited access to the radio telescopes in other countries.</p> <p>In addition to the scientific and economic impact of the GBO, I am actively involved in the educational programs ongoing there. I have been a lecturer and mentor for middle school students participating in the Governor's Schools for Math and Science every summer since 2009. I have brought WVU undergraduate students to Green Bank to use the 40-foot radio telescope (also used by about a thousand school kids every year), and I am using the Green Bank 20m radio telescope as part of an educational activity for middle school students in and around Morgantown. All of these activities give students the opportunity to do real science as part of an open-ended, inquiry based project. Furthermore, by interacting with real scientists from all over the world, these students can see the diverse range of people who can do astronomy. That these activities occur where the first astrophysical molecules were discovered, These activities have helped inspire these students to pursue studies in STEM fields; I have seen graduates of the Green Bank educational programs in my classes and as Physics majors at WVU. These educational activities would either not exist or be severely compromised without GBO and the two educational telescopes.</p>	Against Closure	Email - Scanned	11/22/2016	gbo_leber_pisano.pdf

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257		Joey	Aloi		<p>Please keep the Green Bank Observatory open. It has economic importance for West Virginia and Pocahontas County. It gives poor children in the coalfields something to aspire to. And if we lost the National Radio Quiet Zone, there'll be nothing like it on this side of the Mississippi for years to come. Quiet spaces are important.</p> <p>More importantly, Central Appalachia is in a state of economic transition. The extraction industries that have been central to the region's economy for the past hundred years are disappearing through automation, globalization, and technological change. This period of transition has been devastating already, causing many people to flee the state and many communities to dissolve. Now more than ever, Appalachians, and especially West Virginians, need the hope and inspiration that Green Bank offers - ----- the hope that there is a future in education, that school matters and that, even in West Virginia, the mysteries of the universe are accessible through these telescopes.</p>	Against Closure	Email - Scanned	11/22/2016	
258		Al	Wooten		<p>I am an astronomer, a member of the NRAO scientific staff and the faculty of the University of Virginia,</p> <p>The [GBT] stands alone as the highest achievement in the long history of American telescope construction. It provides the largest collecting area in the world with unmatched sensitivity and directivity for frequencies up to 116 GHz. As it is of fairly recent construction, its capabilities at the highest frequencies have only recently been realized. That has occurred in part through the dedication of highly talented staff who have brought the cutting edge of technical achievement to the remote area in which it is located. That remote location itself is part of the observatory's uniqueness as it sits in the heart of the National Radio Quiet Zone and West Virginial Radio Astronomy Zone, an area specifically designated to the sensitive radio astronomy operations carried out at the [GBO]. Since the (NSF) Astronomy Division's outdated Portfolio Review of 2012, the [GBT] has provided the US millimeter astronomy community with the world's most powerful tool for exploring thermal emission from molecules in cool sources such as emerging galaxies and star forming regions in the northern hemisphere. The [GBT], an instrument of tremendous scientific productivity, provides US astronomers with their only current access to the supramillimeter sky outside of the venerable ARO installation on Kitt Peak. The [GBT] enables productive use of ALMA by astronomers in the United States as well as providing sensitive access to the northern sky. Two of ALMA's partner communities, at ESO and at NAOJ, have access to an array of facilities (IRAM Plateau de Bure, IRAM 30m, APEX, OSO and in fact part of ARO for ESO, ASTE and the NRO 45m for NAOJ) which are in practice unavailable to US astronomers. US users of the GBT at 3mm have submitted over 200 ALMA proposals in the past three cycles. ALMA Time is very difficult to obtain and demonstration of concepts through ancillary data obtained with the GBT is an important factor in obtaining Time. The GBT's collecting area and spectral line sensitivity are similar to that of ALMA. Its 8" beam size offers resolution comparable to that of ALMA. American access to telescopes has diminished with the closure of CARMA and the reduced funding of ARO though currently the Smithsonian Array operates at higher frequencies. The relative productivity of US astronomers in publishing ALMA data is lagging—they have authored 29% of ALMA papers compared to the 42% from ESO. Closing the [GBT] would further jeopardize our communities' competitiveness. The [GBT] stands at the threshold of an era in which its already unparalleled capabilities might be enhanced a hundred or thousandfold by array receivers. The GBT hosts instruments constructed through collaboration with the US community, enhancing US technical prowess and providing student training in advanced technology. Recently, the MUSTANG bolometer array, built by a collaboration including the University of Pennsylvania, NIST, NRAO, GBO, the University of Michigan and Cardiff University was upgraded to 200 single--- polarization, feedhorn coupled bolometers with an instantaneous 2.5' field of view, well---matched to ALMA's 90 GHz field of view of about 1'. ARGUS, built by a collaboration of Stanford, Cal Tech, Maryland and NRAO provides 16 beams of about 8" size for spectroscopy from 80---116 GHz, again well---matched to the ALMA field of view.The [GBT] offers unique and powerful scientific opportunities to investigators and empowers American use of other facilities, funded by NSF, NASA or privately, to reach high levels of productivity.</p>	Against Closure	Email - Scanned	11/22/2016	
259		Thomas	Troland	Physics & Astronomy Department University of Kentucky Lexington KY	<p>As a user of the Green Bank facilities since 1969, I wish to offer my thoughts regarding the future of the Robert C. Byrd Green Bank Telescope.</p> <p>The GBT is a unique instrument for radio astronomy in terms of frequency coverage, unblocked collecting area, and sky coverage. The telescope has been remarkably productive during its still relatively short lifetime, and it is supported by a dedicated staff of scientists, engineers and other personnel. Indeed, the infrastructure of the GBT resides as much in the human expertise at the site as in the hardware.</p> <p>I understand that the NSF is under significant budget pressure, given a variety of astronomy projects it currently funds and wishes to fund in the future. Yet the partial or complete loss of GBT capabilities would be very detrimental to the scientific community.</p> <p>The GBT is the premier instrument of its type in the world. It is in the prime of its operational lifetime. It represents decades of human effort in design, construction, commissioning and continuing development. The GBT also represents a very large investment of NSF funds over the years. It would be very regrettable to invest such human and financial resources and not reap the full rewards of the facility.</p> <p>Of the alternatives described in the Federal Register document, the first (No---Action Alternative) is by far the best. The second alternative (Collaboration with interested parties) risks a substantial dilution of the availability of the GBT for pure science purposes, depending upon which interested parties, if any, can be identified.</p> <p>Therefore, I urge the NSF to make every possible effort to support the GBT so that it can continue making major contributions to astronomical research at radio frequencies.</p>	Against Closure	Email - Scanned	11/22/2016	
260	a	Mark	Reid	Senior Astronomer Smithsonian Astrophysical Observatory	<p>This letter is in regard to the NSF solicitation for input regarding the environmental impact statement for proposed changes to the Green Bank Observatory Operations and, more generally, the future of the 100-m telescope. The Robert C. Byrd Green Bank (GBT) 100-m telescope is the largest, best performing radio antenna in the world. It has produced and is producing some of the most important results in radio astronomy. Also, it is the only radio telescope located in a Federally controlled radio quiet zone.</p>	Against Closure	Email - Scanned	11/22/2016	gbt_support.pdf

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260	b	Mark	Reid	Senior Astronomer Smithsonian Astrophysical Observatory	The Senior Review committee that recommended divesting NSF support made an ill-advised conclusion for two reasons. Firstly, it was given a charge that Decadal Survey recommended new initiatives must be funded, even if it meant throwing away multiple telescopes that were built under previous Decadal recommendation. My reading of New Worlds, New Horizons is that that Decadal committee would not agree with this approach. Secondly, the Senior Review is now out of date and current events have significantly added to the scientific potential of the GBT. In particular, the astounding discovery of gravitational radiation by LIGO has opened up a new window to physical processes in the Universe. The GBT is critical to this venture, as the nano-GRAV pulsar timing array will provide a new, unique, and complementary window for gravitational radiation. Given the \$100M NSF investment in the GBT and the reasons given above, I strongly recommend continued relatively modest support for the operation of the telescope for the U.S. astronomy community.	Against Closure	Email - Scanned	11/22/2016	gbt_support.pdf
261		Sarah	Francke	Director of Operations, ABCWV	West Virginians value the science, STEM jobs, public education opportunities, and tourism revenue provided by the Observatory. The Observatory is state treasurer and leader in cosmic research (the nature of gravitational waves, interstellar chemical processes to determine the building blocks of life, planetary formation, stellar evolution, etc. The cosmos need this. Much more needs to be done in regards to making this a matter of public awareness.	Against Closure	Email - Scanned	11/22/2016	
262		Randall	Ridenour	Orbital ATK Director, Structures and Large Caliber Programs Tactical Subsystems	I have been a longtime advocate of the Green Bank Observatory, visiting and learning about the research being performed there for the past 25 years. I introduced my daughters to the field of radio astronomy at Green Bank during our visits and can say that what they learned and observed there helped to shape their interests in science, technology and engineering. They both are engineering students at West Virginia University and to this day feel strongly about the science that they learned while visiting the observatory. I'm sure that many children have been motivated in the same manner as my daughters. I believe that the research performed at Green Bank and the resulting data is invaluable to furthering our understanding of the universe. The knowledge that is being acquired today will likely be needed in the future to sustain mankind's existence. For all of these reasons, I ask that you continue to fund the Green Bank Observatory and the research activities that take place there.	Against Closure	Email - Scanned	11/22/2016	
263	a	Xavier	Siemens	Chair, NANOGrav Director, NANOGrav Physics Frontiers Center Associate Professor Center for Gravitation, Cosmology, and Astrophysics Department of Physics	Human and Cultural Importance of the Green Bank Telescope We are writing to comment on issues related to human and cultural environment. Any option that NSF pursues that is incompatible with continued science--focused operations at Green Bank will put in serious peril 1) the ongoing science and engineering training of students from high school through postdocs, discussed further below, 2) the research and careers of our more than one hundred students and scientists in NANOGrav, 3) US leadership in low--frequency gravitational wave astronomy and high precision pulsar science, and 4) a new scientific discovery as profound as the one announced by LIGO earlier this year. Over the past decade NANOGrav has involved a diverse group of hundreds of US high school and undergraduate students in Green Bank Telescope observations of pulsars and gravitational wave astronomy. The Green Bank Telescope has played a particularly inspiring role in training underrepresented West Virginia high--school and undergraduate students through the Pulsar Search Collaboratory based at West Virginia University. Over 2000 high---school students, 50% of them female, have participated in the program over eight years, and several of these have gone on to be involved in NANOGrav research at undergraduate institutions. Currently more than 50 NANOGrav undergraduate and graduate students form a critical part of our group of Green Bank Telescope observers. The excitement of our students in personally operating the Green Bank Telescope has propelled many of them into careers in physics, astronomy, engineering, and other STEM fields. With Green Bank's continued science---focused operations, over the coming years hundreds more students will continue doing cutting edge research by operating the most sensitive steerable radio telescope in the world in our search for gravitational waves, a truly valuable research and educational experience for them.	Against Closure	Email	11/25/2016	NANOGravGBOEISNOIResponse.pdf

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263	b	Xavier	Siemens	Chair, NANOGrav Director, NANOGrav Physics Frontiers Center Associate Professor Center for Gravitation, Cosmology, and Astrophysics Department of Physics	<p>We are the North American Nanohertz Observatory for Gravitational waves (NANOGrav), a collaboration that involves over 100 students and scientists from 15 institutions in the US and Canada. The US portion of NANOGrav is largely funded by the National Science Foundation's NANOGrav Physics Frontiers Center. Using the Green Bank Telescope and the Arecibo Observatory, our collaboration is doing gravitational wave astronomy: we are leading the search for low-frequency gravitational waves produced by the mergers of supermassive black holes at the centers of galaxies. These low-frequency gravitational waves have periods 11 orders of magnitude longer than those discovered by LIGO and announced earlier this year. By regularly monitoring millisecond pulsars with our telescopes, we are building an observatory, much like LIGO, that will open a window onto a completely new part of the gravitational wave spectrum. We are now at a time when we have reached unprecedented sensitivities and are exploring astrophysically relevant parts of galaxy evolution parameter space. A detection could therefore happen soon. The Importance of the Green Bank Telescope</p> <p>The Green Bank Telescope is the most sensitive steerable radio telescope in the world. Lack of access to this instrument will delay the first detection of gravitational waves in the regime accessible to pulsar timing, and significantly hamper efforts to maximize astrophysical studies using these waves once they are detected. Given the unprecedented sensitivity of NANOGrav, and LIGO's recent gravitational wave discovery-----which was appropriately announced with much fanfare by both LIGO and NSF, and has already received several major scientific prizes-----we were surprised to learn about NSF's decision to continue divestment in the GBT, thus triggering the need to develop a scoping notice for an Environmental Impact Statement. The scientific context has changed profoundly and the scientific merits of this facility need to be re-examined. Other telescopes, particularly the FAST telescope now under construction in China or the proposed SKA phase 2 telescope in southern Africa, have been suggested as possible replacements for the Green Bank Telescope for our gravitational wave science program (though they would not contribute to the educational mission described above). While in the future these facilities may offer more raw sensitivity than the Green Bank Telescope, they will not be able to observe the full northern hemisphere sky, and their suitability ultimately depends on the instrumentation and observing programs implemented at those facilities. In addition, we will not know for several years whether these international facilities will be available to scientists from the United States; these new radio telescopes are not expected to operate under "open skies" policies. Given the timescales for building and commissioning these new instruments, as well as our need for overlapping observations to link existing data sets to data collected with the new instruments, it is critical that Green Bank continue to operate in the coming years. Green Bank's status among US and world radio facilities should be re-evaluated when the new facilities are in full operation and when it is understood whether U.S. scientists and their international collaborators have access to them. If you have any questions or would like to reply to our letter please contact the NANOGrav Management Team (nano-mt@nanograv.org).</p>	Against Closure	Email	11/25/2016	NANOGravGBOEISNOIResponse.pdf
264	a	Justin	Richmond-Decker		<p>You have no doubt been reading through mountains of wonderful feedback about the positive effect the Green Bank Observatory has on the people and the community. Well, I agree with all of it. The Observatory has not only had a hugely beneficial impact on my own life, but the lives of many people I meet and know in my daily life. I don't know of another place that does such wonderful science, while at the same time being so welcoming and inclusive to all people who pass through.</p> <p>I believe that the most important aspect of an organization is how it treats individuals; human beings. And I believe that two of the most important things you can do for a person is to bring them joy and bring them knowledge. And the Green Bank Observatory does that for every single person who sets foot on site. The Green Bank Observatory not only offers excellent employment opportunities for adults, and excellent research opportunities for students, but it also offers excellent tours and events for the public, as well as educational programs for young children.</p> <p>Personally, I have worked on the Space Race Rumpus committee for two years. This is an annual biking festival hosted by the Observatory, which has over the past five years raised tens of thousands of dollars to benefit local nonprofit organizations, supplying food to those who need it, and funding the county's wellness center. This is only one example of the many things the Green Bank Observatory does annually to the great benefit of the local community, as well as any people from afar who take part. And this is to say nothing of the top notch science and engineering that it does, which I'm sure many others have discussed in depth.</p> <p>Now let me change my attitude a bit, and discuss the NSF considerations. I am disappointed that the NSF decided to even decrease funding for the Green Bank Observatory. But, that the thought of actually shutting down the Green Bank site even entered anyone's mind, let alone became a major point of discussion, is absolutely unconscionable.</p>	Against Closure	Email - Scanned	11/22/2016	
264	b	Justin	Richmond-Decker		<p>I understand that the NSF has budget constraints, like any organization. It seems there were recommendations made to cut funding to the Green Bank site, and instead funnel this money into "newer" "fancier" telescopes. There was some perception that the type of science the Green Bank Telescope does is becoming outdated and dropping in popularity, and being replaced by demand for newer types of telescopes. For example, I know the NSF is happily pouring a bunch of money into the ALMA site, in Chile. Now, ALMA I'm sure is a fine telescope, and worthy of funding, but to say that it is MORE worthy of funding than Green Bank, because it's somehow better for the country's scientific endeavors, is absolutely 100% wrong.</p> <p>Demand for telescope time on the GBT is not decreasing at all, nor is the GBT becoming outdated. It is the most sensitive fully steerable radio telescope in the world. No other device on Earth can see so much of the sky with such power. And as we continue to develop new receivers, spectrometers, and everything in between, the capability of the telescope only improves. The GBT is an example of a fully functioning, already built telescope, which can continuously upgrade itself, and keep working for years to come. The opportunity cost for defunding something like this is immense. Basically, the NSF is considering scrapping a scientific behemoth that it spent hundreds of millions of dollars to build and develop, a behemoth that is still currently doing exactly what it was designed to do, and doing it better than ever.</p>	Against Closure	Email - Scanned	11/22/2016	

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264	c	Justin	Richmond-Decker		<p>Now, moving on from that, let us consider the aspects of defunding the Green Bank Observatory that don't involve the great science it does. Appalachia, including rural West Virginia (including Pocahontas County), is essentially the poorest region of the United States. This is an area that is struggling, and has been struggling for many decades.</p> <p>Besides farming subsidies, it seems that rural areas tend to be largely neglected by the federal government, who tends to create jobs in cities, or encourage people to urbanize. This does nothing to improve the quality of life for rural communities, and in fact makes it worse. Not only is this region deficient on money, but we are hugely deficient in quality education. Pocahontas County, though still struggling, has one of the best school systems in the state, in large part helped out by the Green Bank Observatory. ALMA (in Chile), on the other hand, employs some American scientists and engineers, but it does not boost tourism or educational outreach within the United States, nor does it bring money or knowledge into the hands of the general American people, least of all its rural citizens.</p> <p>Here we have a beautiful, cutting-edge bastion of scientific research, which brings millions of dollars annually into the state of West Virginia, and provides wonderful educational programs, not only for the locals but for people from anywhere. This is something that is providing a huge benefit to the American people who most need that benefit. And the NSF is considering getting rid of that benefit. That would be just absolutely atrocious. In a time when our country's poorest people are so concerned that the federal government is doing nothing to help them, this kind of thing certainly feeds that problem.</p>	Against Closure	Email - Scanned	11/22/2016	
264	d	Justin	Richmond-Decker		<p>Cut funding to the Green Bank Observatory, and you get rid of free telescope time that benefits science students all over the country, as well as compromising our status as a forerunner in the American scientific endeavor. That's no good. Get rid of the Green Bank Observatory entirely, and you get rid of one of the most iconic and profoundly beneficial things in West Virginia. You get rid of a learning opportunity for thousands of students every year. You get rid of hundreds of jobs, thousands of tourists, and millions of dollars that come into the state of West Virginia. You get rid of people's livelihood. You leave this county a shell of its former self, and you disgrace your entire country by carelessly removing one of its most marvelous feats of human achievement. This is more than just a place for science. It is an institution, in both the literal and figurative sense.</p> <p>The only right choice for the NSF is to continue funding the Green Bank Observatory as it has in the past. The wrong choice for the NSF is to decrease funding to the Green Bank Observatory, and force us to be funded by external partners, basically making us a business observatory. To stop operations of the Green Bank site is not a choice at all for the NSF, because that would go against everything the NSF should stand for.</p> <p>Thank you for reading, and I sincerely hope the NSF will listen to how overwhelmingly laud this Observatory is by everyone it touches, and that they will make the right choice.</p>	Against Closure	Email - Scanned	11/22/2016	
265		Mike	Brown	Mike Brown Scoutmaster Troop 81	<p>My name is Mike Brown, and I am the Scoutmaster of Boy Scout Troop 81 in Crimora, Virginia. I wanted to let you know what an incredible STEM resource that the Green Bank Observatory is to the Boy Scouts of America. I brought my son Mason, who was a Cub Scout at the time, with a group of 10 Boy Scouts from Troop 81 four years ago because he was really into astronomy. He, and I were both blown away by the overnight program for Scouts at Green Bank Observatory. Since that trip he became a much better science student. He has been to McCormick Observatory three times, has attended several star parties through "dark skies/bright kids", and attended a workshop where he built his own telescope.</p> <p>We brought another group of 13 Boy Scouts from Troop 81, including Mason, back to Green Bank Observatory on November 11-13th to work on their Astronomy Merit Badge, and the program that Sue Ann presented was even better than it was 4 years ago. Please find a way to continue funding Green Bank Observatory so that more Boy Scouts, and Girl Scouts can experience the STEM program.</p>	Against Closure	Email - Scanned	11/22/2016	
266	a	Jennifer	Weston	Postdoctoral Researcher Green Bank Observatory	<p>I am writing to express my support for the continued funding of the Green Bank Observatory.</p> <p>I am a newly minted astronomy PhD, and recently moved to West Virginia after accepting a postdoctoral position at the Green Bank Observatory. In the eight months that I have been here, I have seen the great impact that this facility has not only in the groundbreaking science that comes out of the telescope, but also on the community that surrounds it.</p> <p>As a young scientist at the beginning of her career, access to facilities such as the Robert C. Byrd Green Bank Telescope (GBT) is particularly important to me. The 100m telescope is unique in its sensitivity and its steerable nature which enables it to view 85% of the sky. The GBT's open sky access has led to new finds in pulsar research, star formation and evolution, black holes and gravity, galaxies, astrochemistry, and many other fields of astronomy. New capabilities are still being added to this telescope so that even more will be discovered in the future.</p> <p>Additionally, the training which Green Bank staff often provides for new observers helps with accessibility to radio astronomy and new opportunities in continuing research. Before coming to the Green Bank, all my observations with radio telescopes had been remote, performed by others -- being able to personally undertake my observations was a new and exciting experience even after years of working in radio astronomy throughout graduate school. The GBT is a draw to scientists like myself, who might not be able to get this experience anywhere else, and is an encouragement for us to come to this region and get an excellent start to our careers.</p>	Against Closure	Email - Scanned	11/22/2016	

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266	b	Jennifer	Weston	Postdoctoral Researcher Green Bank Observatory	Green Bank also offers public outreach and education unique to this part of the country that is irreplaceable. In addition to the many school groups and families who visit the science center each year, Green Bank provides opportunities for students which are unique to this facility, including hands on telescope training on some of the older telescopes on the observatory grounds. This includes the PING: Exploring the Cosmos summer camp, which gives 9th grade students, particularly from under-represented groups in STEM, the opportunity to stay the telescope and do their own observations and research. At a time when STEM education is under threat, programs and opportunities like this one are critical in helping young people grow and learn. The Green Bank Observatory has been at the heart of radio astronomy and the heart of the West Virginia community for almost 60 years. Continued funding would secure that place for many years to come.	Against Closure	Email - Scanned	11/22/2016	
267		Stephanie	Haden	lifelong West Virginian who wishes to remain here and raise my family	Would like to take a moment to remind the NSF that we West Virginians value the science, STEM jobs, public education opportunities, and tourism revenue provided by the Observatory. Please avoid at all costs any cuts or reductions to this facility.	Against Closure	Email - Scanned	11/22/2016	
268		Mary	Fuller		This letter is to request the GBT still have funding from the NSF. I believe there is an impact study for the NSF funding ongoing now. I am a 44 year veteran teacher. Have been teaching at a high school in Allegany County Maryland for the last 35 years. I bring my Honors and AP chemistry classes to the GBT to use the 40' radio telescope, annually. This is the only field trip I take my students. My school is in Appalachia. We are a consolidated clientele of farmers, coal miners, urban kids, and rocket scientists from ATK. Many of our students are from broken homes with no apparent income. Our school has over 69 % free and reduced lunch students. I get a STEM grant to pay for a school bus to drive us the 2 ¼ hour ride to Green Bank. For some of my students this is the only time they have left Cumberland. We spend a weekend in the Dormitory. We collect satellite information over a two night data collecting period. The students analyze the data, organize a spreadsheet with their combined results and try to explain what they have found. I have had such positive feedback from my participants. One girl went on to major in astrophysics at Pitt after she graduated. One student is now a college chemistry professor at Barnard in NY. One student is working with NOAA after he received his PhD in atmospheric physics. None of these students were the children of the Rocket scientists though. They were the children of the blue collar workers in our community. Because of the freedom to investigate on their own and use the radio telescope on the Green Bank site, they developed a desire to push themselves out of their comfort zone and try something they thought beyond their abilities. I would hate for this opportunity to be denied to my students. I know without the NSF funding, we would not be able to afford the trip. I have seen many of my students list this trip to Green Bank as the single most worthwhile lab experience of their high school. They felt independence like nowhere else. They have used it on their application to colleges. Funding is being cut everywhere. Our school district is hard hit because we are a rural area in the outermost counties of Maryland. We have a very limited tax base with many of our citizens being retired or in nursing homes. I would be very sad to see this one opportunity that I can afford to my students taken away by yet another cold budget cut. Please consider the impact the education component at the NRAO has on students before writing off the funding. I greatly appreciate your consideration.	Against Closure	Email - Scanned	11/22/2016	GBT and NSF.docx
269		Yurii	Pidopryhora		It really saddens me to hear about all this recent turmoil around the Green Bank Observatory. You see, unlike many other scientific tools, radio telescopes have very long productive age. For example, the flagship of German radio astronomy, the 100 m. Effelsberg telescope went into operation in 1972. The biggest British dish is even older: 250 ft Mark I Lovell telescope at Jodrell Bank was completed at the very dawn of radio astronomy in 1957. A couple more examples: the Australian dish of the Apollo lunar landing fame, 64 m. Parkes saw its first light in 1961, the Dutch Westerbork array (WSRT) came to the stage in 1970. And nobody would even think of shutting down these invaluable instruments, on the contrary, millions of dollars are spent year after year by the governments of the corresponding countries to upgrade these and many other lesser dishes born in 1960-1980, and to keep them honed to serve at the very cutting edge of modern science. Not just that, everybody is very PROUD to have these telescopes, they are considered no less than national monuments. So to even consider shutting down or limiting the operation of the 100 m Green Bank Telescope (GBT) which went into the operation in 2001?! This sounds like something Attila the Hun would do. While you are at it, why don't you go to the Metropolitan Museum and start burning paintings, I am sure that this can save some space and free some money too! Or maybe blow up the Statue of liberty? After all it is pretty much useless, it only occupies some very expensive place! I am resting my argument here, below I will just describe my own experience with the GBT, so maybe you will understand why I am so emotional concerning this whole matter. In 2004-2006 I spent 3 years living and working in Green Bank as a predoctoral fellow. In many ways these years were the best in my life and have determined the course of my entire academic career. In the beginning of my PhD dissertation work I wrote two successful observational proposals for the use of the GBT with myself as the principal investigator. In total we were granted about 150 hours of observation for my project and so I was lucky to spend a lot of time in the GBT control room just after it went operational. It is an amazing instrument. Since then I worked in many radio astronomical observatories around the globe and had some experience with pretty much every major radio telescope in existence, but it has never felt like that time with the GBT. As the result of these observations we have discovered something incredible: a huge super bubble of hydrogen comparable in size with our whole Galaxy, with millions of solar masses of gas locked in its enormous structure. There is no interstellar Guinness book of records that I know of, but this thing may just be the largest Galactic object in existence. If it were visible to the naked eye, it would have completely dominated our night sky. Right now it is known as the Ophiuchus super bubble and it took its place in the pantheon of important astronomical discoveries of the 21st century. We have published our findings in the Astrophysical Journal (v. 656, p. 928, 2007) and presented them at the annual meeting of the American Astronomical Society in 2005. The story has been picked up by the media and produced a news splash of 100+ newspaper, magazine articles and TV programs in many countries all over the world. But my point is, we were able to detect this gigantic new thing in the area of the sky previously covered by many other instruments in various surveys over decades. Nobody saw anything special there before we used the GBT. We have discovered the Ophiuchus super bubble because the GBT is THAT good. I hope that reason wins over greed and political games, and the Green Bank Observatory together with its collection of priceless tools and unique community thrives for many more decades and produces cornucopia of amazing results.	Against Closure	Email - Scanned	11/22/2016	

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270		E. Janney	lockman		<p>I urge to you continue funding for the Green Bank Observatory and the science that is being conducted there, not only for the sake of exploration and discovery but also because of the educational benefits to the community.</p> <p>I grew up in Green Bank and attended Green Bank Elementary Middle School, then later Pocahontas County High School. Throughout my entire education, the Observatory provided a constant supplement to my rural, public school education. Whether it was through field trips to the facility to learn about pulsars, lectures by astronomers, engineers and educators that encouraged us to dream of careers in STEM or simply supplying the community with employees who volunteered their free time to coach soccer, judge the science fair or even teach calculus, my public school education would not have proven as rich without the presence of the Green Bank Observatory.</p> <p>The reach of the Green Bank Observatory goes far beyond that of its facility and the Radio Science Community. The GBO is a major pillar of the economy in Green Bank and Pocahontas County and every child who has passed through the school system there, as well as other members of the community has been impacted in at least one positive way by its presence.</p>	Against Closure	Email - Scanned	11/22/2016	
271		Devaky	Kunneriath		<p>I am writing this email to express my support for continues NSF investment for science-focused operations at Greenbank Observatory. I am a radio astronomer and the impact that Green Bank observatory has had on radio astronomy cannot be overstated. I believe continued NSF investment in the observatory will be beneficial to the astronomy committee for many years to come.</p>	Against Closure	Email - Scanned	11/22/2016	
272	a	Daniel	Froideveux	M.F.A. Director/Cinematographer	<p>When we began filming in March of 2012, we were welcomed by the staff at the NRAO, in particular Michael Holstein and Dr. Karen O'Neil, who were tremendously generous with their time, and gave us great access to the facilities. We later conducted extended interviews with Dr. Karen O'Neil and Dr. Felix J. Lockman that were very informative, and provide the informational backbone for our film. The resulting footage from our tours of the facilities and the telescope itself is at once beautiful, and incredibly instructive. The telescope is both an engineering marvel and an architectural structure of tremendous beauty. Through the NRAO's public education programs, people the world over are invited to learn about the complex science of radio astronomy, and I expect that films like ours will only increase the public appetite to visit this unique and fascinating place.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_letter_to_NSF.pdf
272	b	Daniel	Froideveux	M.F.A. Director/Cinematographer	<p>I am writing to express my support for the continued operation of the Robert C. Byrd Green Bank Telescope. As a documentary filmmaker from Canada, my perspective is informed by the tremendous value of the NRAO, and the Green Bank Telescope as an opportunity for public education about radio astronomy.</p> <p>I am currently completing a documentary film titled The Quiet Zone, which examines both the unique science of radio astronomy, and the positive effects of the National Radio Quiet Zone for a community of people who believe that they have an illness brought on by a hyper-sensitivity to certain frequencies of electromagnetic radiation.</p> <p>While the science on the existence and causes of the electro-sensitive community's medical condition remains unclear, the positive effects of the presence of the GBT for the community are irrefutable. For many people, the existence of a unique environment which fore.es people to unplug is gaining increasing recognition as a benefit for everyone. Personally, I don't believe that a clear causal relationship between EMF and illness needs to be established in order to make a strong argument that in a society that is constantly connected there is great value in having an area that is federally protected from the permeation of wireless communications.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_letter_to_NSF.pdf
272	c	Daniel	Froideveux	M.F.A. Director/Cinematographer	<p>Finally, during our time in Green Bank, it became clear that the NRAO has had a profoundly positive effect on the community: attracting business from the international scientific community, promoting tourism in the area and creating a myriad of jobs for the local economy. We met wonderful people who worked at the observatory from service workers in the cafeteria and gift shop, to the highly skilled operators of the telescope. Everywhere we met locals who would talk to us about the observatory with a great sense of pride.</p> <p>Since returning from multiple trips to the observatory and the surrounding community, friends and colleagues from around the world have expressed interest in visiting the area.</p> <p>For all of these reasons, I urge you to consider extending the mandate of the Green Bank Radio telescope for astronomical research.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_letter_to_NSF.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
273		Jonathan	Keohane	Associate Professor of Physics and Astronomy	<p>I am a professor at Hampden-Sydney College who teaches courses in both astronomy and physics. I have been bringing my students to the National Radio Astronomy Observatory at Green Bank for a hands-on, multi-day, field trip for the past decade. I am very concerned about the future of the observatory, and the impact that it will have on the future of American astronomy.</p> <p>As a field trip destination for a 200-level astronomy course, the Green Bank Observatory cannot be beat. This is because of the unique combination of (1) a world class radio observatory, (2) an analog telescope that the students control themselves, and (3) a location within driving distance from many colleges and universities.</p> <p>This past spring, my students spend almost a week in Green Bank. During that time, they (1) mapped the neutral hydrogen in the Galactic plane using the 40 foot antenna, (2) applied a galactic rotation model to these data, (3) toured the control room for the Byrd 100 meter telescope, and (4) worked with pulsar data from the Byrd telescope. While we may have done some of these things back at school, the simple act of being at the observatory made for a completely different experience for the students.</p> <p>As I understand it, the NSF is considering the following five possibilities for the site:</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3. Collaboration with interested parties for operation as a technology and education park 4. Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) 5. Deconstruction and site restoration. <p>Given these alternatives, only the first two are viable for our continued use of the facilities.</p>	Against Closure	Email - Scanned	11/22/2016	
274		Sarah	Wheeler	Federal Relations Associate, Federal Research Relations	<p>Email: Attached you will find 6 PDF letters of support for Green Bank Observatory in response to NSF's request for comments prior to GBO's Environmental Impact Statement. Hardcopies of these letters were also mailed to Elizabeth Pentecost's attention.</p> <p>Please let me know if you need anything else regarding the letters of support, or if the PDFs will not suffice for submission.</p> <p>Letters: Each letter inserted individually.</p>	Against Closure	Email - Scanned	11/22/2016	
275		Mark	Whittle	Professor of Astronomy	<p>I write out of deep concern about the future of the Green Bank Observatory and the Green Bank Telescope, and in particular the possibility that its use by the astronomical community may be significantly reduced. In my opinion this will have a significant and negative impact: on a number of critical astronomical research areas; on the vibrancy of the radio astronomical community (both national and international); on the training of the next generation of radio-literate research astronomers; on the development and implementation of innovative new radio receivers; and on the sustainability of a continuing cohort of engineering staff who design and support the US radio astronomy observatories.</p> <p>My perspective has been recently shaped as current Chair of the NRAO Science Review Panel (SRP) for Active Galaxies, and as member of the NRAO Time Allocation Committee (TAC). As such, I have witnessed close up the number and breadth of proposals to use all the NRAO facilities (VIBA; JVIA; GBT; GMVA). I have been impressed and somewhat surprised to learn that in many ways the GBT is the most sought after instrument and has some of the greatest pressure on its time. Frequently, as the TAC goes down the proposals ranked by the SRPs, it is the GBT that hits its allocation limit first, and many excellent programs asking for its time must be rejected. The range of science being requested is not only very broad, but some of the most interesting and transformative science is represented. One thinks of the imminent detection of gravitational waves from supermassive black holes using the Pulsar Timing Array; or measuring the most accurate black hole masses using maser disks; or witnessing the event horizon of the Milky Way black hole; or the sensitive SZ mapping of the intercluster gas in high-redshift clusters. I could go on, but heres a final example: One of the categories that receives the highest pressure is when the GBT is a crucial element in a global array of telescopes (that can include the Russian RadioAstron satellite), providing the highest angular resolution currently achievable. It's the GBT's great sensitivity that make it a necessary element in these projects, many of which would be impossible without it. I use this example in part because it highlights the international impact that the GBT has.</p> <p>While my own experience of using the GBT and being aware of its impact on research through seminars and the research literature, is of course limited and specific to my own interests, I believe my perspective from the NRAO TAC gives me a much broader and clearer view of the crucial place that the GBT occupies within the radio astronomy community, and in the wider astronomy community. I can say, without any hesitation, that the GBT has played, and hopefully will continue to play, a fundamentally important role as one of the USA's and World's, premier instruments for scientific research.</p>	Against Closure	Email - Scanned	11/22/2016	
276		Jeb	Bouchard		<p>I live in the small, rural state of Vermont. I know how important access to resources are. GBO provides their small town with the means to sustain their elementary school. It provides jobs for local, highly educated people. It offers research and science and understanding of the universe. There is no price tag for this. The greater GBO community rely heavily on the continued operation of GBO.</p> <p>Please consider maintaining full operations and continuing to invest in science- focused operations.</p>	Against Closure	Email - Scanned	11/22/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
277		Christopher	Handy	1st Lt, USAF Flight System Test Engineer	<p>My name is Christopher Handy and I'm currently a Test Engineer for the United States Air Force. When I was in college, I was a part of a trip to the observatory that was sponsored by a radio astronomy course I took. Having visited the site and seen it, I felt that it wouldn't be right if I didn't voice my opinion that this site should NOT be deconstructed or mothballed. Mothballing a facility is never as simple as the statement makes it sound. At my current duty station in Tennessee, we are currently bringing several facilities out of mothball status and the cost of doing so is very high compared to what routine maintenance would have cost over the mothball period. As far as deconstructing, this option would waste a great opportunity to support universities in their coursework and research. It would also miss the mark on the governments push in STEM investments which has been a crucial area that the Air Force has focused its activities. I have no doubts that the National Science Foundation has as much or a greater focus than we do on this area.</p> <p>Ultimately, I think the best option would be to continue investing for science focused operations but knowing full well that the budget for scientific research has been cut over the last few years, the next best option would certainly be to focus on STEM education with interested parties.</p> <p>Thank you for your time in the matter and I wish you a happy Thanksgiving!</p>	Against Closure	Email - Scanned	11/22/2016	
278		Sharon and John	Clouse		<p>I was introduced to the Green Bank Observatory (GBO) about 5 years ago when a family member, Loren Anderson, became affiliated with West Virginia University (WVU). Loren is an Assistant Professor of Physics and Astronomy at WVU and has observed at GBO for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made. It is crucial that we continue to support scientific endeavors such as GBO and I urge you to maintain full operations and continue to invest in science-focused operations.</p> <p>I would also like to stress is the impressive impact the GBO makes in the hills of Pocahontas County, WV. This region is an oasis of inquisitive, bright, and hard-working people who are proud to contribute to this world-class instrument. It is also unique as a radio-free zone, located within a relatively short distance of many urban areas (4 hour drive time to Washington, DC). Loren has worked each summer at GBO and brought his family to stay at the campus facilities located there. The summer scientific community is rich and they have made friends with numerous families who call the GBO-area their home. We understand without the facility, the town will no longer be able to support an elementary school.</p> <p>West Virginia is clearly struggling and it is frequently listed as one of the states failing its residents in terms of education, poverty, and health. Despite those challenges, residents are also an incredibly proud group, made more so by the superb contributions we can make by supporting this facility in its continued full operation.</p> <p>As you consider your options for the GBO, I strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, county, and state rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/22/2016	
279		Hannah	Dalporto		<p>I am a West Virginian with great interest in the Greenbank Observatory. The Observatory is an undisputed national and state treasure, and an incredible resource to science. We all value the science, STEM jobs, public education opportunities, and tourism revenue provided by the Observatory. I hope you will consider my voice when reevaluating the funding this important landmark and resource should receive.</p>	Against Closure	Email - Scanned	11/22/2016	
280		Barbara	Weaner		<p>I heard that once again the Greenbank Observatory is threatened with closure. I hope this will be reconsidered.</p> <p>My children benefited from school visits to the Observatory, and I have had patients employed there. The small community of Greenbank relies on the station for commerce and employment. The station has benefited scientific exploration. The telescopes are expensive and it would be a huge loss to make them defunct.</p> <p>Is there a creative solution that can come up with a way that the station could stay open? Has alternative funding been sought? Can you partner with business or education (Universities or colleges)?</p> <p>I know these are financially strained times, but science is important.</p>	Against Closure	Email - Scanned	11/22/2016	
281	a	Tracy	Clark	Research Astronomer Remote Sensing Division US Naval Research laboratory	<p>The 100-meter Green Bank Telescope (GBT) at the Green Bank Observatory (GBO), the largest steerable single-dish telescope in the world, is a highly valuable and unique astrophysical resource to the scientific and academic community. The high frequency capabilities of the GBT are key to a wide range of critical scientific investigations. In particular, the high frequency system on the GBT is highly valuable as a complement to the AIMA interferometer. In addition, GBT's rapid sky scanning and large field of view serve as a critical source finder for high-resolution AIMA follow-up.</p> <p>The scientific output and future impact of the GBT is very high. I am therefore writing in support of the "No-Action Alternative" to continue the current methods of science operations at the GBO, including the Open Skies policy which leads to time allocations to the highest quality scientific studies.</p> <p>The GBT is a dynamic and evolving instrument. The high-frequency science case shown in Bally et al. (2016) [https://arxiv.org/abs/1610.09014] outlines the latest upgrades that are recently commissioned and/or still being commissioned. These continued enhancements keep the GBT at the forefront of scientific investigation and continually expand its impact on astrophysics. I have most recently been involved in collaborations that will engage the MUSTANG-2 back end for studies of galaxy cluster pressure substructure at high angular resolution compared to other cosmic microwave background instruments.</p>	Against Closure	Email - Scanned	11/22/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
281	b	Tracy	Clark	Research Astronomer Remote Sensing Division US Naval Research laboratory	<p>The GBT also serves a powerful role as an educational and training instrument for the new generation of instrumentalists and observers. The GBO itself, including the visitor's center, is a powerful resource for attracting STEM interest across the State of West Virginia and beyond. Recently there have been millimeter/submillimeter facilities that have been privatized or completely shut down, seriously reducing the facilities available for training the current and future generations of high frequency researchers.</p> <p>The scientific productivity of the GBT and the educational/outreach role of the GBO are both shining examples of how nationally funded facilities can meet the NSF AST mission of supporting forefront research, ensuring scientific excellence to the U.S. community, supporting new instrumentation, and providing a broad understanding of science to a diverse community. The power of the GBT to excel across the board on NSF mission requirements clearly reveals its importance to the U.S. community.</p>	Against Closure	Email - Scanned	11/22/2016	
282		Emily	Brown	Director of Applied Research Knowledge Management & Development Dept.	<p>I am writing today to voice my support for the continued operations of the Green Bank Telescope in Pocahontas County, WV. This telescope is an important research tool that is a major driver of the local economy as well as the state's scientific community. It has supported the development of major discoveries about space, and is an important research facility for thousands of students.</p> <p>In addition to the contributions that the Green Bank Telescope has made toward science, it also contributes to the WV economy, helping to diversify it as fossil fuel and other extractive industries become increasingly fragile.</p> <p>West Virginia is the recipient of millions of dollars in federal funding to combat poverty and health problems in the state. Yet, these programs have not made much of a difference in moving the state forward. For real change to take place in Appalachia, the economy must shift into the 21st century. There is already some movement toward funding this at the federal level.</p> <p>At the International Economic Development Council, I work with the Partnerships for Opportunity and Workforce and Economic Revitalization (POWER) Initiative that is being driven by the Economic Development Administration. This innovative, new multi-million dollar, multi-agency program aims to empower communities to adapt to the changing energy landscape and reposition their economies for a prosperous future.</p> <p>It would be a shame if, while other departments were supporting economic change in West Virginia, the National Science Foundation cut funding to a project that has a long history of successful research endeavors and an established presence as an economic driver in the state. Please consider the continued funding of the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/22/2016	image001.jpg
283		Andrew	Jordan		Seriously, don't do it. You'll be throwing away so much industry and education for West Virginia. People love this thing. Don't do it!	Against Closure	Email - Scanned	11/22/2016	
284		Nathan	Stano		<p>I am writing in response to the call for public comments on the fate of the Green Bank Observatory site.</p> <p>As a student, I was privileged to be part of one of the few student radio astronomy groups in the country. Part of that group's program was an annual trip to Green Bank each spring. This was an incredible opportunity to meet the researchers there and to see the work being done in radio astronomy. These trips were a big part of creating a passion for science and scientific research that endures to this day. It is critical not only that the research that takes place be allowed to continue, but that it be allowed to inspire young people in their pursuit of science.</p> <p>I would strongly hope that either of the following options be chosen: 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p>	Against Closure	Email - Scanned	11/22/2016	
285	a	Ken	Kellermann		<p>I write to support the "Continued NSF Investment for science focused operations" in Green Bank (No - Action Alternative.). I am a long time member of the NRAO Scientific Staff, and for 20 years lived with my family in Green Bank.</p> <p>A large fully steerable radio telescope was part of the original plan for the NRAO. Although endorsed by the 1964, 1970, and 1980 decade reviews of astronomy, the construction of a 100-m class filled aperture radio telescope was always deferred by the higher priority VLA and VLBA projects until funds became available in 1989. The resulting unique capabilities of the Green Bank Telescope are well documented, and as a result if its extraordinary sensitivity, frequency coverage, and low side-lobe level includes unprecedented investigations of pulsars, interstellar molecules, as well as Galactic and extragalactic neutral hydrogen.</p> <p>Very Long Baseline Interferometry was invented in Green Bank, and for decades, the 140-ft radio telescope was the focal point of national and international VLBI. For half a century, joint VLBI observations between Green Bank and radio telescopes in Russia, have provided the highest resolution astronomical ever achieved in astronomy. Of particular note has been the many exchange visits between Russian and Green Bank scientists which have continued until today through the depths of the Cold War which have surely led to a better understanding between Russian and American people.</p>	Against Closure	Email - Scanned	11/22/2016	GBO.docx

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
285	b	Ken	Kellermann		<p>But, I want to call attention to the collateral impact of the NSF facilities in Green Bank of which the GBT is the centerpiece of Observatory operations.</p> <p>The National Radio Quiet Zone and the West Virginia Radio Astronomy Zoning Act, which were created following the establishment of NRAO in Green Bank, over half a century ago, are unique resources which can be compared with other protect national resources such as national parks. Although other radio quiet zones have since been established to protect radio observatories in other countries, none are able to grandfather the proliferation of radio emissions established over the past 50 years. Once abandoned, it will never be possible to return to the radio quiet levels which are currently found in Green Bank.</p>	Against Closure	Email - Scanned	11/22/2016	GBO.docx
285	c	Ken	Kellermann		<p>The Green Bank Observatory is one of the largest employers in eastern West Virginia, and arguably the major employer of highly skilled labor which brings not only badly needed financial resources but also unique intellectual resources to the local community. While I lived in Green Bank, my wife as well as spouses of other staff members taught in the Green Bank and Pocahontas schools. Others provided multiple volunteer services to the local community. Thirty-five years after leaving Green Bank, we and other former Green Bank staff still support the Pocahontas County Library system.</p>	Against Closure	Email - Scanned	11/22/2016	GBO.docx
286		Ann	Comstock Halverson		<p>I was introduced to the Green Bank Observatory (GBO) about 5 years ago when my son-in-law, Loren Anderson became affiliated with West Virginia University (WVU). Loren is an Assistant Professor of Physics and Astronomy at WVU and has observed at GBO for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made. It is crucial that we continue to support scientific endeavors such as GBO and I urge you to maintain full operations and continue to invest in science-focused operations.</p> <p>I would also like to stress is the impressive impact the GBO makes in the hills of Pocahontas County, WV. This region is an oasis of inquisitive, bright, and hard-working people who are proud to contribute to this world-class instrument. It is also unique as a radio-free zone, located within a relatively short distance of many urban areas (4 hour drive time to Washington, DC). Loren has worked each summer at GBO and brought his family (my daughter and granddaughters) to stay at the campus facilities located there. The summer scientific community is rich and they have made friends with numerous families who call the GBO-area their home. We understand without the facility, the town will no longer be able to support an elementary school.</p> <p>West Virginia is clearly struggling and it is frequently listed as one of the states failing its residents in terms of education, poverty, and health. Despite those challenges, residents are also an incredibly proud group, made more so by the superb contributions we can make by supporting this facility in its continued full operation.</p> <p>As you consider your options for the GBO, I strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, county, and state rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/22/2016	
287		Brian	Spragg		<p>Please don't shut down the Green Bank Observatory!</p>	Against Closure	Email - Scanned	11/22/2016	
288		Charlie	Figura	Professor of Physics and Astronomy Director, Wartburg Platte Observatory	<p>I'm writing in support of Continued NSF investment for science-focused operations (the No-Action Alternative) for the Green Bank Observatory.</p> <p>As an astronomer and educator, I recognize that the Green Bank Telescope (now a part of the Green Bank Observatory) is a vital part of astronomical research and astronomical education in the United States and in the world.</p> <p>It's easy to get distracted, I think, but some of the newer telescopes that have come on line or are coming on line: it's easy to think that AIMA or FAST replace the GBT's technologies, that it has now become obsolete. The GBT, however, has several vital aspects that make it an irreplaceable astronomical tool.</p> <ol style="list-style-type: none"> 1. The GBT is able to conduct significant astronomical research at a wide range of radio bands, and is the most sensitive telescope at short wavelengths (<10cm) 2. The GBT plays a heavy role in education at the undergraduate and graduate levels. Research faculty involve undergraduates in research projects, GBO hosts undergraduates for summer research opportunities, and graduate students work with faculty and complete their own degrees using the GBT. <p>As a researcher and educator at a small liberal arts and sciences institution, I feel the potential loss of services at the GBT very strongly. The Observatory plays a vital role in both my research and in student education, and as an open-use facility provides opportunities to faculty and students associated with small institutions that cannot maintain significant research instruments of their own.</p> <p>As the GBO struggles to obtain funding, opportunities for research and education are lost. Within the past month researchers (myself included) have been notified that as part of the divestment and outside investment in the observatory, allocated research time has been cut and capped. As we project the potential loss of NSF funding, these cuts will hamstring the Observatory's role in education and research, and the pipeline for new astronomers will be severely constricted. None of the remaining single-dish facilities in the United States can compete with the GBT in terms of research capability.</p> <p>I strongly urge the NSF to maintain funding in the GBT. Letting support for this facility decrease or lapse will restrict or terminate its use, and severely impair radio astronomy research and education in the United States for years to come.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
289		Elaine	LeRose Ridenour		I am originally from West Virginia, and as a child, was fascinated with learning about the Green Bank Observatory. I remember reading about Green Bank in second grade, and how I couldn't wait to visit it in person. As an adult, I finally had the opportunity to visit the Green Bank Observatory several times with my husband, and we have taken both of our daughters to tour Green Bank many times, beginning when they were very young. It is one of our favorite spots in West Virginia; a real hidden gem for the state. Green Bank encourages people to use their love of math and science to dream big. I have a degree in engineering, and both of our daughters are also studying engineering in college. I feel that our visits to the Green Bank Observatory fueled their passion for engineering. Please do not shut down the Green Bank Observatory.	Against Closure	Email - Scanned	11/22/2016	
290	a	Ardis	Herrold		<p>I am writing a letter of support and input regarding your decision regarding the facilities at the Green Bank Observatory site. I am an educator with 38 years of classroom experience at the high school and university levels. Professionally, I am a past president of both the National and Michigan Earth Science Teachers Associations, and have been involved in astronomy education and outreach and teacher training throughout my career. From this perspective, I wish to share the value and impact that the Green Bank Observatory has had, and continues to have, on teachers, students and the public.</p> <p>My first encounter with NRAO- Green Bank was back in the late 80's, when I attended a two-week teacher workshop there. We were immersed in a research experience, learned how to collect data with the forty-foot telescope, and worked alongside scientists and engineers. Of the many quality NSF-funded teacher training programs I have been a part of, this was without a doubt one of the top two. What I learned there affected the way I taught for the next 30 years.</p> <p>I was so impressed with the program and staff at the observatory, that I formed a unique after school club - the Radio Astronomy Team (RATs). We built our own radio telescope and began making the 500 mile trip to Green Bank once a year, to learn about radio astronomy and use the radio telescopes there. Over the years, this club has had about 300 members, many of who went on to careers in science, computing, and engineering. Today they work in such places as NASA Goddard, Space X, and the Max Planck Institute for Radio Astronomy. One was even hired as a mechanical engineer to assemble the AIMA radio telescopes. At our club anniversary celebrations (of 20 and 25 years), the most common reflection offered was that involvement in the Radio Astronomy Team and their experiences at Green Bank emerged as the single most defining element of what influenced them to go on their chosen careers.</p> <p>Science drives science, but education is where science begins. The impact of scientists and engineers working with the next generation is often poorly estimated. What has energized many teachers and students who have come to Green Bank over the years is not simply the world-class education programs routinely conceived and implemented there - it is the synergy of being in a place where research is conducted, science dialog is a daily routine, and discoveries are generated.</p>	Against Closure	Email - Scanned	11/22/2016	
290	b	Ardis	Herrold		Students and teachers aside, the general public is welcomed and encouraged to make use of the observatory facilities through the Visitor Center, and annual events such as the Green Bank Star Quest star party. I have had opportunity to see these interactions firsthand, having worked two summers at the observatory through the Research Experiences for Teachers program. There is no better way to build support for radio astronomy research and to demystify what it is about than to invite open inspection and participation in events at the facility. And Green Bank is much more visited than NRAO-Socorro, so its impact is greater.	Against Closure	Email - Scanned	11/22/2016	
290	c	Ardis	Herrold		<p>As for funding the GBT to continue science research, I could not have been more perplexed when the announcement came that the NSF would reduce funding for its science operations. Yes, AIMA is the newest research initiative, but that doesn't change the fact that the GBT is still capable of cutting-edge science. Would we defund Hubble once Webb is in orbit? Why not get the most out of our investment and use both as long as possible?</p> <p>The engineers and machine shop personnel at Green Bank are also skilled at creating new instrumentation in radio astronomy, and it would be devastating to lose such expertise.</p> <p>I urge the NSF to continue to invest in science operations at the Green Bank site, and in fact, to restore funding to previous levels, as much as is possible. Thank you for taking the time to read this entire letter, and thoughtfully considering what I have communicated.</p>	Against Closure	Email - Scanned	11/22/2016	
291		Joseph	Trotto		<p>Please know that citizens care about the Green Bank Observatory with its accomplishments, the livelihood it provides for locals, and the scientific impact across the globe.</p> <p>Now more than ever we must support these endeavors. Thank you for the consideration.</p>	Against Closure	Email - Scanned	11/22/2016	
292		Shae	Krispinsky		I am emailing in support for continued funding for Green Bank Observatory in West Virginia. Please keep the observatory, and please keep funding it to make sure its existence stays secured.	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
293	a	Clark	Abadon		<p>I'm writing in to support the maintenance of full operations of the Green Bank Observatory! This observatory has a long and distinguished history of scientific exploration and discovery. Scientists from around the world use this instrument to explore and explain our place in the universe and the cosmos. This observatory continues to provide observations and data that inform how our part of the galaxy evolved and how it may evolve in the future. This is strong, solid and profoundly important basic science which needs the continuing support of scientific research dollars.</p> <p>My son-in-law, Loren Anderson, is an Assistant Professor of Physics and Astronomy at West Virginia University. My wife and I have had the great pleasure of experiencing the scientific outputs the GBO. He has observed for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made.</p> <p>As you consider your options for the GBO, We strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, Pocahontas County, and the State of West Virginia rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/22/2016	
293	b	Clark	Abadon		<p>This region of West Virginia also is significantly supported through the establishment and use of this telescope. West Virginia has many rural areas that are struggling to find solid footing for the families that have lived here for generations. The funding for the Green Bank Observatory provides important jobs and careers for the residents of Pocahontas County. These are jobs tailor made for rural communities. The jobs pay well, have good benefits and are environmentally benign. Indeed, modern jobs to that support rural and proud families.</p>	Against Closure	Email - Scanned	11/22/2016	
294	a	Robert	Anderson		<p>Here are some adverse cultural impacts I have not heard addressed yet.</p> <p>Pocahontas County, WV, is a remote area isolated by mountains. It becomes more isolated in winter. Travel to other areas can be increased by 50 to 100%. This means that a one-hour commuter in summer may travel a 90 minute to 2 hour commute in winter. The scientific and engineering staff have several persons, roughly 25% of the total site staff, who moved here from out of county and out of state. If the NSF decides on a significant change in operations, this group would relocate out of the county to find work in their fields, and being well educated, they could. There would be a significant adverse impact on the economy, culture, and educational involvement in the county, which others have addressed.</p> <p>The remaining 75% of the staff are local residents, consisting of craftsmen, technicians, clerical and support staff. Many only have a high school education or some college education. Finding a full-time job in the county would be nearly impossible as few opportunities exist. Younger staff would also have to relocate outside the county because of the long commutes. As real estate sales move slowly, taking 2 to 5 years sometimes, the breadwinners would likely work away and come home on days off, putting hardships on families. Older, less mobile staff would likely draw unemployment for many years and/or work at seasonal part time jobs. Some may lose their homes or farms as a result.</p> <p>Finally, roughly 65% of the county is federally or state-owned land. Tax Revenues are limited. The Observatory makes payments in lieu of taxes which are a not insignificant portion of county revenue. Loss of this revenue would have a major impact on funding for schools, senior citizen programs, and recreational and cultural activities.</p> <p>All of these aspects, based on your criteria, would have a "severe adverse" impact on all but the first and second alternatives under consideration. In contrast, the possible positive impacts of a partial or total site closure and restoration to a green field are minor: there is only a small hazardous waste stream, small air and water impacts, and the majority of the site (80 to 90%) is already either natural woodlands or fields maintained according to the State's Division of Natural Resources management plans.</p>	Against Closure	Email - Scanned	11/22/2016	
294	b	Robert	Anderson		<p>Because of commute times to these events, many leave mid-day and return after midnight. Most significantly, observatory staff and family members are role models that encourage young people to seek college or community college education. There is tremendous family, community and peer pressure to not pursue education; Pocahontas County has a high dropout rate as a result, and staff role modeling allows students to have a vision of something better than part-time work and welfare. In all aspects of community life, and especially in local churches, observatory families are active, seldom passive, participants.</p>	Against Closure	Email - Scanned	11/22/2016	
294	c	Robert	Anderson		<p>The Observatory provides infrastructure to attract and retain staff in this remote area. This includes site housing and the recreation facilities. These also benefit the community; staff can have family reunions, wedding receptions, and church picnics there, and the swimming pool is not only used by staff families, but the county teaches swimming lessons there, often with volunteer help from observatory staff and family members. The tennis courts, hiking and biking trails also give social and physical activities to observatory summer students and staff. The nearest similar pools and courts are an hour away, which makes them impracticable.</p> <p>Observatory staff and their families are very involved in the community. It is difficult for schools to get many longtime residents involved in school activities. Observatory staff members and family members provide unpaid mentoring in mathematics and sciences, are frequently the ones called on for science, social studies, and math fairs, and are often the one ones who are willing to chaperone school groups and sports teams on away trips.</p> <p>And yes, I am an Observatory staff member. We have lived here over 14 years. Our children were in first grade when we moved here, and we have seen both the advantages and disadvantages of raising them here, and have seen the day to day positive influences the presence of the Observatory and Observatory families have in this community.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
295		Rebecca	Ozbolt		Dear national science foundation members, I would like to voice my concern about the possibility that this observatory may close. Not only is it the largest employer of that region, a large attraction for tourists and students (bringing about \$30 million to the poorest state in the union annually), it is THE FIRST national astronomy observatory and the first national laboratory open to all scientists from around the world. It would be a shame from every angle I look at the matter to stop funding this observatory and risk the shutdown of the facility. Please, please, please give it a chance! Thank you for your consideration.	Against Closure	Email - Scanned	11/22/2016	
296		Emily	Wight		Please continue supporting the Green Bank Observatory! It is key for continued education and employment future for West Virginia.	Against Closure	Email - Scanned	11/22/2016	
297					PLEASE DO NOT LET THIS HAPPEN!	Against Closure	Email - Scanned	11/22/2016	
298		Andrew	Blackwood	Executive Director	Since its inaugural session in 1963, the National Youth Science Camp (NYSCamp) and the Green Bank National Radio Astronomy Observatory (now the Green Bank Observatory) have maintained a very close relationship. Each summer, some of the nation's top-achieving, recently-graduated science and mathematics students attend the NYSCamp which is held less than 15 miles from the Green Bank Observatory. Countless astronomers, physicists, engineers, mathematicians, computer programmers, and technicians from the Green Bank Observatory (GBO) have presented lectures, led directed studies, and facilitated tours. The GBO introduced radio astronomy to more than 5,300 students through the NYSCamp and made astronomy accessible and exciting. While the vast majority pursue STEM careers outside astronomy, their exposure to the field through the GBO has broadened their understanding of basic research. For a decade starting in 2005 and funded with a grant from EPSCoR, the National Youth Science Foundation (NYSF) partnered with the GBO to plan and deliver the West Virginia Governor's School for Mathematics and Science (GSMS) to rising high school freshmen from across West Virginia. Resident professionals at the GBO served as the STEM experts as small groups of students partnered with a teacher and a student mentor, pursued real-world STEM research. As a result, these GSMS students are better equipped to pursue further education and careers in STEM. We believe the work being done at the GBO and the valuable stimulation it provides to the many students who are able to experience it's important scientific work make the facility an important part of America's accessible scientific community that is deserving of continued NSF support.	Against Closure	Email - Scanned	11/22/2016	NSF - GBO letter_V02_20161122_ANB.pdf
299	a	Jaime	Simmons		Good basic research should exist because that is the hallmark of a civilized society. I feel that I understand this more than most, having spent most of my working life in the State Archives library. Why should we repeatedly have to explain to our funding sources why we should continue to exist. Let me tell you that although my own formal exposure to science was minimal, my trip to Greenbank, several years ago I might add, was SO memorable, that it has stirred me to write this letter. I understand that because of reduced funding, the NSF is considering several options for its stable of resources, one of which is to dismantle the Greenbank Observatory. The goal, presumably is to use the decreasing resources in these uncertain times to make grants in other areas of study. The State of West Virginia should be considered an expert in the unintended consequences of reduced funding. In an effort to balance our state's budget, we have drastically reduced the allocation of funds used to award grants to market attractions within our state. Many of our otherwise dependable tourism venues experienced dramatic decreases in traffic as a result of the loss of these advertising dollars.	Against Closure	Email - Scanned	11/22/2016	
299	b	Jaime	Simmons		So in my clumsy attempt to list all the worthwhile and indeed existentially necessary research projects the scientists and astronomers do here, I might fail to mention a key discovery. I will leave such letters to better qualified people. If the greater threat is to reduced monies allocated to the NSF budget, why in the name of all that is good would you snuff out one of your biggest marketing opportunities on the east coast?? Every year, thousands of people come to GBT, many of them children, and are forever changed by their experience. Consider that most will never have another opportunity to see raw, basic science "in the wild" again in their lives. These people go home and vote for representatives who determine your budget. I am old enough to remember the Cold War, Sputnik and the "race to space". While I applaud and support the collaboration of observatories around the globe, I look back at West Virginia's Centennial Year, when GBT took pride of place on the anniversary logo. The average citizen had become hungry for news of achievements in all fields of science. Now, 50 years later, when we know enough about the heavens, to know that we need to know more, I feel we have lost our focus. I believe that the discoveries made with the help of the Greenbank facilities continue to produce citizen soldiers in the war to increase basic knowledge in a broad range of scientific disciplines. Please consider the law of unintended consequences as you make your determination for the future of this still very necessary and highly relevant facility.	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
300	a	Paulo	Freire	Research Associate Max-Planck-Institut fur Radioastronomie	<p>My name is Paulo Freire. I am writing to express my concern regarding possible changes to the current operation model of the Green Bank Telescope (GBT) as a result of the Environmental Impact Study. I have subscribed another letter on this topic (from the group using GBT measurements of the "double pulsar" system to test general relativity), but I feel the need to express my concern individually. I have been involved with several research projects with the GBT for more than a decade; these focus mostly on pulsar topics. During this time, the GBT has proved to be an exceptional research instrument, with many qualities that make it unique and (for the next decade at least) scientifically irreplaceable. The GBT is the most sensitive fully steerable radio telescope in the world; this makes it the best choice for pulsar observations for a very wide range of sky positions (with the exception of the restricted area that can be observed with Arecibo). It has an excellent suite of very low temperature, broadband receivers, an unblocked aperture and some of the best pulsar instruments available today. Furthermore, it is located in an extensive radio quiet zone, which make its observing bands uniquely clean and suitable for pulsar surveys. These qualities are reflected on the scientific results, both in discovery of new pulsars as in their follow-up. The GBT discovered pulsar J0348+0432, this was later found to be the most massive neutron star currently known (see Antoniadis et al. 2013, Science, 340, 448). It has also measured the mass of PSR J1614-2230 (previously discovered with the Parkes telescope) via Shapiro delay (Demorest et al. 2010, Nature, 467). Both results had a major impact on many areas of astrophysics, hinted by their very large number of citations (currently 812 and 1335 respectively); this impact has been greater on studies of the equation of state of dense nuclear matter and the study of the strong nuclear force. The GBT also had a major impact on the study of gravitation, particularly from studies of the "Double Pulsar" system, J0737-3039 (Kramer et al. 2006, Science, 314, 97-102), which allow a set of five independent tests of general relativity. In one of these tests, the amount of energy loss from gravitational waves has been verified with a precision that is now two orders of magnitude better than for the Nobel-Prize winning Hulse-Taylor binary (Kramer et al., in preparation) - and Einstein's general relativity (GR) still passes the test! The GBT is the ideal telescope to study this system: apart from its high sensitivity and location in a quiet zone, its location allows the observation of two full complete orbits per day (the 100-m radio telescope at Effelsberg is further North and can see only part of a single orbit.) These studies allow a unique study of the nature of gravitational waves, providing information that cannot be obtained with UGO and Virgo - but complements and completes their results, allowing a more complete picture.</p> <p>Needless to say it, the GBT, together with the Arecibo telescope, is vital to the North American effort to detect very low frequency gravitational waves (NANOGrav, http://nanograv.org/) produced by supermassive binary black holes as part of the process of hierarchical galaxy mergers. Still in the topic of tests of general relativity, the GBT has also discovered the first millisecond pulsar in a triple system (Ransom et al. 2014, Nature, 505, 520). This system will improve (by more than 4 orders of magnitude) current tests of the strong equivalence principle, one of the fundamental features of GR. This tests promises to be the most stringent test ever of several wide classes of alternative theories of gravity. There have been many other successes in the pulsar field coming from the GBT - it would make no sense to list them all here. However, there is a fundamental reason why I am emphasizing scientific results here: the GBT is a scientific instrument. Science is and should be the main reason for its existence.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_environmental_impact_concern.pdf
300	b	Paulo	Freire	Research Associate Max-Planck-Institut fur Radioastronomie	<p>It is because of the great science that the GBT and NRAO contribute to all the other things they do so well: foster international scientific cooperation, help train the next generation of astrophysicists (many of my outstanding colleagues were trained with data from the GBT), inspire young people to pursue STEM careers - particularly in West Virginia - and for the general public the intangible benefit of our collective improved understanding of the workings of the Universe. Reducing the access to the telescope would be especially harmful for many important tests of gravity theories and detection of gravitational waves that rely on long-term observations. It would also greatly disrupt the pulsar community in North America and abroad. If the GBT does not continue to be the world-class, cutting-edge research facility that it is now, its main reason for existence will be gone. Then, inevitably, its power as a tool to educate and inspire will be diminished. We urge the NSF to consider these concerns and we hope that the GBT can be funded at a sufficiently high level to ensure a full "open skies" policy as an investment into the future.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_environmental_impact_concern.pdf
301		Naomi	McClure-Griffiths	Professor, ARC Future Fellow	<p>I am writing to express my strong support for the Green Bank Telescope (GBT). The Green Bank Telescope is one of the world's best radio astronomy facilities. It is reaching the height of its productivity with new instrumentation and as a result has an outstanding international reputation.</p> <p>In my own research, the GBT is unsurpassed in its ability to measure weak signals of atomic hydrogen emission in and around the Milky Way. I have a current grant (\$650k from 2016 – 2019) from the Australian Research Council to study the gas distribution in the center of our own Milky Way Galaxy. The GBT is critical to this research and the grant was accepted under the assumption that the GBT would continue to be operated as a scientific research facility. There is no other telescope in the world that can do this research as well as the GBT.</p> <p>I hope that the US National Science Foundation will continue to invest in the Green Bank Telescope for science-focused operations. I fully expect the GBT to continue to be an valuable asset to the world's astronomers for many years to come.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_support_2016.pdf
302		Holly	Compton		<p>As a lifelong resident of WV the green bank observatory has been a unique feature to our state and something I am proud of. Please continue your investment in the green bank facility. I want to share the amazing experience the facility offers and bolster the love of science and discovery with my children for many years to come.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
303		Anthony	Minter	N/A	<p>Appalachians are a generally poor, rural, disadvantaged population. Opportunities for students to experience anything related to Science, Technology, Engineering and Math (STEM) are few and far between in Appalachia. I know this firsthand as I grew up in the rural mountains of Southwestern Virginia. The few opportunities that gave me any exposure to STEM were precious as gold and were beheld with wonder and amazement. They certainly played a significant role in my determination to overcome the disadvantages of growing up in a technology poor area.</p> <p>The Green Bank Observatory is one of the few National Science Facilities located in Appalachia that is easily accessible to thousands of disadvantaged students. The Green Bank Observatory provides experiences for students of all ages: including programs for elementary school students, middle school students, high school students, college students and postgraduate students. Many thousands of students visit Green Bank each year to take use the GBT, the 20 meter and the 40 foot telescopes and to interact with the scientists. It is the ability to use the telescopes and interact with the scientists that provides the students with the motivation to seek out careers in STEM. If science is reduced at any level, these educational programs will be diminished at a time when the economy of Appalachia is experiencing a huge downturn and will result in Appalachian children being put at a further disadvantage.</p> <p>The students who visit Green Bank Observatory and participate in the education programs are exposed to all aspects of STEM. They see how engineering, software, and math are used to make the telescopes work. They are able to observe with the telescopes while they do mini science projects. They interact with engineers, software programmers and scientists as they work on their projects. These interactions show the students that the engineers, programmers and scientists are just ordinary people who have chosen to do interesting things with their education. They learn that yes, they too can do these same things and that they can have a career in a STEM related field.</p> <p>The Green Bank Observatory educational outreach is very successful. Many students from rural Appalachia have learned that they wish to have a career in STEM and most importantly, learn that it is achievable for students from their region. The reason these programs are so successful is because it takes place at a site where cutting edge science is happening. This cutting edge science makes it necessary to have engineers, programmers and scientists on site. The interaction of these professionals with the students provides a very unique opportunity for the students to learn about STEM and to find out that they are capable of working in a STEM field. The genuineness of these experiences - seeing research being done by real STEM professionals and taking part in that research using the telescopes themselves - affects the students at much deeper levels than other programs.</p> <p>I was lucky enough to be one of the early students to go through a program at the Green Bank Observatory in 1988. Being able to see the active science research occurring in Green Bank and talking with the scientist in Green Bank had a profound affect on my career decision. I now have the privilege of being one of the scientist in Green Bank with whom the students interact.</p> <p>If the science done at Green Bank Observatory is decreased at any level then access to the telescopes for the rural Appalachian students will also be decreased. It would be a disservice to the rural Appalachian student socio-economic class to reduce the science being done in Green Bank which would reduce their opportunities to learn about STEM education.</p> <p>Also, if the science being done at the Green Bank Observatory is decreased, the STEM staff would be decreased or could even go away.</p> <p>I urge the National Science Foundation to not reduce the amount of science being done at the Green Bank Observatory as this would create unreparable damage the educational programs at Green Bank Observatory and would further repress the STEM educational opportunities available to rural Appalachians.</p>	Against Closure	Email - Scanned	11/21/2016	N/A
304		Sergey	Galkin	Aerospace Engineer	<p>It has come to my attention that as a result of an ongoing Environmental Impact Study, there is a possibility that the funding of the Green Bank Observatory by National Science Foundation may be reduced. As a former student and a participant, I strongly urge you to reconsider that decision.</p> <p>Green Bank Observatory is a world class research facility and is a vital part to further our understanding of the solar system as well as the rest of the universe. Additionally, the experience that it provides to students and its activities of educational and public outreach provide a lot of excitement and inspiration. Green Bank is one of the rare facilities that allows participants to develop hands-on skills, as well as conduct live observations of actual celestial objects and gather relevant data. I can personally attest that my trip to the Observatory has provided numerous learning opportunities and inspired me to pursue a career in a STEM field. It is an indispensable facility, and the loss of its functionality in the scientific, educational, and outreach fields will certainly deal a major blow to the astrophysics and engineering communities.</p> <p>It is due to the statements listed above that I strongly urge you to consider maintaining the current levels of support for scientific and educational programs at Green Bank Observatory (Option 1), or to seek collaboration with interested parties for science- and education-focused operations (Option 2). Thank you very much for your consideration. Please feel free to reach me at elkibravo@gmail.com if you have any questions.</p>	Against Closure	Email - Scanned	11/21/2016	
305	a	David	Stark	IPMU Postdoctoral Fellow	<p>I am writing in response to the NSF's recent announcement to conduct an Environmental Impact Statement for the Green Bank Observatory (GBO). I would like to take this opportunity to share my opinions on the GBO. I am strongly in favor of the NSF continuing funding to GBO (No-Action Alternative).</p> <p>From a personal viewpoint, the 100m Green Bank Telescope (GBT) was instrumental in my PhD thesis, where I conducted a census of atomic hydrogen gas in galaxies within a closed volume of the nearby universe. This survey enabled unbiased exploration into galaxy evolution, particularly in a relatively unexplored mass regime, and with an understanding of galaxy environments that is hard to beat. Our survey was made possible by the high sensitivity and movable dish of the GBT, and all our efforts have born fruit. Several papers using this data set discussing unique results have been released (http://adsabs.harvard.edu/abs/2016arXiv161006932S, http://adsabs.harvard.edu/abs/2016ApJ...824..124E, http://adsabs.harvard.edu/abs/2015ApJ...810..166E), with several more in preparation.</p> <p>Furthermore, the GBT's new capabilities in the 60-115 GHz regime are extremely exciting and valuable. These are described in detail in https://arxiv.org/pdf/1610.09014v2.pdf, but key strengths I think are worth emphasizing are (1) it would be very complementary to ALMA, and (2) the potential for new receivers that can map wide areas rapidly would be extremely valuable and unique (I know of no other telescope capable of doing this). Instead of divesting from GBT, I would encourage the NSF to fund these new receivers to go on the telescope.</p>	Against Closure	Email - Scanned	11/21/2016	

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305	b	David	Stark	IPMU Postdoctoral Fellow	<p>Lastly, the GBT has been a fantastic tool for education. While conducting my own survey with the GBT, I was able to introduce at least 7 people in our research group (from students to postdocs) to radio astronomy through the GBT, where they actually got to use the telescope. These experiences are not limited to my own university. One of the reasons this works so well is that the hardworking staff at the GBT have built the infrastructure to make observing manageable and training relatively easy. It would be a shame to lose such a great resource.</p> <p>I hope you consider these arguments, and those of my colleagues. The GBO is an invaluable resource to the scientific community which we should not lose.</p>	Against Closure	Email - Scanned	11/21/2016	
306	a	Robert	Stricklin, Jr.	Retired CMOS IC Sensor Developer Senior Member IEEE Member American Physical Society (APS) Member of APS Division of Gravitational Physics Texas Rancher	<p>Please accept my comments regarding the Environmental impact regarding the Green Bank Observatory aka Green Bank Telescope (GBT).</p> <p>Asteroid Defense Measures</p> <p>The GBT is a tool to protect the environment and human life. A real and continuing threat to the environment is the impact of asteroids. Geological records reveal a history of past impacts with the impact results to the earth documented.</p> <p>Recently the GBT coordinated with other radio telescope installations including Goldstone Ca. and Arecibo in Chili have demonstrated the ability to observe and map asteroids passing near earth. This is a demonstrated ability to gather information on any asteroid or heavenly body currently on a path to impact earth. With orbital mechanics data, physical measurements gathered from GBT a determination of the threat could be determined. If warranted, an effort can be undertaken to protect earth. If we can learn the details of the threat early enough taking action to prevent a disaster is possible.</p> <p>Some may argue the potential devastation created by an asteroid is all in God's hands. My view is that God expects us to take action to protect ourselves and especially to protect the weak from devastation.</p> <p>The potential of the GBT to provide information and facts on asteroids as a real threat to human life and earth's environment is critically important to US government and all. This capability must be maintained just as a military capability must be maintained. We cannot count on other facilities, which may be decommissioned due to cost saving measures or natural disasters.</p>	Against Closure	Email - Scanned	11/21/2016	
306	b	Robert	Stricklin, Jr.	Retired CMOS IC Sensor Developer Senior Member IEEE Member American Physical Society (APS) Member of APS Division of Gravitational Physics Texas Rancher	<p>Astronomical Research</p> <p>The GBT has provided over 50 years of astronomical data about our universe. Lists of some of the more important discoveries are presented at https://science.nrao.edu/GBT_DiscoveriesV4.pdf. There is no reason to believe this contribution cannot continue. Helping to understand the details of planetary development and evolution of heavenly bodies contributed to our ability to deal with issues here on earth.</p> <p>The time available to collect data using the GBT has been oversubscribed. Every year proposals have been reviewed and decisions are made about who will benefit from the observation time available. The capabilities of the GBT are on a path of continuous improvement with new improvements in research capability being demonstrated every year of GBT operation. Many of these advancements are made in concert with other telescopes.</p> <p>The GBT plays a role using interferometer techniques by coordinating data collection with other telescopes all over the world. Eliminating the GBT contribution will reduce the overall world capability.</p>	Against Closure	Email - Scanned	11/21/2016	
306	c	Robert	Stricklin, Jr.	Retired CMOS IC Sensor Developer Senior Member IEEE Member American Physical Society (APS) Member of APS Division of Gravitational Physics Texas Rancher	<p>Economics</p> <p>The GBT contributes to employment directly and indirectly of a large number of people locally and in other areas. These include the staff at GBT in West Virginia, NARO facility in Charlottesville, VA, vendors in the area and across the world, research scientist located in other government sponsored institutions like NASA, JPL, and university professors and students in the US and around the world. Many people routinely travel to the GBT to work on projects, celebrate, and to learn.</p> <p>We cannot afford to stop the funding of this facility instead we should be looking for ways to continue to improve the capability of GBT. Closing or eliminating funding for the GBT will be devastating to the employment around the GBT facility, which is already depressed.</p> <p>Submitted with respect for the process.</p>	Against Closure	Email - Scanned	11/21/2016	

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307		Kathlene	Eckert	Student, University of Pennsylvania	<p>My name is Kathleen Eckert and I am a postdoc at the University of Pennsylvania. I am writing to express my opinion that the GBT should remain an active research instrument for the astronomical community (option "no action"). The GBT was critical for performing my PhD work at the University of North Carolina and has contributed to the creation of an unprecedented catalog of galaxy gas content for the RESOLVE survey (database website http://resolve.astro.unc.edu/pages/database.php). My PhD work involved using this catalog to create accurate galaxy gas mass estimators for application to larger galaxy surveys, and to analyze the distribution of galaxy mass as a function of their mass in stars + gas. These works led to two published papers so far:</p> <p>http://adsabs.harvard.edu/abs/2015ApJ...810..166E http://adsabs.harvard.edu/abs/2016ApJ...824..124E</p> <p>In my new position at the University of Pennsylvania, I have also become aware of higher frequency capabilities of the GBT, including the Mustang instrument, which will provide the ability to detect galaxy clusters and map their gas on astrophysical scales. Such measurements are important to understand dark energy and the growth of large scale structure in the universe. Thus with MUSTANG, the GBT provides a unique facility that complements other cosmology focused projects such as Planck and the Dark Energy Survey.</p> <p>The GBT is critical for the larger astronomical community, and maintaining it as an active research facility is vital to the health of the fields of astronomy and cosmology.</p>	Against Closure	Email - Scanned	11/21/2016	
308		Sean	Brown		<p>Please consider keeping the Greenbank Observatory operating with full NSF funding, the telescope is a great asset to scientific research and to West Virginia.</p> <p>I, as a graduate of West Virginia University's college of engineering and member of both space exploration and astronomy club was always inspired by the GBO. I know that I was not the only student to feel this way, it was an incredibly proud feeling to have students and friends at the university working on advanced research with data sourced from the GBO.</p> <p>The benefits to the local economy and prestige of the state are also not to be overlooked, West Virginia as a state has supplied many natural resources necessary in the technological advancement and growth of this country but is often considered poorly educated and backward. The GBO and the work done there is a powerful symbol to the young people of the state and surrounding region that more is possible if they study and work hard.</p> <p>I ask that the NSF consider fully funding the GBO, and if that is not possible as a secondary request to consider a public private partnership to save the facility despite the changes that will entail.</p>	Against Closure	Email - Scanned	11/21/2016	
309		Anja	Baudler	Resident	<p>closing the GBO would mean:</p> <ul style="list-style-type: none"> - the total ruin for a thriving community (including my own family - my husband would lose his job, my child would lose his home and his place in the school since we would be forced to move away) - a big loss for Pocahontas County and West Virginia's tourism market (since the GBT has become an important WV landmark and tourist destination) - a terrible loss for West Virginia's universities and other scientists from around the world who work with the GBO's one-of-a-kind instruments and technology for their important astronomical scientific research that already has and could lead to more groundbreaking discoveries in the astronomical field which would otherwise never have been/never be possible. New instruments utilizing brand new technologies are still coming online for the GBT as we speak, so I really don't understand were the desire to shut down or divest a relatively inexpensive facility like this comes from. <p>It would also mean the end of the unique Radio Quiet Zone, that is a wonderful sanctuary from the modern "wireless" lifestyle and has become a safe haven for numerous people from around the globe who were seeking this place out to cure their health issues related to electromagnetic radiation (Electrohypersensitivity or EHS).</p> <p>I strongly suggest to consider the "No-Action Alternative".</p>	Against Closure	Email - Scanned	11/21/2016	
310		Randy	Thomas		<p>I do not like cuts at all.....But, we must weigh all our options! I have some questions because I am not that failure with Green Bank!</p> <ol style="list-style-type: none"> 1) State or Federal funded? 2) How many employees? 3) Budget to Operate and Maintain yearly? 4) Actual need and age of facility? <p>Thank you in advance for your reply to my questions!</p>	General	Email - Scanned	11/21/2016	
311		Susan	Peyton		<p>The Green Bank Observatory is a great learning center and must be preserved for today's and future generations.</p>	Against Closure	Email - Scanned	11/21/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
312		Marian	Pospieszalski	Ph.D., Fellow IEEE Scientist/Senior Research Engineer	<p>This email is in strong and enthusiastic support of continued NSF investment for science---focused operations (so called: No---Action Alternative) for the Green Bank Observatory.</p> <p>The NRAO, since its founding more than 60 years ago, has been providing what one could call general purpose instruments to world---wide scientific community. At NRAO's birth in 1956 so little was known about the radio Universe that pointing any telescope with any receiver on it to any position in the sky was bound to discover something new. Many groundbreaking discoveries later AUI/NRAO is operating four general purpose instruments: ALMA, VLA, GBT and VLBA. These instruments, although quite often erroneously treated as instruments with separate scientific missions (especially by the AST Portfolio Review of 2012), in fact are strongly dependent on each other. The combinations of some or of all of these instruments constitute another powerful instruments, as for example of High Sensitivity VLBI (GBT+ VLA +VLBA), ALMA Bands ## 1, 2 and 3 plus GBT, GBT as a receiving antenna for bistatic planetary radar, and more. The Green Bank Telescope plays a unique and important role not only as a stand---alone instrument but also, as indicated by the above examples, as necessary and important complement to other instruments. GBT because of its unblocked aperture, excellent surface accuracy and placement in the National Radio Quiet Zone may map diffuse objects that no other telescope in the world can even detect. Its large collecting area, constituting almost total collecting area of ALMA (for the first three bands) and more than half of the total collecting area of VLA, make it the most powerful survey instrument in the world without which any interferometer is highly disadvantaged. Similarly, GBT's collecting area and unmatched system noise allow for detection and monitoring of temporal radiation that no other telescope in the world can equal (for example, pulsar observation of nano---Hz gravitational radiation).</p> <p>As of last October, NRAO has undergone a dismemberment, apparently for funding reasons at the level of several M\$ a year which already has destroyed to a large extent a synergy between these four NRAO's general purpose instruments. Further removing the GBT from the list of instruments available to American scientific community would do untold damage to progress in many areas of pure science as it is well documented in two White Papers by F. J Lockman et al and J. Bally et al. Moreover, GBT's continued availability might prove to be of extreme societal impact. It is well known that the GBT bi---static radar observations are essential in determination of the structure and precise orbits of near---Earth objects, a question very much in focus of US and word---wide scientific community</p> <p>In determination of the future of the GBT the question of what is possible next in the broad area of radio astronomy instrumentation should be also considered. The estimated cost of next general purpose instrument will certainly exceed \$ 1 billion in the current dollars and given the foreseeable funding scenarios might not be feasible. The example of an interNational project already underway (the SKA in its many forms) is not very encouraging. It seems, these are Times of some uncertainty as to the future course of development of radio astronomy instrumentation. The scientific returns of the GBT in the next several years might help to keep in focus what questions are scientifically important. Consequently, a diminished scientific role of this unique and extremely well performing instrument would be especially troublesome at this Time.</p> <p>In conclusion, continued NSF investment for science---focused operations for the Green Bank Observatory is the only sensible and cost effective in terms of scientific outcome Alternative.</p>	Against Closure	Email - Scanned	11/21/2016	
313		Tatiana	Vinogradova	Russian poet	<p>you know, to say I was astonished when visited the place for the first Time --- is to say nothing. Science and Nature co---exist here in perfect harmony. People all over the world need such places for not only their intellectual development, but also for their spiritual formation. How one can even think about closing it?! It's disaster! I have no words for this malicious decision.</p> <p>Well, I'd better place here my poem about the GBO instead. (It was written both English and Russian during my second visit to the Space Place. You can also read it here, in one of the famous Russian poetical journals, page 65 http://www.sreda1.org/sreda---2016---01)</p> <p>SONG OF FALL FOLIAGE (Ode to Green Bank Observatory)</p> <p>Green Bank Observatory is lost in the heart of the Appalachians in the heart of silence and woodlands, in the heart of autumn, amidst of Undisclosed Eternity where Miracle and Mystery are born again and again and again. Scarlet torches of maples faded away. Waving hillsides and vales are waiting for winter lace. In autumn the essence of being uncovers itself. Rational grid of branches reveals through chaos of flying fall foliage, splendid, perishable foliage, rustling about fundamentals. The trees of radio telescopes are also naked. They present the skeleton of existence: but yet intersecting steel boughs are trying to reach for the sky, while reflectors – the crowns of telescope---trees are flickering, full of blazing star foliage – splendid, perishable foliage, rustling about fundamentals.</p> <p>There are many of them growing in Green Bank, those tall and small autumn trees of the Universe, beautiful, man---made, sophisticated, – from the apple tree of Jansky Antenna to sequoia of GBT.</p> <p>But what is the most important thing in the observatory? It is people! They try to decode milky whisper of galaxies. Here, in the heart of autumn, in the heart of ancient Indean mountains these wonderful people work day and night trying to cognize Miracle and Mystery again and again and again.</p>	Against Closure	Email - Scanned	11/21/2016	

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314		Kathryn	Stauffer		<p>The Green Bank Observatory is very important to me because I suffer from EHS.</p> <p>A year ago my whole world was turned upside down because I could not shield myself from the ever encroaching Electro Smog in our small town in Illinois. I was forced from my home to live in the country. A temporary arrangement, and it was far from perfect, with two cell towers and many local house hold Wifi.</p> <p>After 3 visits to Green Bank area I was able to secure a small home for myself. I moved here in September 2016. I left everything. Like many of us who have run here, this whole thing has hurt me financially too. We who suffer with EHS need some place on this earth to exist. It is our earth too. This has truly become a human rights issue.</p> <p>Still, for today, I am so grateful to have found this space in Green Bank to live. I am grateful to the Observatory for being here and working to keep the space exploration and education going.</p> <p>My hope is that the EHS community and the Observatory can be of service to each other by working together to keep this beautiful telescope in operation in Green Bank. It is a win, win for all!</p>	Against Closure	Email - Scanned	11/21/2016	
315	a	Carole Ann	Bradley	Stanford University Class of 2014, B.S. Product Design (Mechanical Engineering) Stanford Solar Car Team 2011	I am writing to you in support of the Green Bank Observatory and highly encourage the NSF to continue its funding of NRAO/GBT. Not only is it an irreplaceable piece of equipment, it is also a huge point of pride and education for West Virginians....At Green Bank, I was able to discover the unknown through hands on projects using radio telescopes, projects that challenged me both academically and philosophically. In the afternoons, we were able to explore the fossil---rich banks of the surrounding streams and caves. . The friends that I made while at Green Bank are some of my closest friends, friends who, although lived throughout the state, encouraged me to pursue higher education. My idyllic experience at Green Bank is easily one of the most influential experiences of my life	Against Closure	Email	11/21/2016	
315	b	Carole Ann	Bradley	Stanford University Class of 2014, B.S. Product Design (Mechanical Engineering) Stanford Solar Car Team 2011	Please understand that closing NRAO at Green Bank will influence more than the scientists, the fragile local economy, and the people who flock to Green Bank for its ideal tranquility. It will impact future generations of West Virginia youth who desperately need a STEM resource that can only be found at Green Bank. If anything, funding for Green bank should be increased. With a future being more and more shaped by technology, it is even more important to encourage young women and young West Virginians to enter a STEM field. The world needs the skills of engineers, chemists, scientists, and those who code and our country, especially West Virginia, cannot survive without putting its students' education at the forefront.	Against Closure	Email	11/21/2016	
315	c	Carole Ann	Bradley	Stanford University Class of 2014, B.S. Product Design (Mechanical Engineering) Stanford Solar Car Team 2011	<p>The Green Bank Observatory ignited my interest in math and science, which helped me and many of my peers achieve higher educational goals that I never knew were possible. Growing up as a low---income, minority female student in West Virginia, STEM (science, technology, engineering, mathematics) education certainly did not seem like a high priority. I was fortunate enough to be in the first class of the WV's Governor's School of Math and Science held at Green Bank (co---sponsored by NSF), under the leadership of the wonderful Sue Ann Heatherly and Dr. Blackwell. My experience with the radio telescopes and the friendships I formed at that camp forever changed my life.</p> <p>Scientists know that one unique event does not tell the whole story, however, much research has shown that STEM exposure young girls in middle school shapes future education/career goals. These studies have shown that young girls lose interest in STEM around 7th/8th grades. The loss of interest is not due to lack of interest and certainly not due to lack intelligence; instead, many girls see the issue as a choice between social pressures (fitting in/femininity) and pursuing STEM.</p> <p>These social pressures are something that I most definitely experienced as a young woman but my Green Bank friends were always there to support me. With their friendship, I never felt like I was an isolated "nerd" --- I had found people who had the same passions and dreams. They were friends who encouraged me as we struggled through similar experiences miles away. My 8th grade experience at NRAO was a critical path component which led me to study Engineering at Stanford University, an experience that should be supported and funded for many generations of West Virginia students.</p> <p>I challenge you to find another similar educational outreach program (both within West Virginia and nation---wide) that has a more impressive diversity and higher education attainment than the sixty person 2005 Class of WV Governor's School of Math and Science at the Green Bank Observatory. Without looking at a full list of alumni, here's a quick look of schools attended:</p> <p>West Point (Female) Harvard University (Minority/ female) Princeton University (Minority/ female) Harvard Medical School (Minority/ female) Princeton University, Mathematics University of Colorado Boulder, Mathematics, Ph.D Stanford University, Engineering (Minority/ female) UC Berkeley, Electrical Engineering/ Computer Science (Minority/ female) Georgetown University Haverford College (Minority/ female) WVU, Chemical Engineering WVU, Physics WVU, Electrical Engineering UPenn (Minority) WV School of Osteopathic Medicine (Minority) Rhode Island School of Design</p> <p>If you should happen to have any more questions about the impact of NRAO please do not hesitate to reach out to me at (510) 734 ---7628. The Green Bank Observatory holds more than a beloved place in my heart --- it holds the key to many young students' futures.</p>	Against Closure	Email	11/21/2016	

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316	a	Dave	Cohen		<p>I am responding to the NSF proposal that includes the possibility of mothballing or dismantling the Green Bank Observatory.</p> <p>I am a member of the board of directors of SARA (the Society of Amateur Radio Astronomers). We hold our annual Eastern conference at the GBO every July. I also mentor high school and college students in radio astronomy. We have taken several annual field trips to the GBO.</p> <p>I can think of several good reasons why the GBO should be allowed to remain in operation:</p> <p>--- The GBO is the most accessible observatory to the general public. If science in general, and radio astronomy in particular, is to remain relevant in the United States, it had better be widely accessible. Thousands of people tour this observatory every year. Many schools send students to use the 40--foot student radio telescope. They also generously allow adult groups like SARA members access to the dish as well. I can attest to the fact that the student dish is heavily used, as our group had to apply for Time on the dish six months in advance.</p>	Against Closure	Email - Scanned	11/21/2016	
316	b	Dave	Cohen		<p>The GBO employs approximately 150 people, of a wide range of skill levels. There are scientists, astronomers, cafeteria personnel, electricians, etc. Since they also hire locally, the GBO provides a major economic benefit to Pocahontas County, where the median household income is only \$26,000 a year. The loss of this facility would have a severe impact on the local community.</p>	Against Closure	Email - Scanned	11/21/2016	
316	c	Dave	Cohen		<p>If the 40--foot student telescope were decommissioned, there would likely be no hands on radio telescopes for high school education anywhere in the United States.</p> <p>The 20 meter telescope is the only publicly remote access radio telescope radio telescope. It is part of the Skynet program developed by the University of North Carolina and Green Bank. It is a powerful instrument that is an important part of their astronomy curriculum. It is also in heavy demand --- I have had personal experience waiting in queue to get access to the dish.</p> <p>--- Other countries are building up their radio astronomy capabilities, are we are considering tearing a large piece of ours down. China has just built the largest fixed radio telescope in world. The GBT still has the advantage of being a steerable dish, and it is exquisitely sensitive. The staff at GBO are still improving the function of the GBT. Shutting down the the GBO would is a clear sign to the rest of the world that we are a nation in decline, that science is no longer a priority here. That is a sad statement to make, especially right now.</p>	Against Closure	Email - Scanned	11/21/2016	
317		Dave	Cohen		<p>My visits to the GBO have been some of the most profound moments of my life. The quiet, beautiful surroundings and the lack of light pollution make this a peaceful and comforting place. It is wonderful to walk its expansive grounds and see the wildlife and the massive radio telescopes in peaceful coexistence. I have walked the long road through the facility many Times --- someTimes it allows deep personal reflection when I am alone, and other Times pleasant conversation with friends. I imagine that there are others who feel the same way as I do.</p> <p>Personally, I would be deeply saddened by loss of this National treasure, and very disappointed in a country that was once a leader in the pursuit of knowledge.</p> <p>I thank you for taking the the Time to read this; I sincerely wish the best for the GBO and the people that work there.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
318	a	Jason	Ray	Electrical Engineer	<p>My name is Jason Ray, and I'm a life-long resident of the Green Bank area, and a current employee of the Green Bank Observatory (GBO) as an electronics engineer, with 15 years of service as of this writing.</p> <p>Growing up in the Green Bank area, I was always fascinated with the Green Bank Observatory. Going to school so close by allowed my classmates & I to make several visits through the years where we learned about science, electronics, liquid nitrogen, computer programming, and all sorts of other exciting astronomy related topics. When I entered Pocahontas County High School, I learned that a series of vocational electronics classes were available, and I took them for three years. As a senior in high school, I spent 40 hours of mentorship time working in the electronics lab at GBO.</p> <p>All of this exposure to science and electronics inspired me to continue my higher education towards a degree in electrical engineering from the West Virginia University Institute of Technology, which at the time was located in Montgomery, WV.</p> <p>During my time at WVUIT, I spent my first summer (1996) as an REU summer student at GBO, working on an electronics test setup used to test up & coming GBT equipment. During the remainder of my time in college, I participated in the co-op program, working a total of five additional semesters at the GBO, doing exciting research work with lasers.</p> <p>Upon graduating from college in 2001, I was offered a full time position at GBO and I jumped at the chance to continue working at this amazing facility.</p> <p>As you well know, GBO does a lot of educational programs, working to train the next generation of scientists and engineers. Soon after I began working full time at NRAO I wanted to "pay it forward" and immediately became involved with many aspects of education. The educational opportunities given to me by GBO had such a great positive affect on my life that I felt honored to return the favor to the next generation of students. Through the years I've participated in many educational endeavors including – mentoring local high school students, REU summer students, working on other projects like the "hour of code" event we do each year, providing electronics lab & telescope tours for student groups, and numerous other things.</p> <p>For the past two years I have supervised two different groups of WVU electrical engineering seniors who chose to do their capstone project in collaboration with GBO to upgrade a critical system for the GBT. This offered them a very unique opportunity to participate in a real-world project. As of this writing, there have been four other (different) groups of WVU senior engineering students doing projects with other GBO staff engineers.</p> <p>Given how few technological opportunities there are in WV, I think it would be a very bad decision to pursue any options other than #1 (no action alternative) or #2 (collaborations with reduced NSF funding). Even option #3 (education park) would be detrimental because one of the most intriguing things for students visiting GBO is the fact that they get to be involved in an actual working research environment – scientists are here studying things, engineers, technicians, and machinists are building things, and the telescopes are moving around making real discoveries. Simply visiting a campus of classrooms and telescope statues wouldn't have nearly the positive effect. My WVU students have all told me that the main reason they chose my project is that they are able to contribute to something "real".</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf
318	b	Jason	Ray	Electrical Engineer	<p>Another negative impact to the community would be the inevitable flood of houses for sale on the real estate market, in conjunction with the major reduction in workforce (GBO employees) to purchase houses.</p> <p>There would also be considerable impacts to the state of WV. From an education perspective around 3,500 students (mostly from WV and some from VA as well) per year visit Green Bank to participate in our educational programs. Also, there would be a negative impact from a tourism perspective, as around 50,000 people visit Green Bank each year. That is a lot of people that may not visit WV, or at least may not pass through as much of WV on their trip.</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf
318	c	Jason	Ray	Electrical Engineer	<p>Any options other than #1 or #2 would have a very negative impact on the community in Pocahontas County due to the reduction in population because of employees required to move away to find comparable employment. Losing these employees from GBO also means losing their countless other contributions to the community, some examples include – volunteer firefighters & EMS personnel, soccer, football, baseball, & tee ball coaches, school fair judges, school tutoring, mentoring high school students, boy scout & girl scout volunteers, electronic repairs for local schools (scoreboards, audio equipment, computing equipment, and other things), and many other things, too many things to list here.</p> <p>Along with the employees' contributions to the community, the spouses of employees contribute just as much, if not more. Many of them are full time school teachers, EMS workers, and they volunteer in the schools and in many other capacities in the community.</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf

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318	d	Jason	Ray	Electrical Engineer	<p>I would like to also encourage you to fund the GBO as much as possible to ensure that "open skies" is still available for science purposes. This is very important for universities and their students who cannot afford expensive telescope time, but would like to pursue research that requires a large telescope with open skies access. Currently, the GBT is oversubscribed by a factor of four! Any new funding sources that are attained for the GBT directly reduces the precious open skies time that is already in high demand.</p> <p>From a science perspective, do not underestimate how important the GBT is to the scientific community. The 2012 portfolio review trivializes the impacts of the GBT to the worldwide scientific community, and the proposed recommendations to achieve the science are flawed in many ways. More details of this can be found in the NRAO response to the portfolio review (NRAO Doc. #: PRC-2012.08). To summarize, the GBT has many capabilities that CANNOT simply be replaced by other existing telescopes, for a variety of reasons. Some of the GBT projects would take 1 to 2 orders of magnitude longer time to do on other telescopes. The unique sensitivity, large size, pointing accuracy, and sky coverage enables world class research on star formation, pulsar discovery, pulsar timing, astro-chemistry, radar experiments, just to name a few. If the GBT were to go away, scientists would have to rely on other telescopes to do their science. Many of these telescopes do not have an "open skies" policy, and they are also quite oversubscribed to begin with, making it that much more difficult for scientists to get time on them. It's a major problem that snowballs quickly when you consider observing time required, telescopes available, and telescope time available.</p> <p>The US is currently the world leader in radio astronomy. However, other countries (China, South Africa, and the Australia to name a few) are investing heavily in the area of radio astronomy. If the NSF allows world-class instruments like the GBT to be taken out of service, it won't be long until the US is no longer a world leader in the field. American students looking to enter this field will be required to go to other countries to get their education, experience, and their jobs.</p> <p>In closing, I would like to thank you for your time and I'm hopeful that you take all of the comments you receive seriously and only consider options #1 (no action) or #2 (collaborations) for the future of the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf
319		John	Cannon	Macalester Astronomy	<p>I write to strongly urge that the National Science Foundation chooses alternative #1 of its "Notice of Intent to Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations..." , namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>As a scientific user of the Green Bank Telescope for over 5 years, I can attest to its continuing importance for studies of galaxies. Its enormous collecting area (the largest of any fully steerable radio telescope in the world) has been and continues to be crucial in studies of faint objects, such as low-mass galaxies. The facility is less than twenty years old; it remains in the prime of its scientific life, uniquely able to make important and impactful scientific discoveries.</p> <p>While many radio astronomers (including myself) use multiple-dish interferometers for high angular resolution observations, there remains an important need for large single dish facilities such as the Green Bank Telescope. This is the only type of radio telescope capable of mapping faint neutral hydrogen emission in nearby galaxies; such observations are critical for our understanding of how galaxies interact gravitationally, and in fact have demonstrated that our understanding of the local environments of nearby galaxies is incomplete. As a dramatic example, I used the Green Bank Telescope to observe DDO68, a well-studied local galaxy that harbors extreme physical properties in its interstellar medium. These new Green Bank Telescope observations confirmed the existence of a previously unknown, lower-mass system that is interacting with DDO68 (Cannon et al. 2014, Astrophysical Journal Letters, 787, L1). Signatures of these interactions can often times only be studied with the Green Bank Telescope; optical and interferometric radio observations do not provide the same discovery potential.</p> <p>I have co-authored multiple peer-reviewed scholarly manuscripts that stem from Green Bank Telescope observations that involve Macalester College undergraduate students. This unique instrument plays a critical role in the professional and scientific development of these students. The telescope thus remains a unique, powerful, flexible, and pedagogically central instrument for the 21st century.</p>	Against Closure	Email - Scanned	11/21/2016	
320	a	David	Nice	Associate Professor Physics Department, Lafayette College	<p>I wish to strongly encourage you to pursue any option which maintains the continued scientific operation of the Green Bank Observatory.</p> <p>The Green Bank Telescope, the largest facility of the GBO, is the premiere single-dish radio telescope for all portions of the sky not visible from Arecibo. It is still a young instrument (in operation less than two decades) and it is still doing tremendous cutting edge science. Indeed, in the field with which I am most familiar, observational pulsar and gravitational research, it has only been a "fully capable" telescope for about six years, in the sense that its data-recording instrumentation has only been capable of using the full telescope signal over that period. It really is "almost new." It could be further strengthened by modest refinements in instrumentation, such as wide-bandwidth receivers, allowing it to remain a leading-edge instrument for decades to come.</p>	Against Closure	Email - Scanned	11/21/2016	gbo_eis.pdf
320	b	David	Nice	Associate Professor Physics Department, Lafayette College	<p>The GBO has the unique advantage of being in the National Radio Quiet Zone. As an observational astronomer who has worked at many different facilities, I can attest that this is an important advantage to the Green Bank Observatory that, as a practical matter, could not be replicated anywhere else.</p> <p>The GBO contributes tremendously to the surrounding Appalachian communities. There are no other modern, leading-edge engineering or scientific facilities anywhere near Green Bank. Its educational facilities have a huge impact on everyone from local high schoolers to undergraduates to graduate students to postdocs at leading research institutes.</p>	Against Closure	Email - Scanned	11/21/2016	gbo_eis.pdf
321	a	Thomas	Plumly		<p>I am writing with concern about the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on October 19, 2016. I wanted to express that I think it is extremely important that the full funding and operation of the Green Bank Observatory continues in the future.</p> <p>I am a retired educator and coach who taught in Pocahontas County Schools for forty--one years with thirty--seven of those years being at Green Bank Elementary. I know firsthand what the Observatory has done for the School System and the betterment of students. I know many others have mentioned the obvious support of Science Fairs, Math Field Days and many other such activities but what I want to address is the health and safety it provides to so many students as well as adults that are often overlooked.</p> <p>First of all the Green Bank Observatory is the Emergency Shelter for all Green Bank Elementary Middle School students in case of Emergency Evacuation. Without this planned shelter I do not believe there would be another quick alternative in a crisis. I know the Observatory has also been declared a certified Red Cross Facility and I can recall numerous times when they have opened their doors to those in need when the power has been out in the county for long periods of time and it was critical for residents requiring oxygen on a full time basis.</p>	Against Closure	Email - Scanned	11/21/2016	Observatory Letter of Support.docx

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321	b	Thomas	Plumly		<p>In a society in which obesity is growing in children at an alarming rate exercise is critical. The Green Bank Observatory has allowed the AYSO Soccer League to use their property for years. For this reason most residents probably assume the soccer fields belong to the Pocahontas Board of Education. Should the Observatory not exist the soccer fields would not exist nor would this space be available for physical education classes or recess. Students from this county as well as surrounding counties have used these fields for years. The Observatory has built and maintained goals for the AYSO for many years. Most of the Coaches and Referees for AYSO Soccer are Observatory personnel or spouses and this also applies to Little League Baseball. The Observatory has often helped in moving dugouts and other equipment for baseball as well.</p> <p>Green Bank Observatory personnel were responsible for the planning and the erection of new bleachers and the sound system for the Pocahontas County Football and Soccer Stadium.</p> <p>Observatory Property is often used for Bike--- A--- Thons for Green Bank Elementary School as well as organizations like Muscular Dystrophy. Without the Green Bank Observatory Pool most children on this end of the county would never be able to take swimming lessons. The Observatory has always opened the pool to the Local Parks and Recreation Commission to give swimming lessons to the entire community. I attended the public meeting held at the Observatory so I am aware of the concern voiced for health and safety by the local Fire and Rescue Squad but I wanted to take the time to mention the above items which although are more subtle to health and safety they are very important to our students and community. Please consider the continued NSF investment for Science---focused operations (No -action Alternative) or option one for the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	Observatory Letter of Support.docx
322	a	Tony	Beasley		<p>Thank you for this opportunity to comment on the scope of the Environmental Impact Study (EIS) being undertaken for the Green Bank Observatory.</p> <p>- To what extent are the potential impacts of process timing on the alternatives being considered? The cost of partnership with GBO right now would not involve major refurbishment or upgrade – the site has been well-maintained. An organization attempting to join/manage GBO a few years after NSF lowers their funding may find a back log of technical work that would make it cost-prohibitive to partner. To what extent can NSF guarantee its behavior/performance in this process so that the proposed alternatives are realistic? The critical socio-economic impacts of some of the alternatives to the local area also will vary depending on the timing of any transition. Identifying alternative 1 as preferred, but then starving the site of funding and letting it run down to make that alternative impractical would violate the underlying assumptions of this process. I would like to see this timeliness issue discussed in detail in the EIS.</p>	General	Email - Scanned	11/21/2016	
322	b	Tony	Beasley		<p>The Green Bank Observatory plays many important roles in the scientific, technical, educational and local communities. The flagship instrument on site – the Green Bank Telescope – is an important part of the astronomical infrastructure of the United States, and has continued to improve in the (only) fifteen years since its opening. For more than five decades the National Science Foundation has supported research and education on the Green Bank site, with many outstanding scientific results, and many more discoveries to be made. The infrastructure developed in Green Bank (telescopes, labs, administration, accommodation) is significant, and results from important long-term investment by the NSF and the U.S. taxpayer. To support this investment, a National Radio Quiet Zone has been established surrounding the Observatory, the first of its kind in the world and a key resource for the country.</p> <p>Of the five preliminary alternatives to be considered in refining the Environmental Impact Statement regarding GBO/GBT, the first two allow future use of the site for astronomical research. These are superior choices, and the first alternative is my preferred option. As all the alternatives are explored in the EIS document, in addition to the standard areas of investigation required I recommend the following issues be considered:</p> <p>- Alternative #2 – it is often discussed in the astronomy community that radio telescopes managed by organizations whose primary mission is non-astronomical have had difficulty producing significant results in astronomy. As a result, the impact of this alternative may be much worse on longer timescales in terms of social impacts than initially appears; the EIS should discuss relevant examples to adequately describe the potential impacts here.Reducing the Observatory's ability to perform leading-edge science would be a hugely negative impact.</p> <p>In closing let me suggest that it is incumbent upon NSF as the manager of these facilities to find a way to continue the important work of GBO. NSF has done an outstanding job creating the GBO, and while the stresses on NSF/AST to explore these investment scenarios are significant, this facility has tremendous local and national public benefit, and a bright future. The scope of this EIS is important, so thank you for the opportunity to comment, and I intend to also comment on the draft EIS. I assume the NSF will release all environmental studies associated with the site early enough so the public can review and assess all aspects of the impacts.</p>	Against Closure	Email - Scanned	11/21/2016	
323		Dennis	Smith		<p>In neighboring KY, we have little effect on Greenbank or Pocahontas County or its economy but the importance of the research done there is enormous and needs to continue. Although I resist tax use, I would like to see a concerted effort to fund this and any finances raised by charging for its use returned to fund it. I fully support military and space/discovery programs.</p>	Against Closure	Email - Scanned	11/21/2016	
324	a	Lauren	Bennett		<p>I am writing in support of continued funding by the National Science Foundation for the Green Bank Observatory.</p> <p>The Green Bank Observatory is a vital part of this county's economy. It is one of the largest employers in the county. The majority of those employees reside in Pocahontas County with their families. They own homes, support local businesses and have children in the school system. Closure of the site would be a huge loss to the local economy as these folks moved away for other employment. It would especially be a huge loss to this rural school system in terms of not just students but many teachers (GBO spouses) as well.</p> <p>Additionally, Pocahontas County relies heavily on tourism. The Green Bank Observatory brings in approximately 50,000 visitors a year, many of whom spend money on food, gas, lodging and other recreational activities in the county. Without this additional tourism income, many local businesses would not be able to stay in operation. Additionally, it would mean a loss in hotel-motel tax which would affect many amenities such as county parks and recreation, libraries and arts organizations. Closure of the GBO would be a huge economic loss to Pocahontas County.</p> <p>Please continue to fund and operate the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	GBO letter of support.docx

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324	b	Lauren	Bennett		The Green Bank Observatory is an incredible educational asset to the county, state, country and world. Telescopes are available to scientists worldwide. Students come to study at West Virginia University from around the country and world because of the opportunity to use the Green Bank Observatory for their research. High school and college students have the opportunity to work side by side with scientists and engineers in mentorship programs. Approximately 3,000 elementary, middle school and high school students visit the Observatory each year, getting a hands-on view of science that's hard to acquire in the classroom. In addition, the Observatory offers a variety of scientific outreach programs for schools, organizations and the community. Just recently, 4H clubs in the county were invited to study drones in a special program at the Observatory.	Against Closure	Email - Scanned	11/21/2016	GBO letter of support.docx
324	c	Lauren	Bennett		The Green Bank Observatory is an irreplaceable asset to this community. As director of Pocahontas County Parks and Recreation, I have worked with the Observatory for over 25 years. We have used their swimming pool to offer swimming lessons and lifeguarding classes to the community. We have used their shelters for outside classrooms, especially for art classes, their recreational facility for general "playground" programs and some of their open space for soccer fields. We have used their trails for interpretive hikes and for walking programs. And we have continually used the old tour center for a variety of fitness classes, such as yoga, zumba, ballroom dance, ballet and a creative movement program for preschoolers. Most importantly, the people who work at the Observatory are an integral part of this community. They are volunteer firemen and EMT's. They are coaches and scout leaders. They run sound systems and lighting for concerts and theatrical performances. They serve on many community boards and organizations. They, along with the facility, serve as an important link in any response to a natural disaster or other emergency. Their engineers have helped with designing our community wellness center and the local library, and offered technical assistance throughout the construction process. Their scientists have done "star talks" at campfire programs and offered a variety of programs at 4H camp. Their electricians re-wired an old school annex so that it could be used for a community fitness center. When the Opera House was being restored, two engineers from the Observatory helped to determine its structural integrity. Machinists have helped fabricate special replacement parts and built soccer goals. Add to this all the other community organizations that folks from the Observatory have assisted and the list would be endless. I cannot imagine what Pocahontas County would be like if the Green Bank Observatory was closed. I do know that the loss to the community would be devastating.	Against Closure	Email - Scanned	11/21/2016	GBO letter of support.docx
325		Asher	Wasserman		I am a graduate student at the University of California, Santa Cruz. I'm writing to you today about the proposed options for the Green Bank Observatory. While I was a student at Rutgers University, I had the fortunate opportunity to visit the observatory as part of a class trip. This visit was a formative experience in my scientific education, and it played a role in my decision to pursue a career in astronomy. Through the financial support of the NSF, the astronomical community has had access to one of the best sites for radio astronomy in the world. The Green Bank Telescope is a truly unique facility, and so I strongly encourage the No---Action Alternative, which would provide continued NSF investment in science---focused operations at Green Bank.	Against Closure	Email - Scanned	11/21/2016	
326		Homer	Hickam	Author, Rocket Boys/ October Sky www.homerhickam.com	Please add my name to those concerned citizens who want to save the great National asset of the Green Bank Observatory in my home state of West Virginia.	Against Closure	Email - Scanned	11/21/2016	
327	a	Amanda	Griffith		I am writing to express concern that NSF may reduce funding for or deconstruct the Green Bank Observatory and ask that funding continue to support this unique resource in West Virginia. Because it is large and fully steerable, the GBT has unique capabilities that are not available at other observatories in operation today or even planned for the future. With its large 110m dish, GBT is able to hear incredibly faint radio waves emibed from the universe that smaller radio dishes wouldn't be able to capture. The 305m Arecibo radio telescope in Puerto Rico can capture similar faint radio waves, because it is not steerable, it can only observe about 33 percent of the sky, compared with GBT's ability to observe 80 percent. Additionally, the recent discovery of gravitational waves has put pulsar research at the forefront of modern astronomy. GBT is a crucial tool for this line of work analyzing radio waves emibed from pulsars. Because of it's steerability, GBT has a tremendous advantage over Arecibo and the FAST telescope in China of providing researchers the ability to observe a large number of extremely well---Timed pulsars.	Against Closure	Email - Scanned	11/21/2016	
327	b	Amanda	Griffith		GBT provides up to 140 jobs, draws 50,000 visitors per year and is estimated to bring in approximately \$12 million in tourism dollars per year. I live in WV and have visited this attraction several Times. Just this summer, my family and I vacaPoned at nearby Snowshoe. My husband and I drove our sons (who are 3 and 1) to the observatory one afternoon to look at the huge telescopes. I thought about how great a resource this facility is for our state and how excited I will be to bring my children back to visit when they are older to foster their interest in STEM education. GBT is an irreplaceable research and education tool in a state that desperately needs more STEM resources. I have seen the abacks and the anti---science concepts that are slowly creeping into mandated curriculum in our state. Our teachers and students from the elementary school level to 12 state colleges and universities that make up the WV NASA Space Grant need this great resource. Please fully---fund the GBT. Our children need a resource that will foster their interests in STEM education. Without a clear path to 21st century jobs, children of WV will have nothing to replace the coal mining jobs that are quickly disappearing and WV will continue to be one of the poorest states in the nation.	Against Closure	Email - Scanned	11/21/2016	

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328		Michael	Kramer	Director --- Max-Planck---Institut für Radioastronomie, Bonn, Germany Professor for Astrophysics --- University of Manchester, UK Professor (Hon---Prof.) -- University of Bonn, Germany	On behalf of an international collaboration (listed below) using the GBT routinely for groundbreaking research, I would like to express our concern regarding possible changes to the current operation model of the Green Bank Telescope (GBT) as a result of the Environmental Impact Study. To put our comments in context, let me briefly explain how we use the instrument with one specific example: In 2003 an international collaboration consisting of Australian, British, German, Italian, and US astronomers discovered the so-called Double Pulsar. Using the GBT, and including further international experts from Canada, France etc., our observations provide the most precise tests of strong-field gravity. In an upcoming publication we show that even in the era of gravitational wave detection with UGO, the Double Pulsar still provides complementary and partly more precise tests than possible with gravitational wave detectors today and for the foreseeable future. The GBT is the ideal instrument for the study of pulsars in general and for this specific source in particular, as the telescope has sensitive wide-band receivers and its unique location in a radio-quiet zone is also far-enough South to cover two full complete orbits of this exciting binary system in one day. (In comparison, our own 100-m radio telescope at Effelsberg is further North and can see only part of a single orbit.) For the Double Pulsar and other interesting systems, we have routinely won observing time in an open, competitive peer-reviewed process that follows the so-called "open skies" policy. We truly believe that an open competition for observing time is the best way to produce excellent science, and so we are very worried about a possible restriction of "open skies" at the GBT. We believe that instruments are best used when access is determined by excellence and not by available funding. Scientific successes with the GBT have a direct positive impact on the US community and society as a whole, even if some projects are led by non-US colleagues. This impact starts with a positive influence on young people to follow a STEM career, the education of students being directly involved in cutting-edge science, and goes beyond the very close interaction between US and non-US colleagues in obtaining and disseminating the obtained results. For instance, it is easy to produce a list of more than 50 publications from other groups in the US that were directly triggered by our research with the Double Pulsar. Hence, reducing the access to the telescope endangers the science produced with the GBT as a superb instrument with a global importance for astronomy as a whole. We urge the NSF to consider these concerns and we hope that the GBT can be funded at a sufficiently high level to ensure a full "open skies" policy as an investment into the future.	Against Closure	Email - Scanned	11/21/2016	GBT_Support_pulsar.pdf
329		Daniel	Reichert	Director of the Skynet Robotic Telescope Network Director of PROMPT and Morehead Observatory Professor of Physics and Astronomy University of North Carolina at Chapel Hill	I have been an acPve user of, and contributor to, Green Bank's educational facilities since 1991. For the past 25 years, I have taken undergraduate groups to Green Bank for a week---long crash course on radio astronomy. We have used both the 40---foot and, more recently, the 20---meter. Regarding the 40---foot, we bring our own data acquisition and analysis software, which we have written over the years, and push this telescope to its limit. For a detailed description of the projects that students complete each year: http://skynet.unc.edu/erira/about-erira/ We have even published data from this telescope in the ApJ, with another paper, using both the 40---foot and the 20---meter, in preparation. Regarding the 20---meter, I was the PI on the \$1.8M MRI---R2 award that funded its refurbishment and integration into the Skynet Robotic Telescope Network. To date, thousands of students (as well as a few researchers) have used the 20---meter remotely, through Skynet. Tens of thousands are expected to do so in the coming years, as educational programs continue to be designed around this unique resource, and implemented. I find the 20---meter effort particularly important, because for many students, this will be their only introduction to radio astronomy, at least observationally. Far fewer students are able to travel to the remote locations that host radio telescopes, and no radio telescope has an interface that is as easy for students to use as the 20---meter on Skynet. This effort has already led to new educational programs, such as Skynet Junior Scholars (for middle and high school age students) and Project Intro Astro (for undergraduates), with even larger efforts currently in development. Personally, I hope that options 1 and 2 are considered most seriously. In the event of option 3, I would encourage NSF to retain both the 40---foot, for hand---on education, and the 20--- meter, for remote education to potenPally far larger numbers, through Skynet. In the unfortunate cases of 4 or 5, I would encourage NSF to consider relocaPng the 20---meter to an active NRAO site, so this effort can continue to develop. Or to identify a similar radio telescope already at an active NRAO site that could be integrated into Skynet in its stead.	Against Closure	Email - Scanned	11/21/2016	
330	a	Lynn	Mabhews	MIT Haystack Observatory	As the National Science Foundation embarks on its Environmental Impact Statement process for the Green Bank Observatory, I am writing to strongly urge you to adopt the "No---Action Alternative" that will maintain this world---class facility for science---focused operations. The Green Bank Telescope has already for several years been producing exceptional scientific results across nearly every sub---field of astronomy and astrophysics, and this telescope only continues to grow in importance. The combination of Sensitivity and frequency coverage of the GBT are unique, as is its location in the Radio Quiet Zone. For example, my own personal research has used the GBT for a project involving the study of mass loss from dying stars that would not have been possible with any other telescope in the world. Not only has new instrumentation continued to make the GBT even more cutng edge, the relevance of this single---dish telescope, with its excepPonal mapping speed and surface brightness Sensitivity, is only heightened in the era of new state---of---the---art interferometers such as the Jansky VLA, ALMA, and the SKA precursors. In short, loss of the GBT to the North American community would severely undermine US radio astronomy and be a setback for astronomy as a whole.	Against Closure	Email - Scanned	11/21/2016	

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330	b	Lynn	Mabhews	MIT Haystack Observatory	Finally, it is also important to emphasize that the Green Bank Observatory is far more than just the GBT. The location of a public observatory in a radio quiet zone becomes increasingly valuable as radio frequency interference further encroaches on scientifically important portions of the electromagnetic spectrum at other sites. Further, the observatory and its staff have an enormous positive impact on their surrounding community. Through its education and outreach initiatives, the GBO continues to inspire children and adults-many from underserved communities--and shares with them the excitement of scientific discovery. However, such programs can only be meaningful if the GBO remaining an active observatory, engaged in research and open to the general science community.	Against Closure	Email - Scanned	11/21/2016	
331		Ben	Forrest	Graduate Student Dept. of Physics and Astronomy Texas A&M University	I am a current student at Texas A&M University pursuing my Ph.D. in Physics (astronomy track). During my undergraduate career at Rutgers University, I had the excellent opportunity to take a field trip to GBO. There we took radio data and completed an analysis project, as well as toured the facilities and saw the GBT control room. This trip was an important factor in my decision to pursue astronomy in graduate school. I am strongly recommending the continuation of funding for the GBO as both a research and education facility. The incredible resources available here still have a multitude of uses that can further scientific endeavors and inspire future generations of scientists, policy makers, and the general public.	Against Closure	Email - Scanned	11/21/2016	
332		Patrick	Miller	Director, InterNational Astronomical Research Collaboration iascsearch@hsutx.edu 1---325---670---1393	I am writing in regards to the recent NSF review of its support for the Green Bank Observatory. I strongly favor either of the following options by the NSF: 1. Continued NSF investment for science---focused operations (No---Action Alternative) ---or--- 2. Collaboration with interested parties for science--- and education---focused operations with reduced NSF---funded scope My students and I have made extensive use of the educational programs offered through the GBO. In June 2013 as a faculty member on sabbatical leave, I abended a NASA Chautauqua event organized by Sue Ann Heatherly. From that event and experiencing the GBO and the use of its 40---o transit dish, I developed a 2---week upper division workshop for university students. This has been offered at GBO in May 2014, May 2015, and May 2016...and I hope again in May 2017. I have had students from Hardin---Simmons University and Cisco Community College (both in Abilene, TX) parPcipate. I've had students from Jackson State University (Jackson, MS) parPcipate, and in September 2016 in a separate workshop I had students from the Universidade Estadual do Norte Fluminense (Campos dos Goytacazes, Brazil) parPcipate. Also abending in May 2015 was Jason Kessler, who at the Time was the Executive Director of the NASA Asteroid Grand Challenge. The students spend two weeks on site at GBO where they work with the 40---o transit dish and the online 20---m sidereal dish. They tour the facilities from top to bottom including journeying to the top of the GBT. This is truly an exceptional educational opportunity for these students. The GBO is a research and educational facility that is a treasure for our nation. It merits the full support of the National Science Foundation, as it continues to conduct world leading scientific study and unparalleled educational opportunity for students.	Against Closure	Email - Scanned	11/21/2016	
333		Phillip	Naudus		I am writing to urge you to either continue investing in the Greek Bank Observatory, or collaborate with interested parties to allow the observatory to continue its current science and education focus. During my graduate education in physics, I served as a teaching assistant for undergraduate radio astronomy, in which the class visited the Green Bank Observatory. Even though I was helping to teach the students the necessary science they needed to understand in order to operate the telescope and analyze the data they had collected, I learned an incredible amount myself, as this was my first visit to an observatory. In fact, of all my experiences during my graduate education, the trip I made to this observatory was the one that made the most profound impression on me. Since graduating from Rutgers, I have taught science classes to high school students (Kang Chiao InterNational school, Taipei, Taiwan), as well as middle school students (LOGAN Hope, Philadelphia, PA). The hands---on training I received during my graduate education in physics has transformed my educational philosophy, allowing me to elevate the education of my students, as I teach the next generaPon how to internalize scienPfic principles rather than memorize a series of facts. While there were many facets of my education beyond my visit to this observatory that helped to mold me into the teacher I am today, the Green Bank Observatory had a large impact on the way I understand and teach science.	Against Closure	Email - Scanned	11/21/2016	
334		Cheoljong	Lee		My name is Cheoljong Lee, and I am a graduate student at UVa studying interstellar gas and dust in the nearby galaxies. I believe that the GBT has great capabilities in providing high quality dataset that scientists can use to study atomic gas and dense gas in detail, and so I would like to support for the GBT to continue its operations for science.	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
335		Michael	Strzelczyk		<p>My name is Michael Strzelczyk. I am an alumni of Rutgers University in New Brunswick, and I visited the NRAO in April 2016. While I have always been passionate about astronomy, the trip sparked a lifelong fascination in many of my fellow student after being offered this rare opportunity.</p> <p>The loss of the GBT would greatly concern me. This telescope provides vital data for scientific discovery and it is a National scientific landmark, keeping the United States in the frontier of radio astronomy. I have personally used data sets from observations, which yielded invaluable experience that helped me in my academic career. De--- funding this observatory is an extreme measure that is unsustainable in any period of Time, with inevitable consequences for the telescope. I encourage you to appeal the decision and continue funding scientific operations at the telescope.</p> <p>I thank you for your consideration and look forward to continued funding and observations from the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/21/2016	
336	a	Amanda	Kepley		<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for Green Bank Observatory (GBO). I would like to voice my strong support for maintaining GBO operations at their current level.</p> <p>Last week I received the exciting news that my team had been awarded almost 200 hours of time on the Green Bank Telescope (GBT) to understand how galaxies transform dense molecular gas into stars. This will be the largest survey of its kind: no other telescope has the capabilities and available time necessary to perform this survey. It is the culmination of years of work by myself and others. This survey is supported by two NSF grants: one to the team building the instrument for the GBT and one to my collaborators to fund the analysis.</p> <p>However, without NSF funding for GBO operations, and specifically the GBT itself, we will not have the telescope necessary to collect the data.</p> <p>This project, and many other GBT projects, needs maximum flexibility in the telescope schedule to leverage good weather conditions. Any reduction in science time on the GBT due to reductions in NSF support would severely limit our ability to make the most of excellent 4mm weather necessary. For this reason, I strongly support maintaining GBO operations at their current level. The other options suggested in the EIS Nol, including collaboration with interested parties of science- and education-focused operations with reduced NSF-funded scope, would negatively impact my survey and the other key science done with the GBT. I encourage you to review two whitepapers that summarize other important scientific projects that would be affected by changes in GBO operations: arXiv:1610.02329 and arXiv:1610.09014.</p>	Against Closure	Email - Scanned	11/21/2016	gbt_support_letter.docx, gbt_support_letter.pdf
336	b	Amanda	Kepley		<p>Reductions in science operations will severely threaten the small neighboring communities surrounding the GBO. I lived and worked on site at the GBO for two years and have seen first- hand the impact that the observatory has on the local community. The GBO is a major area employer (second only to Snowshoe, the local ski resort). Residents are employed across the observatory as everything from machinists to engineers.</p> <p>Finally, the Green Bank Observatory provides excellent science outreach to an underserved population in rural West Virginia. The GBO Visitor's Center is a major tourist attraction (and deservedly so). As an observer, I have visited many telescope visitor centers, and the GBO Visitor Center is, by far, the best visitor center I have ever seen. The quality of both the exhibits and the programs sets the standard for what observatories should provide.</p>	Against Closure	Email - Scanned	11/21/2016	gbt_support_letter.docx, gbt_support_letter.pdf
336	c	Amanda	Kepley		<p>The GBO and GBT occupy a unique niche in the radio telescope landscape. They are one of the few facilities left in the United States where students can get hands on experience with the telescope and where university groups can test new instrumentation on a state-of-the-art facility. As a graduate student and postdoc, I have had the tremendous opportunity to learn how radio telescopes work and to experiment with the GBT to try out new ideas. Through these experiences, I developed increasingly rare instrumental expertise and decided that I wanted to pursue a career as a staff scientist at an observatory. Both the current GBT backend, VEGAS, and ARGUS, the instrument my survey will use, have been built as part of NSF-funded observatory/university collaborations. Without full NSF funding for science operations, this unique resource will no longer be available for students and universities.</p> <p>...</p> <p>The GBO student programs are also outstanding. They attract students from West Virginia and neighboring states. I've had the opportunity to mentor some of these students and they regularly astonish me with their enthusiasm and creativity. Part of the excitement of visiting the GBO is that it is a working observatory, not a museum. Visitors experience science in action. They can run across everyone from bleary-eyed observers to maintenance workers installing a new receiver or repairing the telescope track. Any reduction in NSF support would remove this key aspect of the GBO outreach experience.</p> <p>In closing, I would like to reiterate my strong support for the NSF maintaining full science operations for the Green Bank Observatory. The GBO is an observatory at the height of its scientific capabilities that supports its surrounding communities and encourages the next generation of scientists. Without NSF funding, the GBO will become a shell of what this fantastic facility is today.</p>	Against Closure	Email - Scanned	11/21/2016	gbt_support_letter.docx, gbt_support_letter.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
337	a	Felix J.	Lockman		<p>I strongly support Option 1: "Continued NSF investment for science-focused operations" for the Green Bank Telescope and the Green Bank Observatory for the following reasons: (note: specific references supporting the matters discussed here can be found in the two attached documents, also available at https://arxiv.org/abs/1610.02329 and https://arxiv.org/abs/1610.09014).</p> <p>1. The Green Bank Telescope is a national icon, like the Space Shuttle or the Statue of Liberty. It stands for pure research into the nature of the Universe. The Green Bank Telescope and its science are the subject of news articles almost weekly in print, radio, TV, and the internet (see http://greenbankobservatory.org/news/), It was featured in legendary Film Director Werner Herzog's Documentary about the Internet "Lo and Behold: Reveries of the Connected World". It will be the centerpiece in three films now under production including "The Quiet Zone" by Brooklyn Castle Productions, and the "Digits" documentary series by Partisan Pictures. The Telescope will be the focal point of a "Great Course" on radio astronomy produced by The Teaching Company. Its image was chosen for the graphic on U-Haul rental trucks in West Virginia. There are numerous other examples. Option number 2, which would essentially commercialize a majority of the Telescope's functions and remove them from scientific research, would be like turning the Statue of Liberty into a casino.</p> <p>2. The Green Bank Telescope is a rare visible symbol of the work of the National Science Foundation. Most of the Foundation's budget — more than \$7 billion each year — goes for projects that are totally invisible to the tax-paying public. This is perfectly reasonable of course, for the money goes to labs in university buildings, or facilities deep underground, or to the South Pole or remote mountain tops. But the Green Bank Telescope is one of the few fruits of the NSF's labors that is visible to anyone. Indeed, it is seen up close by the 40,000 - 50,000 visitors that come to the Green Bank Observatory every year. The Observatory Science Center is a year-round facility that provides a variety of programs http://greenbankobservatory.org/visit/science-center/. The Observatory hosts star parties and the annual meeting of the Society of Amateur Radio Astronomers. Every day it publicizes the work of the NSF. Located an easy drive from Washington, D.C., the Observatory should be visited by every Congressman wondering what the NSF does with its money. The Green Bank Telescope should be the symbol of the NSF, not something that it is trying to discard.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz
337	b	Felix J.	Lockman		<p>3. The Green Bank Telescope is the focal point of some of the most successful NSF programs in STEM education. It serves a rural disadvantaged population that has few positive role models for STEM careers. The Pulsar Search Collaboratory and Science Teacher Training are just two of the NSF-funded educational programs that have reaped benefits beyond the region. The smaller telescopes at the Observatory are successful tools for education because they take advantage of the scientific and technical staff to provide unique, hands-on experiences for students. I have personally watched school children become fascinated with science after simply seeing the Green Bank Telescope. They realize that they could become scientists or engineers. The thought that they could grow up to actually use the Telescope for their own research is an extremely powerful motivation for education. This, of course, requires that the Telescope is actually used for research, and is not simply a demonstration model. Today's kids are quite good at sniffing out a fake from the real thing. For the Green Bank Observatory to continue its role in STEM education it must continue as a research instrument available to all qualified scientists. 4. The Green Bank Telescope is an increasingly rare example of a facility that can be used to develop new instruments and new scientific techniques. The U.S. scientific community has been very successful at getting funding from the NSF and other sources to build new instrumentation to be used, or demonstrated, on the Green Bank Telescope. Examples include University of California Berkeley development of the VEGAS spectrometer, University of Pennsylvania development of the MUSTANG family of bolometers, Stanford University development of the Argus 3mm camera, the joint Brigham Young University and West Virginia University development of beam-forming technology, the University of Maryland development of the Zpectrometer broadband spectrometer, the University of Massachusetts prototype phased array receiver, and so on. Without the Green Bank Telescope to use as a testbed, development of these new technologies would be strangled to the detriment of the technological base of the United States. 8. The Green Bank Telescope is a rare facility that is both world-class, and allows and actually encourages hands-on use by graduate students. The Green Bank Observatory holds regular schools for early-career professionals and graduate students to introduce them to radio astronomy and train them in the use of the Telescope. As access to the Telescope is allocated strictly by the merit of the proposed research, graduate students can have full use of the facility, and develop their own programs with assistance from the scientific and technical staff. The staff can make changes in the hardware or software to facilitate specific experiments. Many PhD dissertations are produced each year using data from the Telescope. If a significant fraction of the Telescope's time is lost to science, it will make it more difficult or impossible for thesis research to be performed.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
337	c	Felix J.	Lockman		<p>The [GBT] is one of the few facilities available for scientists to develop new observational techniques and new experimental methods. A prime example is the development of "HI Intensity Mapping" by scientists at Carnegie-Mellon University and colleagues elsewhere. This new technique is now the basis for an entirely new telescope being built in Canada. There are other examples in pulsar science. Access to a world-class telescope for hands-on science is increasingly rare at all wavelengths, and the [GBT] is one of the few remaining open facilities. Its removal from active research would severely impact the ability of American scientists to devise new creative strategies and techniques in observational astronomy. 5. The [GBT] offers merit-based access to a world-class facility. The NSF-funded open skies time is allocated on merit. It is not restricted to the rich, or to scientists from wealthy institutions. A recent feature in the international science magazine Nature (2016, Vol 537, p 466) asks "Is science only for the rich?" and notes the large barriers to higher education and STEM careers for students from the lowest income-bracket families in the US. Any reduction in "open skies" time on the GBT directly restricts access to world-class facilities for scientists from smaller universities and liberal arts colleges. The second option under consideration here would strike directly at those in the U.S. who depend the most on NSF-funded public facilities. Choice of the second option will restrict access to this first-rate telescope to those who are either rich, or come from the wealthiest institutions.6. The [GBT] serves perhaps the most diverse group of scientists of any telescope. It has a broad impact far outside the NSF AST division. As documented in the attached articles, the more than 1,000 scientists who are currently active users of the Telescope come from departments of physics, chemistry, planetary science, solar studies, etc., in addition to astronomy departments. Scientific programs cover research into fundamental physics, the nature of the chemical bond, astrometry and heliophysics. It is used to study near-Earth asteroids and occasionally track interplanetary spacecraft. This broader impact is not well served by the current NSF administrative structure, which reflects a more traditional definition of disciplines and does not capture the dynamic cross-disciplinary nature of much current astronomical research. 7. There is a world-class scientific and technical staff at the [GBT], created and sustained by the NSF open-skies funding. Over the many decades of operation of radio telescopes at Green Bank, the Observatory has built up a world-class scientific and technical staff. ...The staff supported through the NSF open skies time developed the breakthrough in GBT control that gives it excellent performance in the 3mm band. If a significant fraction of the Telescope's time were diverted to commercial or other use (Option 2), those groups buying time would no doubt have their own scientific and engineering staffs, located elsewhere, working for their own purposes. The Green Bank staff would be greatly reduced and dispersed, leading to a loss of technical leadership and reducing if not eliminating the support provided to scientists using the remaining available time on the Telescope...9. Adoption of any but Option 1 will effectively cede U.S. leadership in astronomy at radio wavelengths to Europe and Asia. There are vigorous programs in radio astronomy in Europe building new telescope like LOFAR, expanding existing telescopes like NOEMA, and developing new instrumentation for the IRAM 30-meter. In China the FAST radio telescope has just been finished, and plans for a large single dish, like the Green Bank Telescope, are going ahead. Many nations are participating in the Square Kilometer Array, now under construction in Australia and South Africa. Reduction of NSF support for the Green Bank Telescope will essentially cede leadership in critical areas of research to other countries. These are areas of science that have originated and been developed in the U.S. This will likely contribute to a brain drain of talented scientists and engineers from the United States.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz
337	d	Felix J.	Lockman		<p>10. The capabilities of the Green Bank Telescope are unique worldwide; none of the research programs it performs can be done either at all, or more efficiently, elsewhere. The Telescope has unique capabilities that make it either the only instrument, or by far the most efficient instrument, for virtually all of the research it now performs. The location of the Telescope in the National Radio Quiet Zone allows experiments to be done that cannot be performed elsewhere in North America. It has a flexibility that can not be matched by telescope arrays, and can be easily modified to take advantage of new developments, either technical or astronomical. Any diversion of its usage away from NSF-sponsored open skies time will terminate entire areas of scientific research. There is no substitute for the Green Bank Telescope's capabilities in the 3mm band, and no telescope either existing or planned that could match them. The Telescope is highly oversubscribed and already has much more demand for its open skies time than can be met. The Telescope is crucial for U.S. scientists both on its own, and in support of research done with the JVLA and ALMA. Its NSF-funded open skies time should be expanded, not reduced.</p> <p>For these reasons I strongly support Option 1, full support by the NSF for the scientific program of the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz
338		Huib	Jan van Langevelde	Director, JIVE	<p>The R.C. Byrd Green Bank Radio Telescope (GBT), the largest steerable radio dish in the world, is one of the most advanced operational scientific instruments in our field. It is a landmark of the synergy between fundamental science and cutting edge technologies. In our profession - the scientific study of compact celestial radio sources- the GBT has played and is playing a crucial role as a key element in the most sensitive global Very Long Baseline Interferometry (VLBI) experiments. The participation of the GBT in VLBI studies will be in high demand for many year, decades even, especially with the advent of new survey instruments and many more sensitive VLBI elements.</p> <p>For example, the networks that include the GBT, are playing a key role in observations of enigmatic transients sources, such as the Fast Radio Bursts, on which we have a number of high profile publications in preparation. Moreover, starting in 2011 the GBT has been a component in the most sensitive experiments with the Russia-led Space VLBI mission RadioAstron. Experiments with this mission have succeeded in advancing the understanding of the phenomena of active galactic nuclei, interstellar medium, and cosmic masers.</p> <p>The science mission of the GBT is far from being completed and exhausted. With the continuing progress of analogue and digital electronics, it will definitely remain a prime science facility for several decades to come. It will remain unsurpassed for many observations, even when new additions come into operations such as ALMA, FAST, ngVLA, and SKA. In fact, there will be new synergies for researching any new discoveries that will be done by these facilities.</p> <p>Denying the GBT to progress further will have detrimental effect on the development of the world radio astronomy in the coming decades. Moreover, we believe that even de-scoping GBT operations will send a wrong message to the communities well beyond our immediate professional realm.</p> <p>On behalf of the Joint Institute for VLBI - European Research Infrastructure Consortium and the worldwide professional VLBI user community we express our resolute support to continuing operational status of the GBT as the world's prime radio astronomy facility.</p>	Against Closure	Email - Scanned	11/21/2016	GBT support by JIVEv3.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
339		Thomas	Galligan	STEM 7 Math Spring Ridge Middle	I teach at the Spring Ridge STEM Academy. Each year, for the past 7 years, we have taken our seventh grade students to the Green Bank Observatory. At the Observatory, they have the opportunity to use a 40' radio telescope. The students have a chance to collect and interpret real-life data. This makes a tremendous impact on their interest and effort. Without this opportunity, they don't really think people do this kind of work. On occasion, we have shared the telescope with college students and this also impresses the students. The educational staff at the Observatory helps the students make sense of the data they collect. I understand that the National Science Foundation is considering how to make best use of the Observatory. I would recommend Option 1 or Option 2. Thank you for providing this amazing opportunity for our students.	Against Closure	Email - Scanned	11/21/2016	
340		Leonid	Gurvits	Head of Space Science, Senior Astronomer JIVE - Joint Institute for VLBI European Research Infrastructure Consortium	This letter expresses in brief my personal view on the situation around the Green Bank Observatory as stated in the "Notice of Intent To Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia and Notice of Public Scoping Meetings and Comment Period" of 2016.10.19. I feel I am in the position to share this my opinion as a professional who has been relying on the premier observational facilities in Green Bank for nearly four decades. The R.C. Byrd Green Bank Radio Telescope (GBT), the largest steerable astronomy facility in the world, is still a very young science instrument. It is delivering the most advanced results both in the "single dish" regime and as the key participant of the most sensitive Very Long Baseline Interferometry (VLBI) experiments. Other radio telescopes in Green bank, most noticeably the 140-ft antenna, albeit more than 30 years older, are still offering cutting edge experimental opportunities, e.g. as the Earth station of the only currently operational Earth-Space VLBI system RadioAstron. All these GBO facilities are very far from exhausting their scientific potential in the most advanced (called "transformational" nowadays) areas of radio astrophysics. Anything less than the suggested option 1, "Continued NSF investment for science- focused operations (No-Action Alternative)" will have immediate strong detrimental effects. Firstly and quite obviously, divestment and de-scoping of the GBO operations will result in an abrupt termination of fundamental research in a broad variety of astrophysical and cosmological areas. Fundamental research is not an activity that generates revenues on a short timescale. However, fundamental research is undeniably a key component that enables the progress of mankind. Secondly, a suggested discontinuation of the full support to the GBO will send a wrong message to the public at large, especially the younger generation. This latter effect is arguably even more destructive as it will have long-term negative consequences. I do not believe the scientific community and public at large are prepared to endorse these two highly detrimental effects.	Against Closure	Email - Scanned	11/21/2016	Acrobat.pdf
341	a	J.T.	Jezierski	Legislative Assistant	Senator Shelley Moore Capito Statement for Public Meeting on the Future of the Green Bank Observatory November 9, 2016 Ladies and Gentlemen, fellow West Virginians, I am sorry I am unable to attend today's meeting. Though I am not there, I am glad you all are, particularly the team from the National Science Foundation. They will see how important and impactful the work of the Green Bank Observatory (GBO) is to our world, to West Virginia, and to Pocahontas County. There are many impressive facts and figures that one can recite about this facility. But to be here, to see the structure in person, and to hear your stories - that is worth more than any statistic. It was my pleasure to experience this just a few weeks ago when I visited GBO. You cannot help but be inspired and excited for our future by seeing this unique equipment or meeting the men and women who make it work. We are gathered to talk about the future of the Green Bank Observatory. But we are also here to talk about the future of scientific research in the United States. I have long advocated for the continued operation of this facility, supporting robust levels of funding and research. Doing so will not only employ West Virginians, but it keeps people inspired, whether current researchers or the thousands of students who come through here wanting to become researchers. We have to invest in science research in our nation. The promise of discoveries are beyond our imagination if we make the right investments. Whether on the Appropriations Committee, where I am a member, or working with my partners in this effort, Sen. Manchin, and Rep. Jenkins, I will consistently convey my support for Green Bank. I look forward to reconnecting with Director Cordova to discuss the significance of the Observatory. I know there is a process to write this Environmental Impact Study, and I plan to be involved every step of the way.	Against Closure	Email - Scanned	11/11/2016	Senator Capito Statement re GBO Public Meeting.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
341	b	J.T.	Jezierski	Legislative Assistant	<p>Since its inception in 1957, Green Bank has advanced countless scientific and educational initiatives while becoming a staple of this community. The roughly \$8 million annual investment in this facility from the National Science Foundation generates nearly \$30 million every year for the local economy. This premier scientific research facility represents a source of pride and achievement for the Mountain State. Notwithstanding the abundance of scientific achievements to its credit, Green Bank attracts approximately 40,000 students, teachers, and other visitors annually for facility tours from throughout West Virginia and our nation. The Science Center offers students unique interactive opportunities that meet national and state science and engineering standards. National publications and researchers across the country have recognized Green Bank's many contributions.</p> <p>I recognize the challenges presented by a limited federal budget and support any and all efforts to reduce waste and inefficiencies. However, investment in Green Bank does not fall into either of those categories. Every dollar invested here is spent wisely. Meanwhile, Green Bank has been a responsible partner with the National Science Foundation in recognizing the budgetary challenges we all face. Green Bank has been extremely aggressive and forward-thinking to partner with educational institutions such as West Virginia University and other organizations, such as the Breakthrough Foundation, to balance government investment with private funds.</p> <p>There are many quantifiable impacts of this facility on this community, and we know your study will factor and measure them all. As you complete your study, we ask that you please not overlook the less-easily measured impacts. Green Bank is not just looking toward the stars to discover new worlds, but looking toward students in West Virginia and across our nation to discover new scientists, astronomers, researchers, and teachers. May their discoveries continue to inspire us all.</p>	Against Closure	Email - Scanned	11/11/2016	Senator Capito Statement re GBO Public Meeting.pdf
342		Eric	Faustino Jimenez-Andrade	IMPRS PhD Student Argelander-Institut für Astronomie	<p>My name is Eric F Jimenez-Andrade and I'm a PhD student at the Argelander-Institute for Astronomy in Bonn (Germany).</p> <p>I am writing in strong support of continued full science operations of the Green Bank Observatory. I would like to concur with the points raised in the support letter sent by Dr. Karim (from my department) on November 7 2016.</p> <p>Being in the early stages of my career, I would like to stress that my longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	
343		Jonathan	Romney		<p>I write to comment on the Environmental Impact Statement (EIS) concerning the facilities of the Green Bank Observatory (GBO). I do so as a private citizen, but am proud to say I was a staff member at the National Radio Astronomy Observatory until September 30, 2016. I am now affiliated with the long Baseline Observatory, where I am the only member of the scientific staff working full time in support of the Very long Baseline Array (VIBA). My comments arise from that perspective, and address in particular the participation of the GBO's Robert C. Byrd Green Bank Telescope (GBT) as an affiliate in the VIBA's High Sensitivity Array (HSA).</p> <p>The HSA combines the VIBA's excellent network of ten 25-meter diameter telescopes with several much larger telescopes, including the GBT, the phased Jansky Very large Array (VIA), the Arecibo Observatory in Puerto Rico, and the 100-m telescope operated by the Max-Planck-Institut fuer Radioastronomie in Bonn, Germany. The four large telescopes provide extremely valuable enhancement of the VIBA's sensitivity, and the GBT and VIA additionally augment the VIBA's coverage of the (u,v) plane on the continental scale.</p> <p>As examples of the scientific results to which the GBT has made invaluable contributions of this sort, I cite the following:</p> <p>The Megamaser Cosmology Project (MCP):</p> <p>https://safe.nrao.edu/wiki/bin/view/Main/MegamaserCosmologyProject I worked closely with this project team while the VIBA's then-new instrumentation upgrade was being commissioned, and the control of that system at the GBT was being worked out. The project went on to detect maser spectral lines from water molecules in a number of galaxies at cosmological distances, and to measure their velocities as a function of angular offsets from the galaxy centers. These observations yielded an extremely precise value for the Hubble constant. The GBT contributed substantially to the HSA sensitivity, and the angular measurement accuracy, that made these results possible.</p> <p>The RadioAstron Space VIBI Mission: This exploration of extremely compact and thus high-brightness radio emission from active galactic nuclei combines a space radio antenna in an extreme, elliptical orbit (with apogee of 300,000 km), with the largest ground-based radio telescopes, including the GBT. It has detected emission from AGNs on baselines exceeding 20 Earth diameters, challenging theoretical limitations on brightness temperature.</p> <p>These two examples, among many others in other fields of astronomical science, warrant a finding in the EIS in favor of the No-Action Alternative: Continued NSF investment for science-focused operation.</p>	Against Closure	Email - Scanned	11/21/2016	
344	a	Sara	Anderson	Assistant Professor	<p>For the past five years, I have enjoyed visiting the Green Bank Observatory (GBO). My husband is an Assistant Professor of Physics and Astronomy at West Virginia University, and our family has had the great pleasure of experiencing both the scientific outputs and the community of the GBO. My husband, loren Anderson, has observed for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made.</p>	Against Closure	Email - Scanned	11/20/2016	

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344	b	Sara	Anderson	Assistant Professor	<p>What I would also like to stress is the impressive impact the GBO makes in the hills of Pocahontas County, WV. It is an oasis of inquisitive, bright, and hard-working people who are proud to contribute to this world-class instrument. Our daughters have made friends with numerous children who call the GBO-area their home. We understand without the facility, the town will no longer be able to support an elementary school.</p> <p>West Virginia is clearly struggling. We frequently are listed as states failing its residents in terms of education, poverty, and health. Despite those challenges, residents are also an incredible proud group, made more so by the superb contributions we can make by supporting this facility.</p> <p>As you consider your options for the GBO, I strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, county, and state rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/20/2016	
345		Stacey	Smith		<p>I'm writing to tell about how my 2 teenage boys used this unique facility. They are in Boy Scouts and had the unique opportunity to spend a weekend there. They say it was really interactive and they saw results of oxygen clouds using the radio telescope which was really cool. It was an awesome way for them to earn their astronomy merit badge! It would be a shame if future scouts did not have this same opportunity. Please choose option 1 or 2 below.</p> <p>1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p>	Against Closure	Email - Scanned	11/20/2016	
346		Carolyn	Thomas	President, West Virginia Science Teachers Association	<p>On behalf of the more than 250 members of the West Virginia Science Teachers Association, I am writing to express our support for continued National Science Foundation investment in the Green Bank Observatory. The opportunities and experiences presented by the presence of the Green Bank Observatory in West Virginia inspire and engage science teachers and students across the state.</p> <p>Many of us participate in professional development programs offered through the Green Bank Observatory which truly connect the universe with our classrooms. Teachers who participate bring rich experiences and understanding of inquiry and engineering practices back to the classroom.</p> <p>It is exciting not only for our students, but also for us, when we can visit Green Bank Observatory to participate in research on pulsars and radio waves. The outreach programs expand the scope of the scientific learning to schools throughout the state which otherwise might not be able to visit the Observatory. Anecdotally we also find that students who participate in programs at Green Bank Observatory are more likely to pursue STEM courses of study and career preparation beyond high school.</p> <p>The Green Bank Observatory, along with the top notch scientists and educators associated with it, is a powerful contributor to promoting STEM education in West Virginia and is a point of considerable state pride. We respectfully ask that you continue to support and build the scope of the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/20/2016	
347		Max	O'Ganian		<p>The GBO is important to students throughout Pocahontas county. It provides important educational resources for students and teachers throughout the county. it provides a place to hold many events including Science Fair and Math Field Day. It can provide the perfect place for many educational trips the schools have. For many people it is an excellent place to meet.</p> <p>Please help insure the future of the GBO,</p>	Against Closure	Email - Scanned	11/20/2016	
348		DeAnna	Vanover		<p>Please choose option 1 for the observatory. My son's boy scout troop visited the observatory this year as a camping trip. We were able to send 8 boys and 2 adults to the observatory for a two night stay at the bunk house and to earn their astronomy merit badge. The boys had a great time and what I feel like was an experience of a life time. I am hoping to be able to take a group of scouts every year for this experience. This is an experience the boys will never forget.</p>	Against Closure	Email - Scanned	11/20/2016	
349		Willie	O'Ganian		<p>The Green Bank Observatory is doing great at keeping people active and learning because it has things like the Pocahontas County Science Fair and the annual open house. People also like to visit the science center.</p> <p>Please keep the observatory open and funded.</p>	Against Closure	Email - Scanned	11/20/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
350		Juergen	Ott		<p>I am an astronomer and have been a user of the Green Bank Observatory for many years. I consider this facility vital for the radio astronomy community worldwide. In particular, the revolutionary design of the Green Bank Telescope and its outstanding performance due to careful maintenance and upgrades is unmatched. The GBT has been a prime instrument for a large variety of astrophysical subjects such as gravitational wave searches, cosmology, star formation, and galaxy evolution. Radio Interferometers such as the VLA and AIMA by definition cannot image very extended, and usually faint emission. Only the GBT can provide such measurements across all radio wavelengths and I am personally involved in many science topics where the GBT is the only instrument that can achieve our aspired goals.</p> <p>Over the last few years, the GBT has just about reached a new level in radio instrumentation. The GBT is now the prime telescope to work with radio "cameras", moving away from observing single positions of the sky at a time to entire near-instantaneous images. The GBT also conquered 3mm wavelengths and is the largest telescope to reach this regime where abundant lines of molecules reside - opening the sky to study the chemistry of the Universe. long term use of the GBT also promises to detect gravitational waves from the entire universe where LIGO just opened the door by observing individual objects.</p> <p>Over the last few years the GBT just started to explore its full potential. As mentioned above, new cameras, just installed, will revolutionize entire astronomy fields. I cannot imagine US astronomy without this crucial instrument. It is extremely untimely now to divest or even reduce GBT capabilities or observing time. In fact, to close or reduce GBT operations at this time would be a terrible service not only to the astronomy community but also to the tax payers. Telescope construction is costly and commissioning is difficult. But once that is achieved, a telescope can be enormously productive. The GBT is exactly in the first years of productivity after construction and has still at least two decades for excellent and outstanding discoveries.</p> <p>I also think that the US reputation for astronomy is at stake. Shutting down a forefront telescope will resonate on a level that maybe was only surpassed by the infamous super-collider defunding. This event made US scientists spectators rather than leaders in a field where the large Hadron Collider overseas now produces Nobel award winning science. It would be very sad and terrifying to see a similar story happen again in radio astronomy.</p>	Against Closure	Email - Scanned	11/20/2016	
351		Marilyn	Kipley		<p>I am writing in support of continued NSF investment for science-focused operations at the Green Bank Observatory. It is essential to science in this nation and the economy of WV and Pocahontas County.</p> <p>Thank you for your kind consideration.</p>	Against Closure	Email - Scanned	11/20/2016	
352		Tom	Shepard		<p>I am a scout leader from Fishersville, Virginia. Our troop recently visited the GBO and had a truly fantastic learning experience. Our scout troop participated in the Astronomy Merit Badge, for which the staff prepared meals, made accommodations available, and provided a wonderful instructor that spent the entire weekend working with the scouts. I can say that keeping a group of young teenagers and pre-teens occupied all day long is a difficult task, however the staff set up a program that kept everyone busy until bed time and provided adequate time to complete the merit badge, which is lengthy. We had expert instruction, hands on teaching with the visitors center displays, computer lab access, a behind-the-scenes tour of the GBT control room, and access to the 40ft telescope with which the scouts were able to conduct experiments by aiming the telescope and detecting sound waves. We learned that without facilities like the GBO there is no way that astronomers could see into and study our universe as far as they can now. This weekend meant so much to us that we are doing what we can to spread the word about the merit badge program in scouting and promoting the GBO as a great learning experience and place to both visit, and perhaps one day, work.</p> <p>This event brought astronomy alive to the scouts and parents. Without the GBO, this would have been at best a classroom style merit badge, if we had even tried to attempt to teach it, and an unexciting one at that. Keeping STEM alive means that we have to make it an adventure, and the trip we took our scouts on this past weekend is something they will remember for the rest of their lives! Having a facility like the GBO nearby is invaluable to us and the general public! Without the ability to bring STEM alive, we as a society will stop focusing on these professions and will result in a stagnation of imagination and invention, ultimately resulting in a decline in our economy as a nation and a fall from the powerhouse status our country currently enjoys.</p> <p>I urge you to keep the GBO open and fully funded. I see anything short of that a major disservice to science and exploration, as well as a significant blow to our society as a whole.</p>	Against Closure	Email - Scanned	11/20/2016	
353		Ann	Kepley		Continued NSF investment for science-focused operations (No-Action Alternative)	Against Closure	Email - Scanned	11/20/2016	
354		Jotina	Hamrick		<p>I am writing to say I hope there is some alternative to shutting down the observatory. I think it would be a great opportunity to have some kind of education/technology program. The location is one of the most remote parts of the county and there is no doubt that students could benefit from the facility being used in that way. It is my sincere hope that some solution can be found. The local economy as well as the education of many are on the line if the doors close completely. I am hoping the future of the GBO stays bright and growing.</p>	Against Closure	Email - Scanned	11/20/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
355	a	Natasha	McMann	Graduate Research Assistant Fisk-Vanderbilt Master's-to-PhD Program	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I am from Pocahontas County and any change to the current operations of the GBO would deliver a devastating blow to the economy of Pocahontas County, West Virginia, and the United States. If it wasn't for the GBO, I would not be where I am today. After graduating college with my first Bachelor's degree, I didn't know what I wanted to do as a career. I had just recently decided to not pursue the career path of minister. In 2010, I started a tour guide position at the GBO. Within a few weeks, I was in love the GBT, the GBO, and astronomy. After my second season as a tour guide, I decided that I would return to school and pursue a career in astronomy. Because of the relationship between West Virginia University (WVU), and the GBO, I was able to talk with Dr. Maura McLaughlin. In the fall of 2012, I started as a physics undergraduate at WVU. I graduated in May with a B.S. in physics and a minor in astronomy. I accepted a position in the Fisk-Vanderbilt Master's-to-PhD Bridge Program. I am currently working on a Master's in Physics at Fisk University and will hopefully "bridge" over to a PhD astrophysics program at Vanderbilt or another PhD granting institution. I am continuing my work with pulsars in my current program.</p> <p>Because of my experience with the GBO, I am now a graduate student who has a passion for public outreach in science and astronomy. I have gone to Germany twice to do research, received a NASA Space Grant Scholarship as an undergraduate, and developed international research relationships all because of my time at the GBO. It truly changed my life.</p>	Against Closure	Email - Scanned	11/20/2016	letterToNSF.docx, letterToNSF.pdf
355	b	Natasha	McMann	Graduate Research Assistant Fisk-Vanderbilt Master's-to-PhD Program	<p>I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes—a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks—to search for small perturbations caused by gravitational waves.</p> <p>The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves. Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists like myself are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at Fisk University, and at scientific institutions across the United States. Here are the impacts of each proposed scenario, as I see it: _ No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time. _ Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress. _ Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.</p>	Against Closure	Email - Scanned	11/20/2016	letterToNSF.docx, letterToNSF.pdf
355	c	Natasha	McMann	Graduate Research Assistant Fisk-Vanderbilt Master's-to-PhD Program	<p>In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. The GBO was my only hope of returning home to raise a family while having a successful astronomy career. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher tech areas of the country. The people of Pocahontas County are proud of the observatory.</p> <p>At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO.</p> <p>As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.</p>	Against Closure	Email - Scanned	11/20/2016	letterToNSF.docx, letterToNSF.pdf

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356		Steven	White		<p>Let me first state the obvious, the Green Bank Telescope is a premier instrument with unique capabilities that has no equal anywhere else in the world. The Green Bank Observatory supports this unique instrument and provides a location for students, amateur and professional astronomers, technicians and engineers to congregate, share ideas and accomplish common goals. I know because I have dedicated thirty years of my career as an engineer in the pursuit of science at the observatory. I stood by Senator Byrd as Turkey in the Straw flowed from his fiddle strings and echoed through the valley and off the GBT. You see the GBT has a pulse, it vibrates, it sings with the flow of Helium through its lines, it has life and inspires. Senator Byrd had a vision and knew the importance of the site not only to the local economy of Pocahontas County, for the pride of the state of West Virginia, but to the entire nation as a leader in the pursuit of science. Faced with many setbacks during the construction, only through perseverance from the staff and the constant reminders of its importance from the radio astronomy community was it completed. The GBT was meant to be. Now, operating at full potential, it is being faced with reduced funding and consequently less open sky availability for discoveries. How this myopic and uninformed decision came to be I will never fully understand. A tragedy is in the making for a national treasure in a time of divisiveness, desperate for unity with the GBO being a prime example. Can the observatory survive with reduced funding and outside partnerships, possibly? But marketing and seeking funding other than scientific pursuits is not part of our DNA. The facility operates under the guise of openness and cooperation that inspires our young people to pursue science and educates the public. Is this not one of the primary missions of the National Science Foundation? There is only one viable option and that is the no action initiative. The GBO staff collaborates with leading researchers in the field of digital signal processing which advances pulsar research enabling investigations into fundamental physics theorems. The GBO uniquely engages women in this area of engineering and fundamental research. The seed was planted many years ago when Dr. Martha Haynes was appointed as director for the site. This original appointment has fostered many opportunities as evident by the number of women pursuing science as post-doctoral scientists and engineers. As an example, Sara Stanchfield from the University of Pennsylvania is currently building state of the art instrumentation to deploy on the GBT. This will allow her to probe a unique window into the fundamental properties of the universe. This process is necessary for the accumulation of data for a doctoral thesis and also promotes interactions with individuals equipped with diverse skill sets. This experience is invaluable for future endeavors in science and technology.</p> <p>Experiences like hers are repeated many times over and are paramount to the mission of the National Science Foundation. Therefore, the divestment of the GBT is effectively a divestment in the future of our nation's brightest minds.</p>	Against Closure	Email - Scanned	11/20/2016	EISletterNov20.pdf
357		Katy	McClane	Concerned citizen	I'm sad to hear that the telescope and its discoveries in Greenbank,WV might be dismantled. Please keep this important discovery tool, as well as the economic vitality it brings to the area.	Against Closure	Email - Scanned	11/20/2016	
358	a	Yekaterina	Gilbo	BS Physics 2017 Astronomy Club Treasurer	<p>I am an undergraduate physics student at the University of Virginia, and I urge you to continue investing in the GBO for science-focused operations. I would like to attest to the life-changing impacts of the Green Bank Observatory on student lives.</p> <p>Five years ago, I first learned about pulsars during the GBT Pulsar Search Collaboratory Camp for high school students. The experience opened my eyes to American opportunities that most students do not know about; the source of public data from NASA, from NRAO, from NIH, and many other facilities. By teaching me how to analyze pulsar radio data, the GBO endowed me with a passion for science and a confidence that I could learn about our world through real time telescope, satellite, or human genome data; that students could make discoveries too, and that the textbook problems and lectures were only stepping stones for the work to be pursued in problems of engineering and science directly impacting our futures, our societal progress, and our curiosity-driven humanity.</p> <p>After the GBO bolstered me with STEM skills and encouraged my curiosity, I started exploring questions that I had, which led me to an internship at NASA's Goddard Space Center. I would never have ended up with the confidence and strength that led me to such a crucial experience for my life's passion and my career hopes – without that initial experience at the GBO.</p> <p>I continue to learn about important skills on academics and life from my GBT mentors and the wondrous telescopes and center in Green Bank as I have visited GBT five times in total. I felt that the GBT learning experience was so inspiring to students, that I helped make it our biggest annual event for the UVA Astro club, for students of all majors and backgrounds.</p> <p>Those nights mapping black holes (Sagittarius X or Cygnus A) and more with the 40ft. telescope did not only propel me (and others) to apply my newfound astronomy knowledge to my broader interest of biology (as I then worked a summer at the NIH Radiology Dept. using the astronomy programming language of IDL to study imaging of tumors), but also taught me a lot about how science can pull kids out of poverty, out of drugs, out of alcoholism, out of many difficult circumstances. Having done the PSC for two years and continuing to stay involved after going to college, I have met several students (and now my friends) who now have jobs in STEM and who have told me, they felt they had no future before their empowering experience at the GBO.</p>	Against Closure	Email - Scanned	11/20/2016	
358	b	Yekaterina	Gilbo	BS Physics 2017 Astronomy Club Treasurer	<p>As someone who emigrated from Russia to the US, I know how unique the GBO is for student education and for student empowerment. The GBO makes science accessible, and opens it up to students from minority group, from low socioeconomic statuses, to students with low self-esteem who do not believe science can ever accept them—until they glimpse a different perspective after spending a night using a real radio telescope, seeing the pulses of a neutron star and having done all of that completely without the aid of a scientist or a teacher (after training).</p> <p>The GBO is an American treasure for science and for education, for creating a better future for all of us. I truly thank you for your time, NSF reader, and urge you to continue to support the GBO and through GBO, the students of future generations.</p>	Against Closure	Email - Scanned	11/20/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
359	a	Denise	McNeel		I am probably the only Pocahontas County resident who, on a clear day, could see the Jodrell Bank telescope from the end of the road where I was born and had Sir Bernard Lovell speak at my grammar school speech (prize) days. So, I have had a long appreciation of the importance of radio astronomy. We are truly blessed to have had NRAO operating in the county for so long. As an entity, they are the best neighbors imaginable and the employees, their spouses and children enrich our communities. I go to church with one employee, sit on the County library Board with two other employees, enjoy the music of two more, go to a concert sponsored by the Observatory's staff and get invited to special science events. They are our neighbors ...and we are blessed.	Against Closure	Email - Scanned	11/19/2016	
359	b	Denise	McNeel		The financial contribution to our county is huge. Not only does the observatory offer well-paying jobs and bring children to add to our school population, but Science is promoted here. Education is promoted --and tertiary education normalized. Students can see science in action, become aware of the possibility of a career in science and accept early the importance of science. The educational programs offered by the Observatory are exceptional and the opportunity to see science in action, with actual enormous telescopes in operation, is a rare opportunity to learn just how exciting and groundbreaking scientific research can be. I volunteer at the local historical museum and I never fail to encourage our visitors (from many states, and a few from overseas) to do the tour. And, I might add, for many of our visitors, the Green Bank Observatory is THE destination which has influenced their choice of a location to travel to. How far would all those visitors, from multiple states, have to travel to be able to see and learn about radio astronomy with instruments being used for research, right before their eyes? And then, to have programs, exhibits and interactive science activities--what an opportunity, over and over again, to influence current and future taxpayers to fund science research and facilities!!!! Funding for science may well become more stringent in the future. For a long time, there was no admission fee at NRAO (unlike Jodrell, I might add!). What an advertising ploy that was; "See your tax dollars at work!" But visitors are willing to pay and be influenced at the same time to support scientific research. All those visitors are served by congressmen and senators, who decide on the funding allocations. So, please keep the Green Bank telescope operating and promoting science through its tours, its visitor center and active telescopes. Give this facility help in seeking out other users of telescope time. Every time you close down a huge expensive facility like this one, the taxpayers and lawmakers question the amount spent, just thrown away. For your own credibility's sake, when you ask for millions (billions?) more for research, you will need to justify your decision over a facility such as the Green Bank Observatory, which has years of usefulness for the advancement of vital knowledge.	Against Closure	Email - Scanned	11/19/2016	
360		Lawrence	Matson		Unfortunately, I just received notification of a comment period now. My abbreviated comment is simply that the historical, educational, and scientific benefit of this site exceeds the costs as well as benefits of other expenditures currently being made. Deconstruction would be a very poor option.	Against Closure	Email - Scanned	11/19/2016	
361	a	Spencer	Wolfe	Department of Physics and Astronomy West Virginia University	First, the review conducted in 2012 does not accurately reflect the current state and capabilities of the GBT. The GBT is conducting significant observations at millimeter wavelengths, and will be a critical compliment to the ALMA telescope. Unrivaled mapping of molecules will provide deeper insights into a number of processes, such as how organic molecules develop in new forming stars. With the direct detection of gravitational waves by LIGO, gravitational radiation has now been pushed to the forefront of modern astrophysical research. The NANOGrav collaboration relies heavily on the GBT to conduct observations of pulsars to detect and further characterize nano-Hz gravity waves. Other areas of scientific study with the GBT include astrochemistry, star formation, galactic evolution, the solar system and tests of fundamental physics. Indeed, these studies are too numerous to write here. A simple review of the available literature makes that clear. The GBT is doing groundbreaking research that was not realized at the time of the 2012 review and has not yet reached its full potential, especially at mm wavelengths. Second, the GBT is still an unparalleled instrument in radio science. Interferometers such as ALMA, the JVLA and even the future Square Kilometer Array will still need large single dishes to recover faint, diffuse, extended emission from astronomical sources of interest. While there are larger and more sensitive telescopes available, the GBT's design makes it the preferred instrument. Dishes like the Arecibo telescope or FAST can only view one swath of the sky at a time, while the GBT can view the entire sky. Its design and construction also removes significant amounts of contamination from stray sources, which provides much higher quality data products than more traditionally designed apertures....Third, if GBT operations cease, then US scientists and students will be forced to go elsewhere to conduct single dish science. The other options are Germany, Puerto Rico, Australia, China, etc. The US would simply have no significant part in large, single dish science. This would be unfortunate and, in my opinion, unacceptable. I believe mothballing the facilities or deconstruction of the site is not an option. We would be putting an end to an instrument that has not even reached its full potential and has more people applying for time to use it, year after year. Fourth, I believe that collaboration, either with reduced NSF scope or as a technology park is not the best way to proceed. These options will likely lead to a diversion of GBT operations to those interested in commercial, or classified activities. The infrastructure needed to support astronomical research would be severely crippled or would disappear entirely. As I stated above, I believe the only reasonable option is to continue NSF investment for science operations. Lastly, let me finish by saying that this issue is personal to me. I used the GBT to conduct radio frequency observations for my Ph.D. dissertation on neutral gas in and around local Group galaxies. I can say first hand, how remarkable this instrument is, both in its capacity and in its scientific impact. My very first publication as a first author was printed in Nature (Wolfe et al. 2013, Nature, 497, 224) which is quite an achievement, and it was accomplished using data taken with the GBT. This is because the GBT is the only instrument, still to this day, that can reliably and repeatably observe incredibly faint neutral gas around other nearby galaxies. It is very easy to use the telescope and operations have been running long enough that scheduling efficiency is generally maximized. The infrastructure and staff at Green Bank are also incredibly helpful when it comes to dealing with observations, data collection and data analysis. All the pieces of the puzzle to conduct and publish groundbreaking research are already there.	Against Closure	Email - Scanned	11/19/2016	
361	b	Spencer	Wolfe	Department of Physics and Astronomy West Virginia University	Further, the GBT sits in the National Radio Quiet Zone, which limits the amount of radio frequency interference due to terrestrial sources. In a world where everything is becoming wireless and flooding more and more frequency bands, having a sensitive telescope in such a place will become even more important.	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
361	c	Spencer	Wolfe	Department of Physics and Astronomy West Virginia University	<p>My name is Dr. Spencer Allen Wolfe, a radio astronomer and former student of the Department of Physics and Astronomy at West Virginia University in Morgantown, West Virginia. I am writing this to comment on the NSF's review process to create an Environmental Impact Statement for changes to operations at Green Bank (Federal Register, Vol. 81, No. 202, pg. 72124-72125).</p> <p>I believe that of the five proposed alternatives mentioned in the above notice, only the first (Continued NSF investment for science-focused operations, No-Action Alternative) is acceptable for a number of reasons.</p> <p>...Also, I am a native West Virginian. I can tell you that me and my fellow members of the Mountain State feel a great sense of pride for the GBT. We are well aware of its importance and impact on astronomy, particularly for the US. Even in grade school, I knew about the GBT and visited Green Bank on a few occasions. The primary reason I decided to pursue astronomy as a graduate student was because of the opportunities the GBT provided to West Virginia University. Indeed, the Physics and Astronomy department at WVU owes a great deal to the GBT and its accomplishments. It would be unfortunate if WVU, and West Virginia, were to lose such a valuable resource.</p> <p>The GBT is a groundbreaking instrument, whose proficiency has been proven and its full potential not yet realized. It stands at the forefront of many areas of astronomical research, with even more pivotal discoveries yet to be made. It is a significant asset to US science and astronomy, and even more so here in West Virginia. I urge you to keep investing in the GBT for science and research. There is no other instrument of compare, and there won't be for the foreseeable future.</p>	Against Closure	Email - Scanned	11/19/2016	
362	a	Nicole	Gugliucci	Assistant Professor, Dept. of Physics Saint Anselm College	<p>I am writing to you today in response to the call for public comments on the Environmental Impact Statement and future of the Green Bank Observatory, as stated in https://www.federalregister.gov/documents/2016/10/19/2016-25213/notice-of-intent-to-prepare-an-environmental-impact-statement-and-initiate-section-106-consultation.</p> <p>I am an astronomer and an assistant professor at Saint Anselm College, a small liberal arts college in New Hampshire. I did my graduate work in astronomy at the University of Virginia and the National Radio Astronomy Observatory, which, until recently, included the Green Bank Observatory (GBO). The highly sophisticated scientific instruments in Green Bank and the presence of the site as a Radio Quiet Zone were crucial to my training as a graduate student and development as a professional scientist. I've worked with the Green Bank Telescope, searching for water megamasers that are helping astronomers uncover the basic properties of the Universe, and used the site to prototype a new array, the Precision Array For Probing the Epoch of Reionization, an important project that is unlocking the secrets of the earliest galaxy formation.</p> <p>I don't need to expound, however, on the scientific importance of the instrumentation at Green Bank since an excellent job of that has already been done by Bally et al. (2016 - https://arxiv.org/pdf/1610.09014v2.pdf) and Lockman et al. (2016 - https://arxiv.org/pdf/1610.02329v1.pdf).</p>	Against Closure	Email - Scanned	11/19/2016	
362	b	Nicole	Gugliucci	Assistant Professor, Dept. of Physics Saint Anselm College	<p>What is most important about GBO is not just that important science is being done, but how the science is being done and how it is being used to train the up and coming STEM professionals of the future. Green Bank gives young astronomers a unique experience in being able to travel to a radio telescope and take the data on site, interact with the scientists, engineers, and technicians who keep the observatory running every day, and steep themselves in the history of the science that has been done at that facility. This is an experience that one does not get in radio astronomy anywhere else in the United States except, perhaps, at the Arecibo Radio Observatory in Puerto Rico. For those of us lucky enough to live close to the observatory and work there on a weekly basis, the impact of that depth of education is immeasurable. I would not be educating students of New Hampshire today in physics and astronomy had I not gotten these chances to connect with scientists and science itself on such a fundamental level.</p> <p>As a new professor at a liberal arts college, I get the chance to build an astronomy program that will expand the appreciation of science and Universe to a wide range of students with interests in a wide range of disciplines. I also get to share the unique experiences of observing the Universe with the sophisticated technology of Green Bank with my students. Just this year, I am mentoring a young woman, a chemistry major who is likely to go on to pharmacy school, in an astrochemistry project featuring data from the Green Bank Telescope. For a small college with limited resources, access to the data and the ability to apply for new data-taking opportunities is invaluable. Without Green Bank, we'd lose significant capabilities for single dish radio astronomy for our students, and lose the ability to pass on the important research and critical thinking skills that are not just needed for professional astronomer, but for young people going into STEM careers of all kinds. And, despite what some in our current political climate think, we still do need to train more STEM professionals into the workforce.</p> <p>I look forward to building an astronomy program that brings together important scientific and engineering skills that I learned in a hands-on way while at the Green Bank Observatory. However, our small-scale efforts at building local radio receivers and instrumentation for small projects would be perfectly complimented with research experiences using large, sophisticated, cutting edge telescopes such as the Green Bank Telescope. The Universe really would be closed to student like mine, at small colleges, community colleges, and similar institutions across the nation, if it weren't for the "Open Skies" policy of our federally funded observatories. The Green Bank Telescope is an important and unique tool in that package, and losing that would hurt astronomical progress AND science education which ever increasingly relies on active learning experiences.</p>	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
362	c	Nicole	Gugliucci	Assistant Professor, Dept. of Physics Saint Anselm College	<p>Finally, on a personal note, the people of the Green Bank Observatory were among the most welcoming and wonderful folks I've met in my scientific career. Every new visitor was welcomed with good food and hospitality and whatever support resources were needed for their work. Students coming for a visit, a workshop, or to do science found an incredible community and endless wonders of science, engineering, and history at the site. There is no place like it, and I look forward to driving my own students down in one of our college vans so that they, too, can experience the unique setting of Green Bank and, potentially, one day decide to join our ranks as astronomers.</p> <p>With all of this in mind, I wholeheartedly support continued NSF investment for science-focused operations (No- Action Alternative) for the Green Bank Observatory. Its functions as a scientific institutions are invaluable and its capacity for educating the next generation of STEM professionals would be severely diminished without its scientific prowess. I understand that the National Science Foundation has a host of difficult decisions to make with regards to funding the future of astronomy, science, and science education in this country, but the Green Bank Observatory is one aspect of the nation's scientific toolkit that we, I believe, cannot afford to lose.</p>	Against Closure	Email - Scanned	11/19/2016	
363		W. Hunter	Lesser		I strongly urge the continued operation of Green Bank Observatory. Whether funded by NSF, private entities or a combination of the two, it is an important symbol and source of pride for all West Virginians. The mothballing or dismantling of GBO would have far-reaching repercussions. Thank you.	Against Closure	Email - Scanned	11/19/2016	
364		Barbara	Carter		This email is to express my wishes for continual funding of the Greenbank Observatory. I highly objective ti any decrease in the use of the facility. Keep it going America.	Against Closure	Email - Scanned	11/19/2016	
365		Colleen	Anderson	Mother Wit Writing and Design P.O. Box 525 Charleston, WV 25322 304-342-1213 www.motherwitdesign.com	Please add my name to the list of those advocating for saving the Green Bank Observatory. West Virginia needs this wonderful facility!	Against Closure	Email - Scanned	11/19/2016	
366		Phil	Appleton	Caltech/IPAC-Herschel Senior Research Scientist Project Scientist and Task lead -NASA Herschel Science Center	<p>As a Caltech scientist who is (now) very dependent on US national facilities for radio and sub-mm astronomy, I would like to strongly urge the NSF to continue funding the GBT for science operations into the distant future.I list below the scientific reasons I feel compelled to write this message. I also find it surprising that, in an era when other nations (particularly China) are actually building up radio astronomy resources, many US facilities(whether public or private) are either under threat of closure (GBT, VIBA, Arecibo) or are already closed and dismantled (a good example of the latter is Caltech's recent closure of the CARMA and CSO facilities). All of this leads to the feeling within the US astronomical community, that we are in decline in US radio astronomy science, rather than continuing to lead with innovation and new instrumentation.My own background was originally in Radio Astronomy in the UK (Jodrell Bank, U. of Manchester), but my primary science interest has been in mid and far-IR space astronomy with Spitzer and Herschel. I currently lead the management of the NASA Herschel Science Center at Caltech, as well as being very active in IR and sub-mm/mm astrophysics. I am closely involved with new initiatives, such as the NASA Origins Space Telescope concept (a large single aperture far-IR telescope study), and have scientifically advocated for such an instrument in space.Progress in astrophysics requires a broad wavelength approach, and radio astronomy- especially mm-wave astronomy, is a vital part of my work. Having open access to telescope time at GBT is very important.</p> <p>Why Continue Funding science at the GBT in the era of JVIA and AIMA? General Science Considerations:I strongly support the idea that the pulsar timing research done at the GBT will be a crucial aspect of the future gravitational wave astronomy discoveries. ... We will leave it to the Chinese to make the future discoveries with their newly-supported effort in radio astronomy.1) The GBT is developing a new exciting capability in mm-wave astronomy (ability to work in the 3-mm molecular rich wavebands-Argus instrument). The huge collecting area of GBT combined with new detector technology is opening up a new window for GBT work that greatly complements the exciting capabilities of AIMA-especially for spectral- line work. I have been conducting research on warm and cold molecular gas in nearby galaxies-especially galaxies undergoing strong shock-excitation. I am very excited to hear about the new 3-mm capabilities which allow exploration of very extended CO emission to be quickly built-up with rapid mapping. AIMA, with its amazing sensitivity to compact emission, will miss much of the extended emission-for example in the compact group Stephan's Quintet-we find that interferometers miss about 70% of the very low surface brightness turbulent gas in the shocked intergalactic filament. which make observations on spatial scales that are well matched to the new 100GHz mm-capabilities of GBT for redshifted CO. Clearly no other facility in the US has this capability, nor the power.2) large single dish facilities still have a very important role to play in detecting faint sources of HI in the universe. Our team has been conducting observations of HI in galaxies in regions of the em-spectrum where radio-frequency interference (RFI) would normally destroy all hope of detecting signals (with redshifts up to 0.1). The radio-quiet environment of GBT, although still affected by RFI, makes it possible to consider observations on the edge of the normal 20cm radio-frequency band. Furthermore, studies of very extended HI in the Galaxy and nearby galaxies are very important. I hope we don't loose this capability. In conclusion, I hope that the NSF will strongly consider the importance of the GBT -with its fully-steerable capability-and its important role in the future of both gravitational wave astrophysics, and its new mm capabilities which complement the AIMA facilities. With the loss of mm- and sub-mm facilities (like CARMA and CSO) our ability to stay competative in these regions of the EM spectrum is important. Young people need to feel inspired by science, and have the opportunity to get involved in building instruments and the Green Bank Observatory offers such an opportunity through its close geographical location to many east- coast Universities and to NRAO headquarters.</p>	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
367		LuAnn	Creager	Registered Representative Financial Services Specialist Good life Financial	<p>As a financial professional in our community I am expressing my concerns about the National Science Foundation considering closing the Green Bank Observatory.</p> <p>The Green Bank Observatory is an essential part of the community's economic stability. My business Good life Financial (www.good-life-financial.com) and other local businesses would be negatively impacted by the loss of jobs and income for community members currently working at the Green Bank Observatory. Good life Financial has employed several spouses of employees at the Observatory and would lose that pool of educated employee candidates should the Observatory close.</p> <p>I have also volunteered as a Girl Scout leader in the Green Bank community for 12 years. My Girl Scouts have benefited from volunteers from the GBO leading career seminars, science demonstrations, photography seminars, mushroom identification sessions, swimming lessons, and cooking demonstrations. We have hiked on the Observatory property to complete nature badges and had lunches and ice cream at the tour center. These types of educational and fun activities would not be possible without the folks at the GBO.</p> <p>Please consider the significant impact the closing of the GBO will have on our community's people and businesses before making your final decision.</p>	Against Closure	Email - Scanned	11/19/2016	
368		Mark	Scott		<p>I am writing to issue an objection to the reduction in funding and potential future closing of the Greenbank Observatory. The observatory has been vital to space exploration among other things. It sits perfectly situated in the quiet of rural Pocohontas county and is the major source of economic development for that area. For these reasons I ask that you thoughtfully consider not reducing the funding or closing the Greenbank Observatory.</p>	Against Closure	Email - Scanned	11/19/2016	
369	a	Linda	Nielsen		<p>I am writing in response to recent information indicating that you are seeking comments on the future of the Green Bank Observatory. For the last twenty years, I have included a stop at the Green Bank Observatory as part of a travel and education program for seniors. Although our main program topic is the history of railroading, our participants always include the tour of NRAO as one of the highlights of the trip. Many participants indicate that they wish they could have spent more time at the facility. Indeed, it is often hard to get some to leave the museum in time to board the bus! The educational component of this facility is tremendous and an asset to the community and to the State of West Virginia.</p>	Against Closure	Email - Scanned	11/19/2016	
369	b	Linda	Nielsen		<p>In addition, I am aware of the exciting scientific projects that are conducted at this facility. This provides opportunities for the scientific community and well as amateurs. Frequently I pick up newspapers and find articles about a recent scientific discovery made in part through research at the NRAO. Youth that visit this facility have the opportunity to work with scientists to develop and carry out hands-on experiments. I don't think it is possible to measure the tremendous impact this has upon instilling a love of science in our younger generation.</p> <p>Please strongly consider keeping this facility open for continued science-focused operation and an education based facility. Therefore, I support options one and two from the list of options NSF is considering.</p>	Against Closure	Email - Scanned	11/19/2016	
370	a	Jennifer	Scott	Associate Professor Department of Physics, Astronomy, and Geosciences Co- Director Baltimore Project ASTRO	<p>I am writing to express my support for continued NSF investment in science and education at the Green Bank Observatory.</p> <p>For the past two years, I have taught an Astrophysical Techniques class for junior and senior level astrophysics students at Towson University near Baltimore, Maryland. Most of the course curriculum is designed around student projects and access to observing facilities at the GBO is a critical part of the learning experience for students in the course. Each year we have made a class field trip to use the 40-foot telescope at GBO to take spectra of the 21 cm emission from the Milky Way disk, to map the Galactic Center, and to take continuum measurements of other sources of interest to the students. It is a truly unique experience for students to travel as a class and work together to take their own data. The learning that Sue Ann Heatherly and the rest of the staff facilitate is irreplaceable and makes a deep impression on these students. For some, it is the first time they have been to a site dark enough to see the Milky Way in the sky! Upon returning to campus, they work together to analyze the data and I am building up a database of their observations over time. I hope to continue this for many years into the future...In light of both the educational and research value of the facility as well as its economic value to the region and the sheer uniqueness of the US National Radio Quiet Zone I urge you to consider only options:</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) or 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope as you proceed with deliberations on the future of NSF funding at Green Bank. 	Against Closure	Email - Scanned	11/19/2016	
370	b	Jennifer	Scott	Associate Professor Department of Physics, Astronomy, and Geosciences Co- Director Baltimore Project ASTRO	<p>My own research is not in the radio regime but my students and I have come to recognize the unique part that the GBT plays in radio astronomy. The Bally et al. white paper "THE CASE FOR A PUBLICLY AVAILABLE, WELL- INSTRUMENTED GBT OPERATING AT 20-115 GHZ" lays out the compelling case for this. Indeed it seems without the science operations at the GBO there is no strong case for maintaining the current size of the US National Radio Quiet Zone. There is no going back on a decision to abandon science operations at this facility.</p>	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
371		Keith	Payea	Director, Society of Amateur Radio Astronomers	<p>I would like to encourage you to continue to support the Green Bank Observatory. Rather than focus on the obvious current scientific merits of the facility, I would like you to consider another aspect of its importance to our country.</p> <p>Much attention is being paid to Science, Technology, Engineering and Math (STEM) education for our nations children. One piece of that puzzle which is too often missing is inspiration. Anyone who has ever visited Green Bank will tell you how awe inspiring the entire facility, and particularly the 100M Robert C. Byrd Green Bank Telescope is to them. I have visited both Green Bank and the VIA facilities and somehow, the VIA just doesn't have the same impact. I hope that all of you who are involved in this important decision have visited Green Bank and just watched the other visitors to see the impression it makes on them.</p> <p>Combine its scientific relevance, its ability to inspire, and its proximity to the large population centers of the East Coast, and you have a truly unique facility which deserves your support.</p>	Against Closure	Email - Scanned	11/19/2016	
372	a	Lara	Baudler	Resident	<p>The Green Bank Observatory has impacted my life and the lives of every community member in countless positive ways. I cannot imagine my life without this astounding scientific facility. Without the GBO, my family would never have found the beautiful, rural town of Green Bank and come to appreciate it the way we do.</p> <p>I was blessed to be able to grow up in a place held so pristine by the Radio Quiet Zone. GBO is at the center of the Radio Quiet Zone. Mothballing or deconstructing the Observatory would mean the end of the Radio Quiet Zone. This is like closing a unique nature preserve or a national park. Through the unique quiet zone, I was able to gain perspective on our society today. The quiet zone allows the area to be more protected from dangers in the outside world and gives a unique perspective on what the world outside the quiet zone looks like today. An environment such as the one created by the quiet zone, exists no where else in the entire world.</p>	Against Closure	Email - Scanned	11/19/2016	
372	b	Lara	Baudler	Resident	<p>Endless memories exist because of the GBO. As a child, I benefited tremendously from what the GBO has offered. I gained a passion for the scientific world and was continuously encouraged to learn new things. Through annual celebrations that incorporated science in intriguing ways, my appreciation for science was able to continuously grow. I met wonderful people from all over the world at such gatherings, I would never have encountered otherwise.</p> <p>The GBO is a focal point of our community and aids tremendously in uniting us. In a way, the Observatory is the glue to our community. Concerts, Open houses, Star parties, and events like the Space Race Rumpus allow the community to get together and flourish. Additionally, the county relies on the GBO as a source for income and is extremely important for the county's infrastructure. Without the GBO, many people in the community will be jobless and forced to move away, causing the local real estate market to crash. It is one of the largest sources of tourism in Pocahontas County and attracts many people to the area. The surrounding area will lose many community members and the percentage of tourists will dwindle.</p> <p>The GBO has not only supported individuals in the community, but in the public school system as well. The public schools in Pocahontas County have benefited tremendously through the help of the GBO. Countless occasions/events only took place through the support, infrastructure and organization of the GBO. Donation based funding has made new school facilities possible. The collaboration that exists between the observatory and the schools is remarkable and a truly wonderful relationship. Many fantastic events would not exist if it weren't for the continuous support from the GBO. Additionally, the GBO is a valuable location for students and future scientists to explore their passion by using the telescopes and facilities for their studies.</p> <p>I have learned to appreciate the nature and beauty of the surrounding environment and hope it can be preserved in the future. I have seen so much wildlife flourish on the GBO property. It would be an utter shame to damage this delicate ecosystem. The pristine natural environment on the observatory properties benefits tremendously from the GBO's continuous protection.</p>	Against Closure	Email - Scanned	11/19/2016	
372	c	Lara	Baudler	Resident	<p>GBO is also an important symbol in the world's scientific community.</p> <p>Due to the massive positive impact that GBO has on the county, environment, and community members within as well as the scientific community in general, preserving the facility is imperative. By ensuring that funding is continued, our valuable community can continue to thrive. Our community could not exist without the support and stability provided by the GBO. Therefore, continued NSF investment for science-focused operations (the No-Action Alternative) seems to be the most beneficial option for everyone. It is imperative that the Green Bank Observatory stays up and running!</p>	Against Closure	Email - Scanned	11/19/2016	
373		Angela	Gyorko		Blank email; Subject line is: Preserve the station! WV residents supports continued full funding!	Against Closure	Email - Scanned	11/19/2016	
374					My husband and I have visited a few times and plan to go back with our grandson. Please don't close this wonderful facility! We WV citizens are very proud of Green Bank. If funding must change I would vote for collaborating with interested parties for science and education focused operations with reduced NSF funding.	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
375		Bryar	Huff		<p>Hi my name is Bryar. I am a thirteen year old boy from Nutter Fort, West Virginia. We need the Green Bank Telescope because it provides information about space and is the main pulsar telescope. The telescope is important because it is the only one in the world that has the needed resolution, sky coverage, and sensitivity, it also can map gas with extremely low densities, and can take pictures of the Sunyaev-Zel'dovich Effect. The telescope is used to discover interstellar chemical processes, image the Universe as far back as the beginning, detect pulsars, and even discovered that the Milky Way is made mostly of carbon based molecules. Green Bank also works with observatories in Puerto Rico and California. Because of Green Bank scientist can study the highest matter densities. Surprisingly without Green Bank chirality would have never been found in interstellar space. Some discoveries include the abundance of acetamide, a collapse in molecular cloud core, high velocity clouds around the Andromeda galaxy, stellar evolution ,two solar mass, millisecond pulsars in gamma rays, Hydrogen signals, the expansion rate of the Universe, measurement of CO, masers, and chemical processes in space.</p> <p>When I visited Green Bank I was inspired to work there in the future. Without Green Bank the United States would fall behind in the discovery of space. There are many more discoveries to be made that might never be discovered without the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/19/2016	
376		Kim	McBride	Kentucky Archaeological Survey 1020A Export Street University of Kentucky	<p>Continued NSF investment for science-focused operations (No-Action Alternative) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope Collaboration with interested parties for operation as a technology and education park Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) Deconstruction and site restoration</p> <p>The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identifying viable alternatives. At present, NSF has identified the following preliminary resource areas to analyze potential impacts: Air quality, biological resources, cultural resources, geological resources, solid waste generation, health and safety, socioeconomics, traffic, and groundwater resources.</p>	General	Email - Scanned	11/19/2016	
377		Kim and Steven	McBride	Kentucky Archaeological Survey 1020A Export Street University of Kentucky	<p>We write to give our whole-hearted support for the Green Bank Observatory, and hope it can remain fully funded for science-focused operations. We have conducted archaeological research in the Green Bank area for over 30 years, and the Observatory has been an important partner for us, letting us give public lectures in their auditorium, letting students at Science Camps participate in the excavations, providing tours for our excavators, and such. On many occasions Observatory staff have themselves assisted us in our endeavors.</p> <p>This facility is crucial to the economic, scientific and intellectual well-being of the greater Green Bank area and we hope you can find a way to continue its operations.</p>	Against Closure	Email - Scanned	11/19/2016	
378		Ralph	Adkisson		<p>At least offer options to keep it online. Please do not close the observatory.</p> <p>Subject line: Keep Green Bank Observatory</p>	Against Closure	Email - Scanned	11/19/2016	
379	a	Fred	King	Vice President of Research West Virginia University	<p>I write regarding the Environmental Impact Statement assessment for the Green Bank Observatory announced on October 28, by the National Science Foundation. I serve as the Vice President for Research at West Virginia University and as a member of the State of West Virginia's Science and Technology Council and offer my comments from those perspectives. I want to state from the beginning that any reduction in the operations at the Green Bank Observatory would not only be devastating to the local community and its economy, but would also significantly reduce the opportunity for students from kindergarten to graduate school to engage in scientific discovery. These are significant impacts to a region where its citizens are already struggling in so many ways.</p> <p>I believe it is important to make clear that this is a choice of where the Division of Astronomical Sciences at the National Science Foundation chooses to invest the tax dollars of which it is steward. In 2013, the budget for the operations at Green Bank, West Virginia was on the order of \$14M while the budget for the operations at Atacama, Chile was on the order of \$33M, which I suspect is significantly more today. Furthermore, it is also my understanding that the Green Bank user community was not represented on the panel that undertook the portfolio review of facilities that recommended divestiture. A faculty member from the University of Pennsylvania called this review flawed at the hearing on November 9 in Green Bank. These realities raise the question as to whether or not a decision on the future of the Green Bank Observatory will be based, in part, upon a portfolio review that some members of the Astronomy community view as flawed. I do not question the scientific value of ALMA, but believe that the Green Bank Observatory also offers important scientific value, as well as training the next generation of U.S. scientists and providing jobs locally.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
379	b	Fred	King	Vice President of Research West Virginia University	<p>I want to put in context the interest that West Virginia University has in the future of the Green Bank Observatory. Our University has made significant investments in our astrophysics program since the commissioning of the new telescope in 2001. Chief among these was our investment in people.</p> <p>When the telescope was commissioned, we essentially had one astrophysicist working in our Physics Department and occasionally collaborating with the folks in Green Bank. At the time of the commissioning we saw a tremendous opportunity to achieve synergy between the University and the Green Bank Observatory to enhance research and educational opportunities for students in the region and beyond (at the time we simply did not foresee that such a new facility would be up for divestiture within the next 15 years). Working with NRAO leadership at that time, we jointly pursued a strategy to realize this opportunity (clearly NRAO also did not see this divestiture coming either).</p> <p>The initiative started with an advertisement in Science to recruit faculty to the University in the area of astrophysics who could collaborate with researchers at Green Bank. I remember the issue of Science that contained the advertisement as it focused on Einstein and his development of the theory of relativity. The issue also contained an article by Duncan Lorimer on double pulsar systems. Little did I know that Duncan would be an applicant for the position that we advertised in that journal. In fact, Duncan and his wife, Maura McLaughlin, also an astronomer, ended up as finalists for the position. We decided to hire them as a team and begin growing our program with their leadership. Since that time they have started their family here and are active members of the local communities both in Morgantown and Green Bank, engaged not only as faculty and scientists, but as parents and citizens.</p> <p>Following their recruitment we continued to grow the program, using State and University resources. We have added DJ Pisano, Loren Anderson, and Sean McWilliams to our Physics and Astronomy faculty, as well as Zack Etienne in our Math Department. We have also engaged faculty in signal processing in our Department of Computer Science and Electrical Engineering. All of this done to grow a research focus area at our University tied closely to the Green Bank facility. These efforts culminated in the creation of the West Virginia University Center for Astrophysics and the renaming of the Department of Physics as the Department of Physics and Astronomy.</p>	Against Closure	Email - Scanned	11/18/2016	
379	c	Fred	King	Vice President of Research West Virginia University	<p>Of course as you grow faculty you also grow student impact. Over the last decade, 6000 undergraduate students have taken the intro Astronomy course as an elective. For some of those it opened a new career path in STEM that they had not previously considered. In no small part, this was because they could easily travel to the Green Bank site and experience the thrill of scientific discovery there. The number of students graduating with undergraduate degrees in Physics has tripled during this time and the diversity of students pursuing a physics degree has doubled. Ten students have completed Ph.D.'s in this program and 9 are currently in the pipeline. These graduates have gone on to hold faculty positions at Universities, to serve as staff at observatories, or to translate their skills in signal detection and processing into positions in industry. The Green Bank Observatory has significantly impacted education in STEM at West Virginia University.</p> <p>Perhaps one of the most significant broader impacts that I am aware of is how the Pulsar Search Collaboratory, a joint West Virginia University-Green Bank Observatory initiative, has engaged K-12 students and their teachers. If you have not already done so, I recommend that you view the documentary, Little Green Men, available on the web - http://www.lgmfilm.com/. It provides a great overview of the Pulsar Search Collaboratory's effort to engage students and their teachers in the quest to discover new pulsars. It is a fabulous example of hands on science. More significantly, you hear from the students how it has profoundly impacted their lives. Many of them, particularly those from more rural areas and potential first generation students, have come to see that they can be a part of the scientific enterprise. Some have discovered new pulsars, but that is less important than the confidence and skills that they all are developing as participants and future members of the Nation's STEM workforce.</p> <p>It is also clear that those who spend time at the Observatory are inspired with a sense of awe at the phenomenal engineering accomplishment that is the Green Bank Telescope. To date, more than 2000 students have participated in the program. In terms of diversity, roughly 50% of these students come from underrepresented groups. From a workforce development perspective, 99% are either in college or plan to attend. Of those, 68% now plan to pursue post-secondary education in STEM or STEM related area. To date we have had roughly 20 students attend West Virginia University and 8 major in Physics and Astronomy.</p>	Against Closure	Email - Scanned	11/18/2016	
379	d	Fred	King	Vice President of Research West Virginia University	<p>The Green Bank Telescope is certainly a point of pride for the State of West Virginia. It profoundly impacts our efforts to grow technology and a STEM workforce across the state and Appalachian region. The educational outreach provided both within West Virginia and regionally continues to change lives for students who come from rural and underserved areas.</p> <p>Recognized as a National Landmark where the first parabolic radio telescope built by Grote Reber, its scientific import compares to that of other National Landmarks such as Oak Ridge and Los Alamos National Laboratories. It is worth remembering that Green Bank, West Virginia, has been the home of radio astronomy in the United States since the National Radio Astronomy Observatory was founded there in 1956. Since that time, the Green Bank Observatory has been the site of some of the most significant scientific discoveries in Astrophysics. The Observatory is an important historical landmark for the U.S. scientific community.</p> <p>I think that we would all agree to the tremendous scientific research and educational impact of the Green Bank Telescope and the historical contributions to astrophysics that have emanated from this facility since its founding. What may be less obvious are some of the other broader impacts of the facility.</p>	Against Closure	Email - Scanned	11/18/2016	

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379	e	Fred	King	Vice President of Research West Virginia University	<p>Locally, there is a significant economic impact. High-wage, high-skill jobs are few and far between in Pocahontas County. The Green Bank Observatory is the third largest employer in the county and a significant contributor to the local income tax base. With over 100 full time employees and 40 additional summer employees, the Green Bank Observatory accounts for roughly 5% of the workforce in Pocahontas County, West Virginia and a majority of the higher wage jobs. Estimates put the combined impact on the local and state economy at nearly \$30M per year. Equally important is the social impact of the staff of Green Bank on their local community. At the hearing on November 9, we heard from numerous citizens, not employed at the Observatory, about this impact. Whether serving in the local PTA or on the local ambulance crew, it is clear that the Observatory employees shape their community and make it a great place for all to live. This quality of life would simply not exist absent the Observatory and its employees. Green Bank would end up as so many rural communities have once the local anchor of the society and economy is lost.</p> <p>Born in a small town in the coalfields of southwest Virginia, I appreciate the inspiration that a facility such as the Green Bank Observatory can provide to young people. I also understand the economic devastation that can occur when a key driver of the local economy is lost. I cannot emphasize enough, how important it is to have such a powerful symbol of scientific and engineering achievement as the Green Bank Observatory located in a rural region where many lack much in the way of opportunity. I fully appreciate the scientific value of the ALMA site in Chile, however, it does not offer hands-on science training opportunities that the GBO currently offers our budding U.S. science students. At a time when the U.S. is lagging way behind other countries in federal research and development investments, NSF's offshoring research, educational outreach, as well as jobs, is of concern I believe the Green Bank employees understand that their jobs are in jeopardy while ALMA is creating great job opportunities in Chile.</p> <p>As West Virginia and the surrounding region work to diversify the economy and grow in the technology sector, the loss of the observatory as a symbol of the power and impact of STEM in our region of the United States would be tremendous. But the real loss would be to future generations of American citizens in this region who may not have the same opportunities and inspiration that the presence of the Green Bank Observatory, the contributions of its staff, and its outreach programs have provided for nearly 60 years.</p>	Against Closure	Email - Scanned	11/18/2016	
380		Vance	High		My experience as a NSF Fellow at Greenbank was the most influential of my life. I went 'into' teaching full bore to get my students to evaluate decisions with objectivity. Now the earth's population needs objectivity more than ever with issues like global warming, an extinction event. Please continue funding for the GBT.	Against Closure	Email - Scanned	11/19/2016	
381		Mary Alice	Milnes		Please don't close the Greenbank Observatory. It serves us well with it's unique capabilities.	Against Closure	Email - Scanned	11/19/2016	
382		Marilynn	Cuonzo		<p>Green Bank has been home to an observatory that for 60 years has explored the outer reaches of our universe. Eliminating the observatory would hurt the local economy, but far worse the dismantling of such a facility will have light years of ramifications that would extend far beyond West Virginia. You are well aware that the observatory is still heavily used by astronomy facilities. Green Bank's equipment remains capable of adding much to our knowledge of the unknown outer space.</p> <p>Shutting down Green Bank observatory would only amount to closing a window on our universe.</p> <p>Please consider the consequences of such a closing or a decrease funding to our country and the entire world.</p>	Against Closure	Email - Scanned	11/19/2016	
383		Kazuhiro	Hada	National Astronomical Observatory of Japan (NAOJ), Mizusawa VIBI Observatory	<p>As an active user of the Green Bank Telescope (GBT), here I would like to describe the impact of the possible GBT shutdown or reduction of available time on studies of active galactic nuclei (AGN) and high-energy astrophysics.</p> <p>The GBT has played a major role in understanding the physics of black holes, AGN, relativistic jets and the associated high-energy Universe. In particular, very-long-baseline-Interferometry (VIBI) observations in concert with the GBT can image the innermost regions of relativistic jets near the central supermassive black holes at an unprecedented angular resolution and sensitivity. Indeed, our research group has recently performed a joint VIBA+GBT observation of a nearby active galaxy M87, and for the first time resolved and imaged the base of a black-hole jet at a scale just 10 times that of the black holes's event horizon (Hada, K., et al., The Astrophysical Journal, 817, 131, (2016)). This has allowed us to provide some important insights into how an active black hole produces powerful outflows of material despite the existence of the strong gravity, a longstanding mystery in black-hole/high-energy astrophysics. Without the help of the superb GBT sensitivity, our study was impossible to achieve. It should be emphasized that this study with the GBT has just opened a new window on studies of black- hole/AGN accretion and ejection. To better understand the kinematics, acceleration and magnetic-field structures of the relativistic jets, it is indispensable to continuously monitor these objects with VIBI plus GBT. In this respect, the shut down or the reduction of our GBT time will have dramatic impact on the future progress of this kind of study and the wide-reaching astrophysical research community in a broader context.</p> <p>Therefore, I strongly hope that the NSF will continue to support the GBT.</p> <p>References: Hada, K., et al., "High-sensitivity 86GHz (3.5mm) VIBI observations of M87: Deep imaging of the jet base at a resolution of 10 Schwarzschild radii", The Astrophysical Journal, 817, 131, (2016) See also https://public.nrao.edu/news/tip-sheets/2016-feb-tip-sheet</p>	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
384		Harvey	Liszt		<p>This is not an objective or dispassionate opinion. My credentials notwithstanding, the opinion expressed here is my own.</p> <p>As a scientist, tenured NRAO staff member, Green Bank observer, former Project Scientist for the Robert C. Byrd Green Bank Telescope and technical advisor to the legal team that successfully defended in a \$30,000,000+ arbitration arising from the construction of the telescope over three+ years 1997 - 2000, I am disgusted that the National Science Foundation would contemplate options for the future of the Green Bank Observatory and Green Bank Telescope that did not maintain, indeed enhance, their use as basic research facilities.</p> <p>My actual opinion of the last option, deconstruction, is unprintable but I would be happy to provide and indeed elaborate upon it, on request.</p> <p>The Green Bank Telescope is an iconic scientific instrument of unparalleled scientific productivity that is the envy of the world. The success of Green Bank Observatory observations, over more than 50 years, is a testament to the dedication of several generations of NRAO and GB staff who have made substantial personal sacrifices to live and work in a remote area that is specially dedicated, through the National Radio Quiet Zone and West Virginia Radio Astronomy Zoning Act, to protection of the radio astronomy operations they enable.</p> <p>The NSF's act of disinvestment of Arecibo Observatory, Green Bank Observatory and the long Baseline Observatory that has resulted in the current EIS process is a testament to a feckless and disruptive stewardship of American radio astronomy, an abrogation of responsibility and a vast squandered opportunity.</p>	Against Closure	Email - Scanned	11/19/2016	
385		Edward	Montiel	Postdoctoral Scholar, Department of Physics, UC--Davis/NASA Ames Research Center	<p>I am writing to you urging that the option of "continued NSF investment for science-focused operations (No-Action Alternative)" be taken in regards to the Green Bank Observatory (GBO) & the AST portfolio. I support the findings and conclusions laid out in the two white papers made recently available: https://arxiv.org/abs/1610.02329 & https://arxiv.org/abs/1610.09014.</p> <p>I was able to observe with the GBO during my final year of graduate school at Louisiana State University to begin follow-up on one of the components of my dissertation. The GBO was the only facility in the world that has the necessary angular resolution, sensitivity, and most importantly at which I could apply for time.</p> <p>I was fortunate to visit the Green Bank site twice in 2016. First, to attend an observing school in January hosted by the observatory. While there I learned the background of radio observing, how to observe with the GBT specifically, and met other students who were members of projects scheduled for observations. The majority where from West Virginia University, which has its own special relationship with the GBO. While I was at the end of my graduate school career, I cannot imagine the effect on the number of undergraduates and graduates research development an NSF divestiture would have.</p> <p>My second visit was in late March/early April to perform the bulk of my observing and to give a lunch talk on my dissertation topic. While there I got to see first hand how efficiently and dedicatedly the GBO is run by both the science and support staff. The dynamic scheduling employed by the GBO is unique among ground-based facilities and ensures that every possible second is spent towards the advancement of our scientific knowledge.</p> <p>Again, I would like to reiterate my support for the NSF AST to take "No-Action" in regards to the GBO. The facility remains a critical asset for US astronomy and to the thousands of early-career scientists like myself.</p>	Against Closure	Email - Scanned	11/19/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
386		Timothy	Robshaw	Dominion Radio Astrophysical Observatory	I am writing to strongly state my opinion that the NSF should choose alternative #1 of its "Notice of Intent to Prepare an EIS", namely "Continued NSF investment for science-focused operations (No-Action Alternative)." I was trained over many years as a graduate student at the Green Bank Observatory. While many of my peers were conducting radioastronomical research that never required them to leave their desk, the Green Bank staff actively engaged me in the commissioning of the telescope and allowed me to develop a hands-on knowledge of all working aspects of a radio telescope. This knowledge has allowed me to travel to observatories around the world in order to pursue difficult measurements that require a detailed understanding of the instrumental response of a large single-dish telescope. Ultimately, the training I received at the Green Bank Observatory is directly responsible for my being hired as a permanent staff member at the Dominion Radio Astrophysical Observatory, operated by the National Research Council of Canada. To make a succinct case for the Green Bank Telescope's---and hence, Green Bank Observatory's---continued support, I'd like to describe why it is so unique. A telescope's collecting area dictates its ability to see faint light from the distant reaches of the universe. The 100-meter Green Bank Telescope possesses the largest fully-steerable collecting area in the world, but more importantly, it was designed with an aperture that is completely unblocked. That is, radio waves that are reflected from the large 100-m surface end up being collected and amplified by a factor of billions without having to encounter any metal supporting structures that would add impurities to the cosmic signal. This is a novel design---all other large single-dish telescopes have their signals contaminated because of their standard designs making very sensitive measurements of weak cosmic signals prone to instrumental errors. There are experiments that can only be reliably conducted using such a telescope and I will describe a couple of them below. By choosing to shutter the Green Bank Observatory, the NSF would make an active decision to black out a substantial window to the universe. I would first like to address claims that have been made in our community that the 100-m Effelsberg telescope in Germany could provide similar capabilities to the GBT. This is a completely misguided and false statement for the following four fundamental reasons: (1) its aperture is significantly blocked; (2) the Effelsberg telescope is situated in a deep valley and therefore has a limited sky coverage compared with the GBT; (3) the frequency spectrum in central Europe is highly contaminated by interference that blocks out entire windows to the universe; (4) the receivers at the secondary focus of the Effelsberg telescope are situated off of the symmetry axis of the telescope and suffer a considerable instrumental response when compared with the clean optical design of the GBT. To draw attention to a particular topic that can only be studied at the Green Bank Observatory, I will briefly describe a physical phenomenon called the Zeeman effect. Hydrogen is the most abundant element in the universe---the space between the stars in our Milky Way galaxy is filled with atoms of hydrogen. These atoms emit radio waves at 1420 MHz on the radio dial and the study of these radio waves allows us to map the structure of the Milky Way. When one of these interstellar hydrogen atoms emits a 1420 MHz radio wave while in the presence of a magnetic field, a fingerprint is stamped on the radio wave which imprints both the strength and direction of the magnetic field at the location where the radio wave originated. This fingerprint can be detected here on Earth by using only the largest unblocked antennas. There is only one single option for reliably mapping the magnetic field throughout our Milky Way at high spatial resolution in this fashion: the Green Bank Telescope..... I am beginning a large-scale, low-resolution survey of the Zeeman effect in Galactic hydrogen using a small 26-m telescope in Canada. Our ultimate goal would be to provide the Green Bank Observatory with a world-class receiver and waveguide feed to be installed on the GBT in order to follow up features of interest at high spatial resolution, allowing us to answer fundamental questions about how magnetic fields shape the dynamics and structure of our galaxy...The study of cosmic magnetism in our Milky Way and the broader universe would be directly affected by a decision to close the Green Bank Observatory. I will allow my colleagues to provide more examples of the unique observational astrophysical endeavors that are in peril by the NSF's potential decision.	Against Closure	Email - Scanned	11/18/2016	
387		Billy Joe	Peyton	Professor of History WV State University Institute, WV	Please consider continued funding for the Green Bank Observatory in West Virginia. It is an important research center for world-class scientists, teachers, and students, as well as one of the most historic radio astronomy facilities in the world. Moreover, the Robert C. Byrd telescope remains a viable, relevant and modern instrument in the 21st century. In conclusion, please consider continued funding for the Green Bank Observatory, an important center for scientific endeavor. WV needs it, and the scientific community needs it.	Against Closure	Email - Scanned	11/18/2016	
388		Brian	Mason	Scientist, NRAO	I am writing this letter in response to the public comment period for the planned environmental impact statement and proposed changes to Green Bank Observatory operations. I am a radio astronomer; a long-time user of NRAO facilities (since my thesis work at the University of Pennsylvania); and an employee of NRAO since 2002. For the first decade of my employment with NRAO I worked primarily with short-wavelength instrument development programs on the GBT. I have since shifted my main focus to AIMA and at present manage a team of scientists who support AIMA software development, though I continue to support new millimeter cameras on the GBT with a modest fraction of my time. I also have a strong research interest in GBT millimeter wave capabilities. The GBT is a unique, relatively new, and highly valuable asset to the world-wide scientific community and an essential component of the (remaining) US Radio/Millimeter/Submillimeter research infrastructure. I therefore **strongly support the "No-Action" alternative of continued NSF investment for science-focused operations**, including operation at the highest frequencies and with "Open Skies" access for world-wide scientific researchers. The range of exciting science that the astronomical community has recently done and plans to do in the coming decade is summarized in two recent preprints (on which I am a co-author) at https://arxiv.org/abs/1610.09014 and https://arxiv.org/abs/1610.00239 . These range from mapping the dynamic context of star formation in nearby molecular clouds; to astro-chemistry; to fundamental physics with precise pulsar timing measurements; to high-resolution imaging of colliding clusters of galaxies in the early universe. Key strategic assets the GBT offers include: *An amazingly precise (250 micron RMS), 100-meter diameter reflector. *An unblocked aperture that greatly improves image quality and reduces the amount of unwanted, interfering radiation scattering into the data. *A suite of receivers covering a factor >300 in frequency (300 MHz to 115 GHz). *One of the radio-quietest operating environments within the continental United States. *A highly flexible, cutting edge platform for instrument development and validation. *One of the few remaining radio or millimeter wave telescopes where the next generation of students can "get their hands dirty" building and using new instrumentation. *Two new millimeter wave cameras funded by the NSF (ARGUS and MUSTANG-2), which have been built and are beginning to be used for science. *Excellent complementarity to current and near-future radio and millimeter facilities (AIMA, Jansky VIA, and Next-Generation VIA): the frequency coverage and high surface brightness sensitivity of the GBT makes it the perfect telescope to fill in the big picture that will be missed by these super-high resolution interferometers. *A vital and very successful Education & Public Outreach program associated with the site and telescope. In conclusion, I urge you to maintain the US position of leadership in radio and millimeter astronomy by continuing to operate and develop further our existing, cutting-edge facilities, in particular the Green Bank Telescope.	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
389	a	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>I am writing to express my strong support for the continued NSF investment for science-focused operations of the Green Bank Observatory. In addition to the unique properties that enable the Green Bank Telescope to make crucial contributions to our understanding of the universe, the observatory has important broader impacts both locally and at universities across the world. These will all be greatly affected negatively without continued NSF support of science-focused operations.</p> <p>During my first postdoc at the California Institute of Technology and continuing into my current postdoc at Dartmouth College, the Green Bank Telescope (GBT) has played an important role in developing my scientific skills as well as the questions I am investigating regarding the evolution of galaxies with a specific focus on the relation of the activity of the central supermassive black hole and formation of new stars in their host galaxies. The gas contents of galaxies provide crucial insights into these processes and measuring them requires both high frequency observations to probe the molecular gas and low frequency observations to measure neutral gas, capacities that are now available and in development at the GBT.</p> <p>One of the first proposals that I had accepted is to search for neutral gas in distant ($z > 0.1$), massive spiral galaxies whose existence is a challenge to our current paradigm of galaxy formation and evolution. Our current understanding posits that mergers between large galaxies, needed to grow the most massive galaxies, disrupt the spiral structure of galaxies and yield large elliptical galaxies. Simulations of such interactions suggest that only very gas rich galaxies could reform disks, so our measurement of the gas contents of these massive spiral galaxies are necessary to test this hypothesis and show us where the limits of our understanding currently lie.</p> <p>These observations are only possible because of the unique characteristics of the GBT. First, due to their distance, the neutral gas signature of these galaxies is very faint. We therefore require the sensitivity that only a large, filled- aperture telescope can provide. These observations are also critical for determining whether more expensive facilities such as AIMA or ngVIA can provide observations with higher spatial resolution for different science goals in a reasonable timeframe and to provide short-spacing data necessary to ensure interferometric observations do not resolve out significant fractions of the gas content...Third, the steerability of GBT enables much larger coverage of the sky. As part of my research, I work with two samples of galaxies, Superluminous Spiral Galaxies (93 galaxies) and Shocked Poststarburst Galaxies (1067 galaxies), whose gas contents will provide important insights into their formation and evolution. Due to its steerability, GBT is able to observe these samples drawn from the Sloan Digital Sky Survey (SDSS) in their entirety. In contrast, stationary dish telescopes such as Arecibo and China's FAST are limited to observations within 20 degrees of zenith and therefore can observe much lower fractions of such samples (50-70%).</p>	Against Closure	Email - Scanned	11/18/2016	
389	b	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>The GBT has also played an important role in expanding my scientific skills into radio wavelengths. I attended the 2015 NAIC/NRAO Single Dish School as well as the 2016 GBT Remote Observing Training School. These schools provide a very good complementary education first in the understanding of radio astronomy and its techniques and second in the practical aspects of observing with the GBT. They fully prepared me to observe with confidence my approved proposal remotely this fall. Additionally, these schools had participants from a large range of professional levels, from students to senior astronomers, indicating that, in an era where multi-wavelength synergy is critical for deep exploration of astrophysical questions, this kind of school (and therefore this observatory) has an impact on a large range of the community.</p> <p>In addition to its value as a scientific resource, the GBT is also having a broader impact on my career trajectory as an early-career astronomer by enabling me to recruit and advise students, primarily for two reasons. First, one of the draws of astronomy is observing with telescopes. I personally chose astronomy over particle physics when applying to graduate school in part due to a summer spent at the Kitt Peak National Observatory where I got to spend time observing with four different telescopes. Complex observatories like AIMA and JVIA simply provide astronomers with data files of their observations. While likely safer for those telescopes, it removes some of the magic of being an astronomer that is retained by user-controlled telescopes like the GBT even if done remotely. This also reduces the opportunities of students to learn how to problem-solve on the fly either when things go awry during an observation or when determining the necessity of changing targets based on observing conditions. Second, interferometric observations have a much steeper learning curve at the start due to the relative complexity of the observations and the data reduction involved. In contrast, single dish, spectral line observations (such as those taken in my approved project) are generally simpler in both the theoretical understanding and practical analysis. Starting in January, I will be advising a freshman undergraduate in using such observations to measure the neutral gas contents of galaxies.</p> <p>At this point in my career, I have not yet obtained a permanent position. One type of institution to which I am applying are primarily undergraduate institutions that seek to engage their students in research. Maintaining high- level research at such institutions is in part dependent on the availability of open-skies time at observatories such as the GBT. Without NSF support of science operations at the Green Bank Observatory, my research possibilities, especially at radio wavelengths, should I find a position at such an institution, would be greatly constrained. As a graduate student at Harvard University and an undergraduate at the University of Maryland, my experience was greatly enriched, scientifically, academically, and personally, by their observing resources. Open-skies access to telescopes like the GBT plays an important role in leveling the playing field for students at institutions with fewer resources.</p>	Against Closure	Email - Scanned	11/18/2016	
389	c	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>Second, the unique placement of the GBT in the National Radio Quiet Zone is critical for observations of redshifted neutral hydrogen emission. Although the specific galaxies observable are constrained in part by the interference environment, such interference would be significantly worsened without the radio quiet zone, making these observations impossible. In the current period of expanding use of the wavelength coverage for non-scientific purposes, a radio quiet zone would be very difficult to re-establish, should it disappear with the scientific operation of the GBT.</p>	Against Closure	Email - Scanned	11/18/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
389	d	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>The important contributions of the GBT to its local community is well illustrated by events that took place during my two visits during the 2015 and 2016 schools. During summer 2015, the New Horizons probe arrived at Pluto. GBT held a public outreach event attended by people who drove several hours to come, showing the important draw of the GBT as a means of informing and exciting the public about space. I also saw a local class of school children on tour of the observatory, indicating its use as a teaching tool for local teachers.</p> <p>Second, as part of the schools, we visited the machine shop on site at the observatory. It was fascinating to see the inventiveness and care of the machinists. I asked our guide about his training and he described the apprenticeship he had as a young man, the relative difficulty today to find people with the technical background necessary for such positions, and his concerns that these skills may be lost without a new generation. The Green Bank Observatory is actively engaged in seeking to form alliances with local technical schools and community colleges to create such non-academia-focused training programs. Given the current level of unemployment in West Virginia and the similarities to professions that formed an important part of the state economy such as the coal industry, this kind of outreach to the local community has the potential for an important and broad impact.</p> <p>I hope the paragraphs above demonstrate my strong sense that the GBT's properties of a large, steerable, filled aperture in a radio quiet zone provide a unique resource for astrophysics that should continue to be supported by the NSF with funding for science-focused operations (the first EIS option) to provide access to the US community regardless of the size and resources of their institution, as well as its important broader impact both through outreach and through training across a broad range of capabilities and skill sets.</p>	Against Closure	Email - Scanned	11/18/2016	
390	a	Joshua	White		<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory available in the Federal Register on October 19, 2016.</p> <p>I want to document my enthusiastic support for the sustained functioning and full funding of the Green Bank Observatory as a science and learning focused operation in Green Bank, West Virginia. Our family is a very common one. We enjoy spending time together- hiking, visiting exciting places, watching science-fiction movies, swimming and relaxing by a winter fire. I think I speak for a lot of families when I say that we were floored when we discovered the multitudinous opportunities at the Green Bank Observatory.</p> <p>My parents discovered this place in the 90s, shortly after they had married. They, as a lot of people, discovered this place by chance. When they stumbled upon it, however, the science center had not yet been built and so they enjoyed the walking path along the telescopes and the trees. It was beautiful then, even when they knew very little about it. About 10 or so years later, my older sister and I got to visit the observatory, now with an even more blossoming future than before, newly equipped with a science center, gift shop, and public tours.</p> <p>My sister and I were both smiling kids who were eager to learn more by the time we had exited the museum, and we as a family took a walk around the biggest fully maneuverable telescope of any kind in the world.</p> <p>This story of discovery and enchantment about the Green Bank Observatory is quite universal, as I have observed.</p> <p>My 16 year old sister grew up mostly with a book or paintbrush in her hands. She's always enjoyed art, and has been a creator of such her whole life. I have grown up my 14 years with either a Gameboy or computer mouse in my hands ninety percent of the time. I've always enjoyed computers and animation, and have attempted to make such things my entire life. As we've gotten older, we have improved our work. My sister is a beautiful painter and seamstress. My computer skills have (arguably) gotten better and I have been dabbling in new ways of animation.</p> <p>One of the magical things about Green Bank is that it has a place for virtually any ability. My sister, as a seamstress, is now creating and selling dolls to raise funds for the GBO, and has found an intense passion for science and astronomy. I entered a GBO video contest and won first prize for my animation, and received contact information for potential future work as an animator. I hope to provide, at some point, educational animations to the observatory and others. These are opportunities that I have never seen before in any organization, and are experiences neither of us will forget.</p>	Against Closure	Email - Scanned	11/18/2016	
390	b	Joshua	White		<p>Also, in addition to these amazing things, we've been so privileged to be able to participate in the Radio Astronomer for the Day program, which has made us both very interested in the field of radio astronomy. There was something just so neat about seeing this big box of wires and switches turn the faintest of signals into hard-copy data! That moment of truth when you calibrated the telescope just right and see the printer produce the magic of radio waves onto the chart was a sensation that every aspiring scientist should feel in their start as an astronomer. There have also been many other opportunities for us at the GBO. The "Skynet Junior Scholars" program, along with an RFI project that my sister, in cooperation with an Oregon Tech student, worked on with the mentoring of Dr. Richard Prestage, have provided us with invaluable education as high-school students.</p>	Against Closure	Email - Scanned	11/18/2016	
390	c	Joshua	White		<p>This facility has multiple parts- educational value, top-of-the-line scientific equipment and research, creation of jobs and support for the West Virginia economy- which work together like gears in a watch, bits of circuitry in a computer, and peanut butter on bread; you take one away, and the entire structure is bound to stop functioning. Such a loss to West Virginia, which is suffering from a declining coal industry, would break the hearts of our family in addition to all the others who have been touched by this facility, not to mention the workers and scientists who would be out of jobs. The people of West Virginia need something to be proud of, and this facility will deliver such pride for years to come. I hope that I'll be able to pass this wonder on to the next generation in the same way my parents did for me and my sister.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
391		Helen	Kirk	Research Associate Herzberg Astronomy & Astrophysics Program	I am writing to you in response to the request for comments about the NSF's future plans for the GBO. I am presently a Research Associate with Herzberg Astrophysics at the National Research Council of Canada; the thoughts I express here are my own and not reflective of a policy position by the NRC. I have the privilege of being involved in two large programs using the GBT: the Green Bank Ammonia Survey (GAS) which only recently finished obtaining data, and the ongoing KEYSTONE survey. These two surveys, in addition to others I am not involved with, highlight the power of the GBT to make a significant impact on the field of star formation with the current instrumentation suite on the GBT. Indeed, many years of continued operations would be needed to fully take advantage of the present suite of instrumentation. Both GAS and KEYSTONE use the KPFA on the GBT to map the presence of NH ₃ (ammonia) emission within star-forming molecular clouds in our galaxy. NH ₃ emission is one of the most powerful probes of cold, dense, star-forming gas that we have available; for a combination of chemical and physical reasons, it uniquely allows the measurement of both the temperature and density of the emitting gas, for the coldest and densest condensations where star formation is actually occurring. What we have been learning in the past decade, in part thanks to observations from Herschel, is that larger-scale observations (i.e., mapping full molecular clouds to a reasonable resolution) provides essential information to understanding the context in which stars form. The current instrumentation suite on GBT provides access to this large-scale molecular cloud context (particularly gas kinematics and temperatures), in a way that no other facility in existence is presently able to do. One key question that can be answered with large-scale kinematic data include the role of filaments in supplying mass to both individual and clusters of stars (which is suggested but untested from Herschel continuum data), and there is a long list of other important topics. Surveys like GAS and KEYSTONE are just beginning to scratch the surface of what can be done with the KPFA. Even more importantly, the new ARGUS detector, which allows for higher spatial resolution spectral mapping of N ₂ H ⁺ and HCO ⁺ , has only just been commissioned. HCO ⁺ is a key tracer of infall motions, another key component to understanding filamentary accretion, and there has been very little opportunity to exploit this significant capability of the GBT. The current capabilities of GBT are essential for making progress on understanding how stars form. These capabilities will not be available elsewhere to (North) American astronomers if the GBT were to close: the areal coverage of these observations are not feasible to complete with interferometers, even an array as sensitive as ALMA. It's also important to note that this large-scale context is a key component of interpreting (and knowing where it is important to obtain) higher-resolution observations such as those with the JVIA and AIMA. Loss of access to quality single-dish facilities will impact the ability of American astronomers to do the best science that they can from AIMA and the JVIA. (In Canada, we have been having a similar concern as our involvement in the JCMT diminishes.) The recent papers by Lockman et al. and Bally et al. also make it clear that for a very modest investment in tested technologies, new instrumentation and facility improvements could easily be implemented to provide truly revolutionary advances in the already impressive capabilities of the GBT. In my view, it would be extremely unfortunate and short-sighted to diminish or halt entirely the ability of American astronomers to pursue unique, world-class science with state-of-the-art instrumentation only recently made available on the GBT, which would at the same time also undermine astronomers ability to fully exploit the exquisite interferometric data coming in from AIMA and the JVIA. I therefore strongly urge the NSF to consider maintaining their current level of support of the GBT, so that radio astronomers in the USA have the tools available to maintain their research excellence on the world stage.	Against Closure	Email - Scanned	11/18/2016	
392		Adri	Persad		I worked as the Education and Public Outreach Intern at the Green Bank Telescope for ten weeks last summer. It was a great experience for me to be immersed in the events at the facilities while I was there, and I was able to learn a lot about the many discoveries that happened during the last few decades the observatory has been operating. Pulsars were discovered, the hydrogen of the universe was mapped, and the lunar surface was imaged. These discoveries, among others, have been huge contributions to the scientific community, and it would be an unnecessary mistake to eliminate the potential for more groundbreaking discoveries. Moreover, as a member of the Science Public Outreach Team (SPOT) of West Virginia, which is heavily tied with the GBO, the telescopes at Green Bank are something we can point to as a prime example that living in West Virginia doesn't rule out the opportunity for scientific advancement. I've lived my whole life in West Virginia, and it's not a state that seems to offer many opportunities. Being able to show that there is a world-class scientific research facility in West Virginia is huge, and the message it sends is powerful. It would be a terrible thing to be asked by a student what the telescope was doing currently as a presentation was being given, and to have to reply that the facilities had been shut down for lack of funding or destroyed entirely, despite the past successes and promises held by the future research of the telescope. On top of that, during the course of my internship, I was involved in many of the outreach efforts made by the GBO. At the beginning and middle of my time there, I was able to give lessons on the use of the 40 foot telescope to many different groups, and every one of them was amazed by the science that was able to be performed by both the researchers there and themselves. The visitor's center had people coming in and out of it every day, with guests diverse as to be so young and so old they could barely walk, and participating enthusiastically in the tours and the multitude of exhibits. Later on, there was an impressively well-run summer camp for scientifically-minded groups underrepresented in the community that I had the privilege to be a part of. It was an incredibly rewarding experience for both myself and the 20 children, some of whom came from a rough background where quality scientific education can be hard to come by. Many of the children told me that they hadn't really known about or cared about radio astronomy before they arrived there, but that after their two weeks there they had developed a major appreciation and possible career interest in it. In short, the Green Bank Observatory is a place where advanced science can be performed, and there's no other facility like it on Earth. The public outreach performed there is unlike that done anywhere else, and serves invaluable in educating the public about the otherwise arcane science carried out in the state and around the world. Removing that sort of a facility from the map would be a huge mistake.	Against Closure	Email - Scanned	11/18/2016	SPOT letter.docx

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
393		Nipuni	Palliyaguru		<p>I am writing to you to let you know about my experience working with the Green Bank observatory. I received my PhD from West Virginia University in 2015 where I worked in the field of pulsars. located only about three hours away from West Virginia University, my fellow graduate students and I have made numerous visits to the site to get telescope training, to attend summer schools, to take data or simply to just stay at the site and work on research problems. Being at the telescope, and understanding the engineering marvel were definitely highlights of my grad school years. The basics I learned about radio astronomy and observations at the single dish and interferometric summer schools held at GBO have become very useful in the research I am currently engaged in, which is the follow-up of LIGO gravitational wave sources with the VIA.</p> <p>I have used GBT data for multiple projects that utilize single-pulse studies of millisecond pulsars and rotating radio transients during my PhD. Single pulse tests may ultimately become important for gravitational wave detection with pulsars because the pulse-to-pulse jitter (which is a single-pulse phenomenon) plays an important role in the pulsar noise budget. I have worked on developing methods using single pulses that could potentially be used to overcome jitter noise. Furthermore they can shed light on pulsar emission mechanisms (to differentiate between millisecond and normal pulsar emission mechanisms). These single-pulse tests are possible because of the unprecedented sensitivity of the telescope and the large bandwidths made available for pulsar data taking.</p> <p>I fervently wish the GBO can be kept operational because there are lots of students like me who have gained so much from it. On a broader note, now that LIGO has detected gravitational waves from binary black holes, the detection of low-frequency gravitational waves with pulsars is imminent. Having the GBO around, will help with such large, ground-breaking discoveries that would change the future of science and how we view the universe.</p>	Against Closure	Email - Scanned	11/18/2016	
394		John	Saunders		<p>Don't close the NRAO, for the love of God...don't do it!! Senator Byrd is spinning in hi grave. This is THE single institution that's put WV on the world-wide map! Remember last year when that news crew came all the way from Germany?? Closing the observatory would be the most short sighted decision since banning ramps in the public school kitchens! NOOOOOOOO! Don't do it!</p>	Against Closure	Email - Scanned	11/18/2016	
395	a	Jacob	Sheets		<p>The Green Bank Radio Astronomy Observatory Site was opened in 1956 in the midst of the Cold War Space Race. While part of its reason for existing at all may have been coupled with the aim of beating the USSR into space, the Observatory also had the larger questions in mind. Was there life out there somewhere? What are other stars like? What might other celestial bodies and planets be made of? The results of these questions led to breakthroughs not only in our knowledge of the Universe, they sped our technological development in the fields of receivers, transmitters, and computers.</p> <p>My grandparents were a local family who were instrumental in the early days of the Observatory's success. My grandmother Beatrice was hired as the first secretary on-site, and my grandfather Jamie served as the local driver who shuttled scientists from across the globe to and from the various airports. Through them, my father was able to learn about cutting edge science, and meet astronomers from other countries who would have never given West Virginia or Green Bank any thought. This contact with the outside global community certainly contributed to my family's outlook on the world, as it also impacted the way Green Bank as an Appalachian town looked at itself. It was now an important center of research; it wasn't just a small logging town with no stop-lights and few prospects for growth. New families moved into the area, and locals could find a new place to work besides the family farms and the logging companies. The immediate economic and social advantages that the observatory brought to the community were and still are astounding.</p>	Against Closure	Email - Scanned	11/18/2016	
395	b	Jacob	Sheets		<p>Today, that impact remains essential not only to Green Bank, but to the state of West Virginia. In addition to the world-leading scientific work being done, the Observatory employs a large part of the workforce in the area. These are steady, secure jobs, that support families who have children in the local school system. When the Observatory hires new scientists they also bring their families, adding children to the school system, which directly impacts those employed by the school system. During the summer months, high school students are able to find jobs at the Observatory, vastly increasing their options from the few that are available.</p> <p>The tourism impact of the Observatory has also been significant more recently. Since the Science Center has opened, thousands of visitors now have a reason to stop in Green Bank instead of passing through to Cass Railroad or Snowshoe Mountain. The visitors who stop are amazed by the Observatory, and always learn something about the Universe. Perhaps more importantly, they learn about their misconceptions they may have had about West Virginia. I worked as a Tour Guide for a summer, and visitors are often surprised that an Observatory is located in the middle of the mountains. The social impact that this carries is enormous. It leaves a positive impression of West Virginia on visitors' minds, and to put a price on that is impossible, especially at a time when the State overall is trying to attract new business. The economic benefits of the tourism traffic are clear as well. Once visitors take the tours, they often ask about other activities including the local art co-operative, State Parks, and restaurants. Without the Observatory, Green Bank and Pocahontas County overall would be severely harmed. There would be fewer employment opportunities, reduced class sizes in the local schools, no reason for tourists to even think about stopping in the area and, most crucially, the notion that the United States is a leader in scientific research would be drastically diminished. As a concerned citizen who grew up near the Observatory, it must be funded.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
396	a	David	Fraye	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>Thank you for soliciting public input associated with the NSF Environmental Impact Statement and Section 106 Consultation for Proposed Changes to the Green Bank Observatory Operations. I strongly encourage the NSF to choose option (1): Continued NSF investment for science-focused operations (No-Action Alternative). For the EIS sub-contractors hired by NSF, my letter makes two cases for the continued NSF support of the GBO: Section (1) STEM educational value, and (2) Astronomical Research from 20-115 GHz. I also discuss some of the budget issues in Section (3) which are outside the scope of the EIS, but I would appreciate these opinions being passed along to the appropriate parties within NSF. Thank you.</p> <p>(1) STEM Educational Value</p> <p>I have been a PhD astronomer for 20 years carrying out astronomical research primarily at radio, mm, sub-mm, and infrared wavelengths. In previous decades, there were many options within the US for obtaining hands-on research experience with public-access radio/mm facilities, including the CSO, FCRAO, NRAO-12m, NRAO-140ft, OVRO, BIMA, and CARMA. All of these facilities were once NSF supported, and none exist anymore. The only remaining US radio/mm facility with public access that permits hands-on observing is the GBT. Hands-on observing is key for training the next generation of scientists. The technical experience gained is crucial for supporting the success of future facilities.</p> <p>The NSF's new Strategic Plan, Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014 - 2018 highlights the importance of STEM education. The GBO does an amazing job at STEM education and the training students ranging from middle-school to postdocs in astronomical research. I would challenge anybody to find an organization that does a better job with the hands-on astronomical research experience than the GBO. I have worked at many places, and the GBO is by far the best, hands down. The success of the GBO on this front is spectacular given it makes due with a shoe-string budget. I encourage the NSF to continue to support the STEM activities at the GBO.</p>	Against Closure	Email - Scanned	11/18/2016	
396	b	David	Fraye	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>(2) Astronomical Research from 20-115 GHz</p> <p>As part of this process, it appears that the NSF does not want to consider the scientific merits of the GBT or discuss the issues associated with the 2012 Portfolio Review, but I need to put a few comments on the record even though I realize that these will likely be ignored by the NSF. Every astronomer I have talked to about this review has said that the process was deeply flawed, including members on the committee that carried out the review who shared their frustrations about the process with me and others off the record. The 2012 Review implied that the Bonn telescope could carry out the science being done by the GBT at high frequency (e.g., >20 GHz). Nobody with any knowledge on the subject would consider this claim credible, including our colleagues at Bonn who found this claim absurd and irrational. The 2012 Review also claimed that the VLA could be used in phased-array mode to replace many of the science programs currently being done with the GBT. Anybody with knowledge of the capabilities of the VLA and GBT would know that this is not practical (e.g., GBT Memo 294 from the NanoGrav group: https://library.nrao.edu/public/memos/gbt/GBT_294.pdf). When discussing the science being done by the VIBA, the 2012 Review highlighted the importance of the "HSA" (High Sensitivity Array, i.e., the GBT used with the VIBA.) The GBT is crucial for providing the necessary sensitivity for the HSA. In short, the GBT is unique and no current facility or any planned facility would be able to come close to matching its capabilities into the foreseeable future. As stated within the recent GBT High-Frequency community report:</p> <p>"No other observatory has the capabilities of the GBT, and none has open access for US investigators to the degree offered by the GBT. Adequately instrumented, the GBT would be a pillar for 20 -- 115 GHz science in the US and the world."</p> <p>Representatives from NSF-AST have basically stated to the astronomical community that the 2012 Review report represents all of the needed input from the scientific community (i.e., this box has been checked off for NSF bureaucrats). I urge the NSF-AST to reconsider and to take into consideration the advice from scientists all over the world. For the NSF to blindly accept the recommendations of the 2012 Review with the knowledge of its shortcomings is not responsible. I understand the review process is complex, but it is possible to carry this out in a fair way. In contrast to the flawed 2012 Review, the 2006 Senior Review was much more balanced and well-reasoned in their conclusions. Although some could argue about the merits of some of the recommendations within the 2006 report, most felt that the 2006 process was reasonable and fair. The same cannot be said for the 2012 Review. Nobody I have talked to outside of the NSF has defended the 2012 Review process. Everyone believes that it was a "flawed" process.</p>	Against Closure	Email - Scanned	11/18/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
396	c	David	Fraye	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>Irregardless of the many shortcomings within the 2012 Review, many would claim that the recommendations of the 2012 Review with regard to the GBT are no longer applicable. This argument has been put forward in a recent white paper published on astro-ph, which states:</p> <p>"The National Science Foundation (NSF) Astronomy Division's Portfolio Review of 2012 is no longer relevant to the Green Bank Telescope (GBT) of 2017 for two principal reasons, one instrumental and the other astrophysical: 1) The GBT has begun significant operations in the 3mm band, giving it unrivaled capabilities for spectroscopy and continuum studies over 67-116 GHz. It is now an instrument that is unique worldwide and is a critical complement to AIMA for the U.S. scientific community. These capabilities had not been implemented at the time of the review. 2) The detection of gravitational radiation by LIGO in 2015 places the GBT's work on pulsar observations of nano-Hz gravitational radiation at the forefront of modern astrophysics.</p> <p>The paper also argues that "In the era of AIMA and LIGO, other countries have bolstered their mm-wave and cm-wave facilities; it is critical that U.S. scientists have ready access to a large filled aperture to remain at the forefront of research." And</p> <p>"The National Academies study New Worlds, New Horizons: A Midterm Assessment highlighted the importance of measuring gravitational waves, constraining the equation-of-state of nuclear matter, determining the mass of supermassive black holes, determining Ho, and understanding the physics of star-formation, as key science goals for astronomy. All of these key areas are currently being advanced using the GBT."</p> <p>The GBT is currently being used to carry out key science programs for astronomers from all over the world (the GBT userbase is approximately 1000 and has been growing with the new instrumentation at high frequency). The loss of the GBT is not replaceable, and decreasing the amount of time available for science would drastically affect the progress being made at high-frequency with the GBT given the scheduling constraints necessary to accommodate the low-frequency "paying" customers. In "the good old days", when the NSF was funding GBT operations at the 95% level, the over-subscription rate at high-frequency for the GBT ranged from 4--10, depending on the IST range. If for example, the NSF funding goes down to 25%, one could naively expect the over-subscription rate to increase by a factor of about 4. However, things would actually be worse than this due to the additional scheduling constraints. It is estimated that another factor of two decrease in available high-frequency time would result in this scenario pushing the over-subscription rates to 30-80. In other words, high-frequency NSF supported science on the GBT would basically stop, or at best be on life support -- few users are going to invest effort in writing observing proposals for a 1/50 chance of getting time. The only realistic possibility for high-frequency programs would be from paying customers, which would be challenging for the current high-frequency user community given how astronomers are funded in the US. This is key justification for supporting option (1). I do not believe any of the other options would be healthy for future science operations on the GBT. Our user community has not yet come to terms to with what will happen if the NSF only funds the GBT at less than the 50% level (e.g., option 2). Our observers will become frustrated with the GBO/NSF, and the GBT userbase will drastically decrease initiating a cycle of decline for GBT science (fewer users --> less support from NSF --> fewer users --> less support from NSF....). I, likely many other astronomers, care deeply about the science enabled by the GBT. If the NSF values science, then option (1) is the most reasonable choice.</p>	Against Closure	Email - Scanned	11/18/2016	
396	d	David	Fraye	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>(3) Budget Considerations</p> <p>I also encourage the NSF to think outside the box in dealing with their budget challenges. While I have been at NRAO (since 2009), I have seen significant increases in management and administration costs from NRAO-HQ, at the expense of telescope operations. The NRAO/AUI management claim that this has been necessary to comply with NSF policies. If this claim is true, then the NSF could reduce the "red-tape" to save money across the board within the organizations they oversee. For example, within NRAO/AUI, we could save more than 5 million dollars per year by decreasing management and administration costs associated with NRAO-HQ/AUI without decreasing any useful functionality for the AIMA, VLA, GBT, and the VIBA observatories, as well for CDI (based on my assessment of the budget provided within the NRAO Program Operation Plan and public AUI tax records). The priorities of an organization can be gleamed by following the money.</p> <p>Analyzing the public tax filings of AUI over the last 30+ years shows a disturbing trend. Thirty years ago many of the highest paid NRAO/AUI employees were the top scientists and engineers within the organization, but now the highest paid employees are just the managers and bureaucrats (many of which have no contact or association with the telescopes we operate). I urge the NSF to look for savings from excess management and administration costs both internally and within the organizations for which they provide oversight, and to use these savings to invest in our facilities and to strengthen the NSF grant programs.</p>	Alternatives Consideration	Email - Scanned	11/18/2016	
397		Caroline	Simpson	Professor, Department of Physics CP 217A	<p>I'm writing to express my strong support for continued science operations with the Green Bank Telescope (GBT). As a large filled-aperture instrument operating at a wide range of frequencies, it is an essential and unique tool for cutting-edge research in the United States, and in the world. For astronomers such as myself, working at universities that don't have their own astronomical research facilities, access to a publicly available instrument such as the GBT is what allows me to continue to perform research, train graduate students, and inspire undergraduates to pursue careers in STEM. My two most recent Ph.D. students used the GBT for work that has resulted in published papers for both of them. The GBT data taken by one, Dr. Trisha Ashley, formed a large part of her Ph.D. dissertation and allowed her to finally answer a long-standing question in dwarf galaxy evolution. The GBT is the only instrument in the world that is capable of making the kind of observations required to do such research.</p> <p>I trust that a careful and honest assessment of the GBT's current science capabilities will result in the decision to let it continue science operations. It is an invaluable asset for U.S. astronomers.</p>	Against Closure	Email - Scanned	11/18/2016	
398	a	Aditya	Togi	Department of Physics & Astronomy University of Toledo	<p>The new radio interferometer facilities such as the Atacama Large Millimeter Array (ALMA), Very Large Array (VLA), which provides high resolution but subjected in filtering out the light flux distributed over large spatial scales and this calls the need for a single dish radio telescope like GBT. The implementation of new state of the art facilities such as Argus camera, MUSTANG-2, and their involvement in the NANOGrav project makes GBT a unique modern tool and no less compared to other radio facilities in the world. Moreover, with new radio telescopes coming up in different countries it is important for United States to maintain and improvise their current radio astronomy facilities.</p>	Against Closure	Email - Scanned	11/18/2016	GBT_NSF.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
398	b	Aditya	Togi	Department of Physics & Astronomy University of Toledo	<p>Letter: I, Aditya Togi, am a recent Ph.D. graduate student from the Department of Physics and Astronomy, University of Toledo, Ohio. My area of research is primarily focused on studying dust and gas properties in galaxies.</p> <p>The Robert C. Byrd Green Bank Telescope (GBT), a facility at the Green Bank Observatory did play a major role in my Ph. D. career path. I attended the NAIC-NRAO school on single dish radio astronomy at the Green Bank Observatory in July 2015. The school was focused on learning/improving observation skills in radio astronomy by doing tutorials along with hands on experience on a radio astronomy project. In our project we estimated the atomic gas mass limit in Hydra II, a newly discovered dwarf galaxy of our Milky Way, which was published in Astronomy and Astrophysics, a popular refereed astronomy journal. In the same batch another group performed high-resolution observations on a recently discovered near Earth asteroid using radar signals, which led to a press release. Along with scientific studies the observatory is also involved in training young fresh minds of the nation on the engineering aspects of the telescopes and is helping in passing the technical knowledge to the next generation....</p> <p>The radio telescopes of the Green Bank Observatory along with the GBT has proven helpful in my career path in learning and improvising my radio astronomy observation skills. The new development and state of the art facilities of the Green Bank Observatory will not only be useful in scientific aspect of our understanding the universe but also in training our young minds to prepare for the new technical challenges of future. With this I strongly recommend and request National Science Foundation (NSF) to allow continue the science operation at the Green Bank Observatory and opt for "no action"</p>	Against Closure	Email - Scanned	11/18/2016	GBT_NSF.pdf
399		Andrew	Harris	Professor, University of Maryland Department of Astronomy	<p>The Green Bank Telescope, with its size and surface accuracy, is unique in the world. Its enormous collecting area and ability to observe from decimeter to millimeter wavelengths allows it to explore astronomical objects from the Solar System to the early universe. As the remaining federally-funded single-dish telescope available for general use, it plays a critical role in developing new instrumentation. Ensuring U.S. community access to the scientific results and instrumental development that the Green Bank Telescope (and, preferably, other observatories with broad capabilities and uses) offer is essentially to keep U.S. science not only competitive but to rebuild U.S. radio astronomy's capability leadership in the field. Considering the environmental impact of a proposal to change a telescope's role in the national scientific infrastructure is an excellent approach, as it combines the impact on the scientific community with other considerations. I would like to add two perspectives to the discussion of scientific impacts: one at the international and national level, and one reflecting my own research.</p> <p>For the broader view, I bring perspective from my participation over the past few years as a member of the visiting committee (Fachbeirat) of the Max Planck Institute for Radio Astronomy, Chair of the APEX Telescope Review Committee, Chair of the Scientific Advisory Committee for the CfA's Submillimeter Array (SMA), and Chair of NASA's science advisory committee for the SOFIA observatory. These committees have reported on facility health and futures to the President of the Max Planck Society, Director General of the European Southern Observatory, Director of the CfA, and other key decision and funding authorities. It is clear that almost all new technical developments in U.S. radio astronomy are being eclipsed by research in other nations. In many cases foreign scientists are reaping the benefits of ideas that started in the U.S. but could not be realized here. This is especially obvious in the production of large focal plane arrays for continuum imaging, in development of receivers and imaging focal plane arrays at THz frequencies, and in the push to construct large arrays at low frequencies. A serious drag on U.S. efforts to maintain competition here is the lack of facilities where U.S. scientists can try out new ideas on interesting astronomical projects; we are almost at the point that any instrumental development requires building a telescope as well as the detector system. This approach works well for experiments such as those common to measurements of the Cosmic Background Radiation (where the U.S. is leading), but it does not work at all well for simpler projects, such as exploring new technologies that may be prototypes for inclusion in much larger instruments.</p> <p>As a concrete examples, the Effelsberg 100 meter telescope, which is constantly being upgraded, is a highly productive scientific instrument on its own, but has also been a key factor in the MPIfR's ability to lead and join other projects. Projects at the IRAM 30m telescope provide direct advantages in applying for ALMA time as well as spurring instrument development of immediate relevance to ALMA. Statistics from the APEX review showed that APEX -- a single, modest-diameter telescope -- was cited in 22% to 30% of ALMA proposals in the ESO database. As a community, the U.S. has done an excellent job of highlighting the capabilities of ALMA and the VLA, but the unfortunate byproduct seems to have been to diminish the perceived need for complementary capabilities available with other instruments. At a personal level, the Green Bank Telescope has been an important part of my research, along with a number of graduate and undergraduate students, and colleagues across the country.... In conclusion, the growing trend of reducing the number and capabilities of instruments available to the Nation's astronomical community is increasingly excluding U.S. scientists from opportunities available from the interplay of data and instrumentation available from a broader approach to science. Ecosystems flourish with diversity, but wither with monoculture. The Green Bank Telescope is a key part of the U.S. diversity in science and technology.</p>	Against Closure	Email - Scanned	11/18/2016	envlmpact16.pdf
400		Casey	Law		<p>I am a professional astronomer based at the University of California, Berkeley and I am writing to express my support for continued science operations at the Green Bank Observatory.</p> <p>I would not be where I am today as an astronomer without the GBO. My professional training and doctoral thesis made great use of the Green Bank Telescope. The staff there dedicated so much to supporting me, the astronomical community, and the public.</p> <p>One peculiar point relevant to radio telescopes in particular is that instruments and computing define a great deal of an observatory's science capabilities. The GBO has invested in novel and powerful science instruments in the last few years (such as high frequency, wide-band, and multi-beam receivers). This has helped transform it into a new telescope that serves a wide-ranging and vital needs in astronomy. With continued investment and allocation of significant time to astronomical research, the GBO will continue to play that role.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
401	a	Hanna	Sizemore	Research Scientist Planetary Science Institute (PSI)	<p>I'm a researcher at Planetary Science Institute (PSI), and I spoke at the public scoping meeting for the EIS on proposed changes to Green Bank Observatory operations. I am writing now to reiterate my support for the following options: Continued NSF investment for science-focused operations (No-Action Alternative, PREFERRED) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p> <p>As I noted in my spoken comments, I'm a native of Pocahontas County and I received my early education in the local school system. NRAO-GB / GBO has been an invaluable partner to Pocahontas County Schools for more than 40 years. I benefited directly from this partnership as a high school student, when I was given the opportunity to do a research mentorship with a staff scientist at the observatory. The technical instruction, academic and professional advising, and exposure to the international research community I was given at Green Bank as a teenager have benefitted me throughout my career. Mentoring from staff scientists at GB *and* teaching by observatory spouses in the local schools were vital to my becoming a first generation B.A., M.S., and Ph.D. like 2/3 of PSI scientists, I work remotely from our Tucson, AZ headquarters. I have an adjunct position at GBO and work primarily from a shared office in the Jansky lab. Being an adjunct at NRAO-GB / GBO has enabled me to live in rural WV while continuing my career with PSI. (Persistent major problems with broadband internet access in the area would have made working from a home office near GB untenable; working in close proximity with GBO scientists and engineers also benefits my work in numerous small ways on a daily basis.)</p>	Against Closure	Email - Scanned	11/18/2016	
401	b	Hanna	Sizemore	Research Scientist Planetary Science Institute (PSI)	<p>Being physically located at GBO has given me unique opportunities to give back to the local community. My children are enrolled in local schools (which are in dire need of students to retain current levels of state funding). I served two years on the local school board. I've participated in many EPO activities as an individual and with GBO staff. In a community this small, I think it's also important that I've been able to bring my income from NASA grants into the local economy. GBO enables all of these things; it is unlikely I would live or work in Pocahontas County if the observatory were not here.</p>	Against Closure	Email - Scanned	11/18/2016	
401	c	Hanna	Sizemore	Research Scientist Planetary Science Institute (PSI)	<p>Personally, GBO has helped me strike a surprising compromise between being a part of the rural community where I grew up and being a part of the international space science community. The benefits that the observatory has brought to me individually are a microcosm of the benefits it provides to the local community as a whole. The observatory is an indispensable source of jobs, population, education, and community organization. Removing the observatory from Green Bank would be devastating to a rural area that is already economically depressed. It would also significantly narrow the academic and professional options for bright young people from WV who might one day contribute to STEM fields.</p> <p>I want to emphasize that federally funded facilities like GBO provide conduits of people, ideas, and money between rural areas of the US and the larger national and international communities. The benefits of these conduits flow both ways. At a time when the major economic and political schisms between rural and urban America are so prominently on display, removing any of these conduits may have long-lasting negative effects on American society and science leadership.</p> <p>Public/private partnerships (option #2 above) that maintain science activity at GBO are preferable to any alternatives that would end active research at Green Bank. However, this option would likely diminish the availability of open observing time on the GBT and might result in reductions to science staff. It would also make access to the telescope much less democratic and merit based. Only continued federal funding of the observatory with an intact science staff and substantial publicly competed observing time truly preserves the the vital role of GBO in the local community and the science community.</p>	Against Closure	Email - Scanned	11/18/2016	
402	a	Scott	Ferris		<p>My name is Scott Ferris. I proudly tell people, "I'm a West Virginian: born, raised, and educated." My secondary education is from West Virginia University where I achieved a B.S. in physics, focusing on general relativity. Although my studies where theoretical by nature, the quality of my department, professors, fellow students, and overall experience were undoubtedly linked to the experiments, funding, and educational programs offered by and through Green Bank.</p> <p>First and foremost the Governor's School for Math and Science at Green Bank was one of the most memorable and formative experiences of my early education. Being immersed in that community of learning and experimentation was eye opening. Using the GBT for one observation instead of the 40 ft dish we had used for all other observations changed my perspective in many ways. First, how lucky I was to use such equipment, secondly the power of human ingenuity and technological progress, and most influentially was the feeling I got when we saw the clear resolution of the gases we were studying. It was as if we were the first people to see that patch of space clearly, like cresting a hill and be the first to see a great river or ocean; we made a discovery. I have always looked to the sky with wonder and awe. As a child I found God in the stars. As a teen, I found a passion and career in the stars thanks to Green Bank.</p> <p>Although I am currently taking a break from science and academia to enjoy WV's natural resources by being a river guide on the New River and working as a snowboard instructor at Snowshoe Mountain (very close to Green Bank). Many of my friends I made at that camp went to work at Microsoft, Tesla, and NASA. I hope they all took time to write you as well. I am sure everyone looks fondly at those two weeks.</p>	Against Closure	Email - Scanned	11/18/2016	
402	b	Scott	Ferris		<p>In addition to the direct impact Green Bank has made on my life, there are many indirect impacts. While a physics student at WVU the physics department grew a considerable amount. Moving to a newly renovated building and adding an astronomy department as part of the growth. This expansion was made possible by funding associated with pulsar research. The Green Bank Observatory makes this research possible. One of my favorite teachers of all time, Duncan Lorimer, would likely not be at WVU if not for Green Bank and the services it allows. He is not alone in that category. Through his efforts and efforts of his colleagues to get high school students analyzing pulsar data, I saw an increase in the undergraduate enrollment of the physics department with a majority from WV. As a state that is ranked very low in education, getting students into research and into a scientific field is a major accomplishment.</p> <p>In summary, I am one of many West Virginians who have been positively influenced by Green Bank Observatory. The time I spent there at the Governor's School or Math and Science changed my life and sparked my interest in physics. My physics studies at WVU were made possible in great part to the existence the Observatory. Closing Green Bank would mean closing opportunities for the bright, exceptional West Virginian's who already have to struggle in one of the worst education systems in the nation. Please keep the Green Bank Observatory functional for the sake of science, discovery, education, West Virginia, and the future.</p>	Against Closure	Email - Scanned	11/18/2016	
403		Brittany	Hudnall	N/A	Email is completely unreadable, random characters	General	Email - Scanned	11/18/2016	N/A

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
404		Phillip	Ward		<p>The Director of the NSF had this to say Aug.25,2010:</p> <p>"The Robert C. Byrd Telescope will be the workhorse of the Green Bank Observatory for decades to come".</p> <p>Several million taxpayer dollars built and have maintained this very useful facility for many years.</p> <p>It would be foolish to take it out of service and possibly demolish this wonderful astronomy facility. I am in favor of and recommending the No-Action Alternative.</p>	Against Closure	Email - Scanned	11/18/2016	
405	a	Paul	Baker	Postdoctoral Fellow Center for Gravitational Waves and Cosmology West Virginia University	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory. I am a postdoctoral fellow in the Center for Gravitational Waves and Cosmology at West Virginia University (WVU). I primarily work as a member of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) alongside over 100 colleagues spread across North America, several of them at WVU. The Green Bank Observatory (GBO) is absolutely critical to our effort to detect low frequency gravitational waves. No other facility in the world offers GBO's combination of sensitivity and sky coverage. The closure of GBO to full scientific operations would devastate the North American low frequency gravitational wave community.</p> <p>Any of the proposed changes to GBO operations would have major detrimental impacts on NANOGrav, and in turn the careers of dozens of astronomers, engineers, and technicians in West Virginia and throughout these United States. I am just beginning my career in astrophysics, so the closure of GBO would directly impede my own scientific career. I currently rely on funding from the Center for Gravitational Waves and Cosmology (CGWC). The CGWC is funded by several grants (including an NSF Physics Frontier Center grant) tied to radio astronomy at GBO. Grants tied to GBO observations also fund dozens of WVU graduate students and five additional postdocs, beyond myself. Without GBO and these funds the CGWC would cease to operate. I insist that you quantify the full monetary and economic loss to West Virginia University and the state of West Virginia, as a result of any reduction in scope of GBO.</p> <p>Of the five proposed scenarios only the no-action alternative is acceptable to me. Only in the no-action scenario is the open skies time maintained. Open skies time is necessary for NANOGrav to survey and characterize new pulsars, and for astronomers around the country to have the most access to GBO. The other scenarios present too great a cost to myself, my colleagues, the state of West Virginia, and the culture of science in the United States of America. Let us consider the impact of each of the proposed scenarios:</p> <ul style="list-style-type: none"> • No-action alternative: Under this preferred scenario, NANOGrav would continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Additional surveys to find new millisecond pulsars with the GBT would also continue. Dozens of graduate students would continue to receive the highest quality education at institutions around the country, like WVU. The careers of young scientists would continue uninterrupted, continuing the United States' full contribution to astrophysics. • Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. The reduction in NSF funding would directly reduce the open skies time available for our surveys. Scheduling pressure would also make it more difficult to characterize new discoveries, greatly reducing the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress. The reduction in open skies time would also cut off many astronomers who use GBO without the backing of a large collaboration like NANOGrav or Breakthrough Listen. This vastly reduces the breadth of science conducted at GBO and in the United States. 	Against Closure	Email - Scanned	11/18/2016	GBO_letter.pdf
405	b	Paul	Baker	Postdoctoral Fellow Center for Gravitational Waves and Cosmology West Virginia University	<ul style="list-style-type: none"> • Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of scientists, including myself. The GBO and Arecibo are currently the best telescopes in the world for low frequency gravitational wave science, and they have the potential to remain so for the next decade. Other countries, including China, are increasing their investment in single dish radio astronomy. Changes to GBO operations will effectively forfeit US leadership in low-frequency gravitational wave astronomy. <p>Under these scenarios I would strongly consider continuing my scientific career in Europe or Australia, where I could continue working on low-frequency gravitational wave astronomy with the European Pulsar Timing Array or the Parkes Pulsar Timing Array. I expect many of my colleagues would feel the same draw to pursue science elsewhere. This loss of young talent would drain the US of expertise needed to continue the highest quality science and train the next generation of technically adept Americans. In addition, the elimination of this scientific institution will remove a technology center in West Virginia. Even conversion to an education and technology center would likely result in the export of a number of good-paying jobs in Pocahontas County and at WVU in Morgantown to other states.</p> <p>The scientific, economic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the United States astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please feel free to contact me directly.</p>	Against Closure	Email - Scanned	11/18/2016	GBO_letter.pdf
406		Maxwell	Stout	Inactive Attorney Emeritus State Bar of Texas	<p>Before decommissioning the Green Bank Observatory, every effort should be made to sell the facility.</p> <p>Australia might be interested in having a northern hemisphere complement to its Parkes Radio Telescope. The Europe Union has facilities in the southern hemisphere that could be complemented by the Green Bank Telescope. The issue is to have someone take over the expense of operations and maintenance, not the entire loss of the GBT.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
407		Eric	Murphy		<p>I am writing to *strongly* support the continued NSF investment for science-focused operations (i.e., the No-Action Alternative)</p> <p>The statement that has been made: "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm" is unequivocally true. However, the idea that its capabilities are not as critical to New World New Horizons [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities is completely false, as this assessment was made prior to the incredible and un- paralleled receiver developments at higher frequencies, making the GBT the fastest, most sensitive 3mm single-dish instrument for spectroscopic and continuum studies in the world. It is truly unrivaled and one of the primary reasons that US radio astronomy remains at the bleeding edge of scientific and technological developments world-wide. With these capabilities, the GBT is a critical complement to ALMA, an essential resource for the ALMA 2030 development plans that benefit the world-wide astronomical community, and likely the best resource for address short-spacings for the next-generation VLA, which will be the world's preeminent radio telescope even in the SKA1 era.</p> <p>Furthermore, with the recent detection of gravitational radiation by LIGO in 2015, the GBT's work on pulsar observations of nano-Hz gravitational radiation places it at the forefront of modern astrophysics. Thus, the GBT exhibits a huge breadth of scientific capabilities spanning fundamental physics, chemistry, planetary studies, along with Galactic and extragalactic astrophysics. Included in these are a number of key science goals identified by the National Academy study "New Worlds, New Horizons: A Midterm Assessment", namely: understanding of gravitational waves, the equation-of-state of nuclear matter, the mass of supermassive black holes, the value of H_0, and the physics of star-formation.</p> <p>To conclude, rather than divesting from this exceptional resource, it is imperative to maintain GBT operations for the U.S. and to instrument it in an optimal manner, enabling it to become an extraordinary complement to existing and future radio interferometers such as a next-generation VLA. In the era of ALMA and LIGO, other countries have invested significantly in their mm-wave and cm-wave facilities. If the US wants to remain a leader in this area of astrophysics where the discovery space is so large, it is critical that U.S. scientists have ready access to a large filled aperture. As such, the GBT will remain a pillar for 1-116 GHz science in the US and the world.</p>	Against Closure	Email - Scanned	11/18/2016	
408		George	Miley	Royal Netherlands Academy Professor Emeritus Vice President International Astronomical Union Professor of Astronomy	<p>This letter is in response to the above-mentioned notice of intent regarding proposed changes to the status of the Green Bank Telescope. I am writing as a member of the international scientific community, as a multi- wavelength astronomical researcher and someone who is not a user of the GBT.</p> <p>The GBT is a unique facility for pursuing several fundamental areas of research. Its large aperture, highly sensitive versatile receivers and wide sky coverage makes it the best facility in the world for studying pulsars and an outstanding observing platform for detecting and studying astrophysical molecules.</p> <p>Furthermore, the GBT is a crucial element of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), the pulsar-timing array that provides a complementary window on gravitational waves to LIGO and space-based interferometry. The discovery by LIGO of gravitational waves during the past year has established gravitational wave studies as one of the most exciting areas of modern science and Nobel Prize material. The LIGO work has strengthened radically the already compelling case for keeping the GBT operational. In my view the GBT has the potential to do paradigm-changing science for at least another decade.</p> <p>I realize that the NSF Division of Astronomical Sciences is facing a difficult budget situation and recognize that difficult decisions have to be taken. However, it would be a great shame if the GBT were to be removed from the arsenal available to US scientists for pursuing fundamental science and a considerable loss to world science. I respectfully urge the NSF to adopt the "No-action" alternative given in the Notice of Intent, namely Continued NSF investment for science-focused operations.</p>	Against Closure	Email - Scanned	11/18/2016	GBT_NSF_miley.pdf
409		Faith	Bailey	Journalist, Balkan Investigative Reporting Network	<p>My name is Faith Bailey, and I'm from West Virginia. Pocahontas County is where I head every holiday season to visit family and to escape into the peaceful quiet of our rural mountains.</p> <p>My West Virginian upbringing is important to my identity--it shaped my experiences as a college student in Baltimore, a Fulbright in Kosovo, and my current work as a journalist in the Balkans. Growing up, my peers and I lacked many educational and economic resources, so the Green Bank Observatory was always something special to be proud of. I still love to visit with my younger brothers, who are interested in STEM and get so excited by the observatory's emphasis on kid-friendly education.</p> <p>I hope that you see how important the observatory is to West Virginians and that you fund the annual budget and keep GBO in WV!</p>	Against Closure	Email - Scanned	11/18/2016	
410	a	Helene	Courtois	Astrophysicist - Full Professor Vice-President International Relations of University Lyon 1	<p>I write in order to support vigorously GBT fully operational capacity. In my science no other instrument of this quality/sensitivity/dish size/ fully steerable/ in a radio quiet zone, exists in the world that can provide us with the necessary data. The instrument is also a top % telescope in the world because of the quality of the support provided to the astronomers by the staff. I have never seen anywhere else in the world such a high quality of support and staff.</p>	Against Closure	Email - Scanned	11/18/2016	

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410	b	Helene	Courtois	Astrophysicist - Full Professor Vice-President International Relations of University Lyon 1	<p>GBT is a major tool for understanding where we live, where we come from and where we are going, literally. Those are not small questions for the general humanity.</p> <p>My job is to create a cartography of the motions of our and other galaxies in the nearby universe. Only with GBT data were we able to create this first modern map, that as lead to a new address in the universe with the identification of our supercluster laniakea. In the search for understanding gravitation, the cartography of the motions of galaxies allow to test the concept of dark matter in trying to localize it *directly*.</p> <p>Our video with this cartography is since 2 years the top-1 video of the « Nature Journal » youtube channel. With 4 millions of views, our astronomy video is the science that the general public watches most, before biology, chemistry, robotics, medecine, .. As you will see in the next few months we are at the point of releasing another major step in understanding our place in the Universe.</p> <p>We would not have been able to build this new knowledge without GBT.</p>	Against Closure	Email - Scanned	11/18/2016	
410	c	Helene	Courtois	Astrophysicist - Full Professor Vice-President International Relations of University Lyon 1	<p>As Vice-president for international affairs of the University of Lyon 1 and full professor in astronomy. I teach science since 20 years. I want to add that I am very admirative of all the work done by GBT staff to promote science to the young people and to the girls.</p> <p>I canno't imagine that NSF, in any manner, would not continue to support a fully operational GBT for all that it brings to the international and the USA community, and to the general humanity.</p> <p>In all my public and science talks I show a photo of the GBT, you can check directly on this video (minute : 17:21) of a talk I gave at the French academy of Sciences two weeks ago. https://www.youtube.com/watch?v=1g3gD5-uP6A</p> <p>I also have it in photo and praise it in my book for the general public « Voyage on the galaxy flows » https://www.amazon.fr/Voyage-sur-flots-galaxies-laniakea/dp/2100738909</p> <p>Even if I haven't come to Green Bank since a few years I am literally in love with this instrument, don't break my heart.</p> <p>Please do not hesitate to contact me if I can help raise awareness that you have in hand one of the most beautiful technological and scientific jewel.</p>	Against Closure	Email - Scanned	11/18/2016	
411		Martin	Sommer		<p>My name is Martin Sommer, and I am writing to you as a scientist at the Univeristy of Bonn (Germany). I have recently learned of the plans to shut down science operations of the Green Bank Observatory, and would like to express my strong opposition to these plans. I am strongly supporting the continued full scientific operation of GBT, for these reasons:</p> <p>The GBT offers the largest collecing area, and thus, in conjuncton with superb modern receivers, the best sensitivity in a wide range of radio and millimeter wavelengths in the world. In particular, the instrument has been used, and continues being used, for detailed studies of the intra-cluster medium in clusters of galaxies, a crucial field of research aimed, among other things, at sensitively calibrating masses of clusters of galaxies, used for precise cosmological measurements in turn aimed at understanding the very structure of our universe.</p> <p>My own longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/18/2016	
412		Heather	Persing		<p>Please keep the GBT. It means so much to our struggling state, and it inspires young West Virginians to study STEM fields. If I had not had exposure to things like the GBT, I never would have studied Mechanical Engineering (especially as a female).</p> <p>I hope you also consider how crippling financially shutting down the GBT could be for the area.</p> <p>I've looked forward to taking my son to see to the GBT, knowing it will broaden his view of the universe, encourage his interest in science, and deepen his appreciation for his state. Please don't take that opportunity away from him (and so many other kids like him).</p>	Against Closure	Email - Scanned	11/18/2016	
413		Reinhold	Schaaf		<p>My name is Reinhold Schaaf and I am a staff member at the Argelander-Institute for Astronomy in Bonn (Germany).</p> <p>I am writing in strong support of continued full science operations of the Green Bank Observatory. I would like to concur with the points raised in the support letter sent by Dr. Karim (from my department) on November 7 2016.</p> <p>I would like to stress that my longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/18/2016	
414		Steven	Stetzler		<p>I am writing to implore you to not defund the Green Bank Observatory. The GBO had a great impact on me as a student and as a scientist, inspiring me to continue with Physics and explore Astronomy. We as a nation, and as a community of scientists, require nationally funded telescopes in order to thrive. It would be an incredible loss to have the GBO lose its NSF funding.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
415		Dick	Manchester	CSIRO Fellow	<p>I am writing in support of maintaining operations and, in particular, access on the basis of scientific merit (the "Open Skies" policy) at the Robert C. Byrd Green Bank Telescope (GBT) in West Virginia.</p> <p>As a foreign-based scientist, I have benefitted from this policy, being co-investigator on several highly rated, and in one case continuing, programs on the telescope. My research area, pulsars, benefits hugely from access to a large, fully steerable, filled aperture telescope with top-class instrumentation. With its high data rates, pulsar research is best done on "single-dish" telescopes. It is very difficult to achieve the required data rates on array telescopes. This is especially true for pulsar searches which are virtually impossible on array telescopes like the JVLA. Furthermore, compared to array telescopes, single-dish telescopes can easily be adapted to meet the needs of new and unexpected directions in future science.</p> <p>As well as pulsar science, which tends to be best done at relatively low radio frequencies, the GBT is the only 100-m-class single-dish telescope in the world that can operate efficiently at high frequencies, in the range of 50 - 115 GHz. As such it forms an extremely valuable survey instrument, revealing sources for follow-up on array telescopes such as the JVLA and ALMA. Such wide-area surveys are essentially impossible with array telescopes.</p> <p>Currently, the GBT is the world's leading 100-m-class facility. It has an outstanding outreach program bringing the excitement of science to school children and the general public.</p> <p>To deprive the community, both scientific and general, of access to such an outstanding and world-leading facility at the prime of its life would be a crying shame.</p> <p>I recognise the budgetary pressures on the NSF, but continued access for the best scientific projects through merit-based processes on the world's leading 100-m-class telescope seems to me to be such a high priority that any departure from this should not be countenanced.</p> <p>I trust that the NSF will recognise this and continue its support of peer-reviewed scientific operations on the GBT for the foreseeable future.</p> <p>Please note that the views expressed above are my own and that they do not necessarily represent those of CSIRO Astronomy and Space Science.</p>	Against Closure	Email - Scanned	11/17/2016	GBT_NSF.pdf
416		Mary Margaret	Serpento		<p>I was shocked to read reports that the National Science Foundation is considering closure of the Green Bank Observatory in West Virginia. Radio astronomy may not make the headlines that orbital telescopes do, but the basic research capabilities are critical. And unique. The electromagnetic spectrum extends farther than human vision can see. Please keep the Green Bank Observatory open and operational.</p> <p>There are more things in heaven and earth, Horatio, Than are dreamt of in your philosophy. - Hamlet (1.5.167-8), Hamlet to Horatio</p>	Against Closure	Email - Scanned	11/17/2016	
417		Blake	Williams		Please keep the Observatory running!	Against Closure	Email - Scanned	11/17/2016	
418	a	Mara	Boggs	State Director	<p>On behalf of TechConnect West Virginia, I write in strong support of the continued full operation of the Green Bank Observatory in Green Bank, West Virginia and would ask that you share this letter with Dr. France Cordova and the entire leadership team at the National Science Foundation.</p> <p>TechConnect West Virginia is a coalition of professionals dedicated to growing and diversifying West Virginia's economy by advancing innovation-based economic development and entrepreneurship. With members representing education and research, private industry, and the public sector, the organization serves as a forum and facilitator to enhance awareness, spur collaboration, and raise the discussion of issues needed to strengthen the state's innovation ecosystem. We believe it is imperative to maintain and utilize the enormous investment by the Federal Government in the facilities at the Green Bank Observatory for both scientific and economic reasons.</p> <p>From the initial establishment of the National Radio Quiet Zone in 1958 and the construction of the Green Bank Observatory in 1960, the Green Bank site has produced a wealth of scientific knowledge about the nature of the universe. The Robert C. Byrd Green Bank Telescope, dedicated on August 25, 2000, has been called a "marvel of the space age" by National Geographic. It can do in hours what other radio telescopes take weeks to achieve, in terms of gathering and analyzing cosmic signals from distant stars and galaxies.</p> <p>We hope the nation will stand with the Green Bank Observatory and with West Virginia by continuing to offer the maximum support possible to one of the most unique scientific research facilities in the world. Rather than discuss the unthinkable potential closure of this national treasure, we urge our country's scientific experts and elected leaders to work together to find a solution to not only preserve, but also enhance, the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	11-9-16 TCWV letter of Support to NSF for Green Bank Observatory.pdf
418	b	Mara	Boggs	State Director	The quiet zone is one of only two such places in the United States that allow for the type of research conducted as part of the North American Nanohertz Observatory for Gravitational Waves, or NANOGrav Collaboration, working to detect gravitational waves and explore pulsar timing in an effort to ultimately open a new window on the universe. Scientific experts working on the NANOGrav project have concluded that the Green Bank Telescope simply cannot be replaced by other telescopes in conducting this research because of accessibility, sensitivity and flexibility, and its location in a radio free quiet zone.	Against Closure	Email - Scanned	11/17/2016	
418	c	Mara	Boggs	State Director	As an inspiration to generations of students, the Green Bank Observatory has also contributed to the nation's need for highly-skilled scientists and engineers. Most recently, the discovery of pulsars by high school students in the Pulsar Search Collaboratory has attracted worldwide notice, including the White House. As America competes across the globe to develop the next generation of leading scientists, the Green Bank Observatory must be positioned to continue to play a crucial role.	Against Closure	Email - Scanned	11/17/2016	

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418	d	Mara	Boggs	State Director	While there is a cost to maintaining this state-of-the-art research facility, it represents a sound and significant investment on the part of the Federal Government on American soil. Supporting its maintenance in order to further scientific inquiries is responsible stewardship of taxpayer dollars. Because of its accessibility to the general public, the Green Bank Observatory has also led the way in educational tourism, providing a much-needed boost to the local economy. While it has been a tourism attraction since the state's centennial celebration in 1963, that boost is needed now more than ever, as West Virginia's traditional economy undergoes its most significant transition in more than a century. With an annual economic impact of \$30 million, the Green Bank Observatory stands as a cornerstone of economic diversification in a state seeking exactly these kinds of solutions.	Against Closure	Email - Scanned	11/17/2016	
419		Bairavi	Sundaram	Parkerburg High School	I haven't personally visited the Green bank Telescope but a few students on our school's academic teams have and they said their entire experience was very well worth it. Once they came back from visiting the facility they seemed to have an increased interest in not only the idea of astronomy and the search for pulsars but also just science in general. It was this trip that helped encouraged our school to start a pulsar search collaboratory, which currently has a multitude of enthusiastic members. It is for reasons such as this that I would be thoroughly disappointed if the Green bank Telescope were to be deconstructed or torn down. If this facility were to be diminished, a part of scientific exploration goes with it. In the state of West Virginia, we do not have that much of an emphasis on education and removing the telescope would just continue to send that message to students who are interested in the subject. It is essential that we as a state keep the Green Bank telescope to keep encouraging students to have an interest in things relating to science and potentially even make West Virginia a more encouraged state academically.	Against Closure	Email - Scanned	11/17/2016	
420		Jerry	Wang	Parkerburg High School	I won't pretend that I have a personal connection with the Green Bank Telescope, however that does not mean that I would not be very disappointed to see it torn down. The state of West Virginia has an abundance of nature, but a troubling shortage of interest in science. Our education has ranked consistently in the bottom ten, and the lack of many programs and facilities that promote STEM fields does help the situation. This is why I insist that the Green Bank facility is allowed to continue operations. I remember when my brother participated in the West Virginia Governor's School for Math and Science, and their class was able to travel to the observatory and actually use it to look into space. He called my parents and told them how great of an experience it was, and how lucky he was to have been able to do it. This kind of enthusiasm is exactly what other bright students throughout the area need: a symbol of learning and a source of pride. I care a lot about my state, and I want to see it genuinely excel. And our excellence will start with the sciences.	Against Closure	Email - Scanned	11/17/2016	
421		Louis	Costanzo, III		Please be advised that I believe that you are being short sided in considering the closure of the Green Bank facility. This facility ponders valuable information to many researches, scientist etc in our world. There are few places where such study is possible because it has intentionally been isolated. In addition, The Green Bank employs people in our state. Your consideration of maintaining The Green Bank is appreciated.	Against Closure	Email - Scanned	11/17/2016	
422		Victoria	Kaspi	Director, McGill Space Institute Professor of Physics Lorne Trottier Chair in Astrophysics & Cosmology McGill University	This letter is to express strong support for continuing full science operations at the Green Bank Telescope. This is in response to the review process to create an Environment Impact Statement. The GBT is a fully functioning, young major facility with a sizable user base worldwide and particularly here in Canada. There is no existing telescope in the world with the combination of the GBT's sensitivity, frequency flexibility, steerability and low-radio-interference environment. The premature closure being considered would represent a waste of substantial capital costs and an enormous blow to science. My research program has long had the GBT at its core and with huge success. Specifically we have used the GBT for timing of pulsars for detection of nanohertz gravitational waves (as part of the NANOGrav collaboration), for constraining the nature of matter having supra-nuclear density, for unique, new tests of Einstein's theory of General Relativity, for discovering a new class of millisecond radio pulsar/low-mass X-ray binary transition objects, and for discovering the first millisecond pulsar in a triple system. Overall I have published over two dozen refereed papers since 2004 using the GBT, including many of very high impact (at least 5 in Science, one in Nature) having several hundred citations. There has been no slow-down in either our publication rate or in the rate of high impact discoveries. Together with my MSc student Pragya Chawla we are in the middle of a crucial GBT paper related to Fast Radio Bursts which will have very important impact on this blossoming field. Indeed I note that the importance of the GBT to FRB science was amply recently demonstrated by Masui et al. 2015, Nature, 528, 523. It is therefore of great importance to me and to my large research group that Green Bank be permitted to continue to function; I cannot believe that the GBT in terms of cost per any-measure-of-science-impact does not compete favourably with practically all other world-class facilities. I respectfully point out that it would also be, in our opinion, a violation of the spirit of U.S./Canada agreements on radio astronomical collaboration. The 2003 North American Partnership in Radio Astronomy (NAPRA), signed by both Canada and the U.S., guaranteed Canadian access to NRAO radio facilities in exchange for significant Canadian contributions to the JVLA and ALMA, all of which have been successfully provided by Canada as agreed. These included a \$20M expenditure by the Canadian government for development and construction of the JVLA correlator, as well as approximately \$20M in contributions to ALMA construction. The availability of the NAPRA funds were announced in our government's 2003 Budget speech and were provided specifically with the understanding that Canadian astronomers would have access to JVLA and all existing NRAO telescopes. An NRAO divestment from the GBT would therefore be a major blow to the spirit of the NAPRA agreement. My participation and leadership in GBT-related science plays a key role in multiple related Canadian endeavors, such as the development of cyberinfrastructure in preparation for the Square Kilometer Array via a \$2M grant from Canada's CANARIE organization. This enabled the creation of CyberSKA, a web-based portal to a wide variety of radio astronomy project applications that are currently being used by hundreds of radio astronomers both in Canada and worldwide. Additionally, Canadian radio astronomers have been awarded significant supercomputing resources from Compute Canada, specifically for processing of GBT data. Canadian astronomers have even made a significant cash contribution toward infrastructure at NRAO for archiving and rendering accessible GBT data. Finally, all these projects have significant Canadian undergraduate, graduate student and postdoc involvement which would also be undermined should the GBT be unavailable. The proposed disruption of science operations at the GBT would therefore be a major blow to many Canadian astronomical research efforts and investments....Nevertheless I believe strongly that the GBT is doing unique and world-leading work for relatively low cost; it would be strongly detrimental to multiple high-impact areas of science – including many of key importance in Canada – if its science operations were curtailed.	Against Closure	Email - Scanned	11/17/2016	nsf_gbt2.pdf

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423	a	Anne	Barth	Executive Director, TechConnect	<p>On behalf of TechConnect West Virginia, I write in strong support of the continued full operation of the Green Bank Observatory in Green Bank, West Virginia and would ask that you share this letter with Dr. France Cordova and the entire leadership team at the National Science Foundation.</p> <p>TechConnect West Virginia is a coalition of professionals dedicated to growing and diversifying West Virginia's economy by advancing innovation-based economic development and entrepreneurship. With members representing education and research, private industry, and the public sector, the organization serves as a forum and facilitator to enhance awareness, spur collaboration, and raise the discussion of issues needed to strengthen the state's innovation ecosystem. We believe it is imperative to maintain and utilize the enormous investment by the Federal Government in the facilities at the Green Bank Observatory for both scientific and economic reasons.</p> <p>From the initial establishment of the National Radio Quiet Zone in 1958 and the construction of the Green Bank Observatory in 1960, the Green Bank site has produced a wealth of scientific knowledge about the nature of the universe. The Robert C. Byrd Green Bank Telescope, dedicated on August 25, 2000, has been called a "marvel of the space age" by National Geographic. It can do in hours what other radio telescopes take weeks to achieve, in terms of gathering and analyzing cosmic signals from distant stars and galaxies.</p> <p>We hope the nation will stand with the Green Bank Observatory and with West Virginia by continuing to offer the maximum support possible to one of the most unique scientific research facilities in the world. Rather than discuss the unthinkable potential closure of this national treasure, we urge our country's scientific experts and elected leaders to work together to find a solution to not only preserve, but also enhance, the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	11-9-16 TCWV letter of Support to NSF for Green Bank Observatory.pdf
423	b	Anne	Barth	Executive Director, TechConnect	<p>The quiet zone is one of only two such places in the United States that allow for the type of research conducted as part of the North American Nanohertz Observatory for Gravitational Waves, or NANOGrav Collaboration, working to detect gravitational waves and explore pulsar timing in an effort to ultimately open a new window on the universe. Scientific experts working on the NANOGrav project have concluded that the Green Bank Telescope simply cannot be replaced by other telescopes in conducting this research because of accessibility, sensitivity and flexibility, and its location in a radio free quiet zone.</p>	Against Closure	Email - Scanned	11/17/2016	
423	c	Anne	Barth	Executive Director, TechConnect	<p>As an inspiration to generations of students, the Green Bank Observatory has also contributed to the nation's need for highly-skilled scientists and engineers. Most recently, the discovery of pulsars by high school students in the Pulsar Search Collaboratory has attracted worldwide notice, including the White House. As America competes across the globe to develop the next generation of leading scientists, the Green Bank Observatory must be positioned to continue to play a crucial role.</p>	Against Closure	Email - Scanned	11/17/2016	
423	d	Anne	Barth	Executive Director, TechConnect	<p>While there is a cost to maintaining this state-of-the-art research facility, it represents a sound and significant investment on the part of the Federal Government on American soil. Supporting its maintenance in order to further scientific inquiries is responsible stewardship of taxpayer dollars.</p> <p>Because of its accessibility to the general public, the Green Bank Observatory has also led the way in educational tourism, providing a much-needed boost to the local economy. While it has been a tourism attraction since the state's centennial celebration in 1963, that boost is needed now more than ever, as West Virginia's traditional economy undergoes its most significant transition in more than a century. With an annual economic impact of \$30 million, the Green Bank Observatory stands as a cornerstone of economic diversification in a state seeking exactly these kinds of solutions.</p>	Against Closure	Email - Scanned	11/17/2016	
424	a	Geoffrey	Hempelmann	Legislative Assistant	<p>We write to express our support for the invaluable and irreplaceable work of the Green Bank Observatory in Green Bank, West Virginia. This asset has advanced our scientific knowledge for decades and has become a staple of the community, inspiring generations to pursue careers in science and research.</p> <p>The Green Bank Observatory continues to be of critical importance to the scientific community in the United States and the world. Scientists use data from the Green Bank Observatory to further their research in cutting-edge fields such as gravitational waves, pulsars, star formation, and even the search for intelligent life in our galaxy and beyond. Green Bank must remain operational to continue to make the scientific discoveries that are motivating the next generation of scientists from West Virginia and the United States.</p>	Against Closure	Email - Scanned and Letter-mailed	11/17/2016	WV House Delegation Green Bank EIS Comments.pdf
424	b	Geoffrey	Hempelmann	Legislative Assistant	<p>One need look no further to see this than the educational programs at the Green Bank Observatory. Each year, thousands of students and teachers partake in their educational, hands-on programs. One of these programs is the Radio Astronomer for a Day Program, where students participate in a real-life research experience using radio telescope sat the Green Bank Observatory.</p> <p>The Green Bank Observatory is directly responsible for exposing countless children in West Virginia to careers in science, technology, engineering and mathematics (STEM) fields. Many of these students are from underprivileged areas and a significant percentage are female. One of the National Science Foundation's key objectives is to expose underrepresented and female students to careers in STEM, and Green Bank does just that. Green Bank is giving 3,000 to 5,000 students each year a chance to explore a career in science and research, an opportunity that cannot simply be replaced in a classroom or at home.</p> <p>The impact is also felt at West Virginia University, where about 6,000 undergraduate students have completed the introductory course in astronomy since the commissioning of the telescope in 2001. Due to the heightened interest in astronomy, WVU has increased its astronomy faculty.</p> <p>These faculty have successfully pursued a number of competitive NSF grants, including both the PIRE and Physics Frontier Center grants using the Green Bank Observatory. The Pulsar Search Collaboratory outreach project, a collaboration between WVU and the Green Bank Observatory, has engaged more than 2,000 pre-college students in hands-on science, and about 50 percent of these students come from underrepresented groups. Without Green Bank, many of these students would never be exposed to the type of hands-on work a researcher in the field does daily - and exposed to STEM fields.</p>	Against Closure	Email - Scanned and Letter-mailed	11/17/2016	WV House Delegation Green Bank EIS Comments.pdf

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424	c	Geoffrey	Hempelmann	Legislative Assistant	<p>The Green Bank Observatory's impacts expand far beyond educating our youth. At peak season, the facility becomes the largest private employer in Pocahontas County, West Virginia, employing about 140 people. These employees are responsible for a \$17 million economic impact in the county and state. Because Green Bank is in West Virginia, 50,000 people visit the beautiful mountains of Pocahontas County. These visitors spend time in our state, eat meals at our restaurants, shop our small businesses, and stay overnight. The tourists contribute an additional \$ 12 million every year to the local economy. At a time when West Virginia is hurting economically, Green Bank is contributing more than its share, adding \$30 million to the local and state economy.</p> <p>West Virginia needs places like Green Bank. The Green Bank Observatory is a shining beacon for our future and hope in our state. It is creating job opportunities for West Virginians, giving out students unparalleled looks into careers in STEM, and enabling cutting-edge scientific research. The Green Bank Observatory must remain fully operational so that future generations of West Virginians and Americans can be inspired to look toward the stars and make discoveries that will redefine what we know about our universe.</p>	Against Closure	Email - Scanned and Letter-mailed	11/17/2016	WV House Delegation Green Bank EIS Comments.pdf
425		Geoff	Heberlein		I know Science is a hard field to invest in, but we are starting to see the effects of our country not putting the money into getting more people to follow jobs in science. Our grip on high tech jobs is slipping bad. We have to stop the hemorrhage while we still can. The facility is still used a lot and is doing great research and now is not the time to throw in the towel. With China surging hard onto the scene we need to do everything we can to keep America first. We need to lead before we end up like the Roman Empire. A power of the past	Against Closure	Email - Scanned	11/17/2016	
426	a	Bruce	Randall		<p>I am a member of SARA (Society of Amateur Radio Astronomers) and visit there once a year for the SARA conference.</p> <p>The options apparently range from keeping operation normal to total closing of all. I would like to see all operations there continue. I would be very disappointed if any instruments were torn down.</p> <p>The GBT is a world class instrument. There is no other instrument in the world that can do the science research that it can. It is the largest fully steerable radio telescope in the world. A priority should be made on keeping this instrument operational. I suspect partial funding could be available from both governments and research organizations around the world.</p> <p>Please consider your decision carefully. The GBT is a unique, cutting-edge instrument unlike any other in the world. The history, research, education and support provided by this institution is unlike anything else.</p> <p>Fully funding the GBO may not be possible, but partially funding it until the staff can build a consortium of interested researcher institutions surely is.</p>	Against Closure	Email - Scanned	11/17/2016	
426	b	Bruce	Randall		<p>The 40 ft. telescope that is a rather old instrument has trained many young people on how to use a scientific instrument. Its usage seems to run quite heavy as the SARA group is often competing with various high school and college groups for the use of this telescope. I believe this telescope has decades of use as an educational tool and along with the GBT should be a high priority. It is an important training tool for our future scientist and engineers.</p> <p>The other instruments on site need to be mothballed if funding cannot be found for them. In no case should an instrument be destroyed!</p> <p>The visitors center supplies needed science education to the American public. It seems many visitors happen onto the observatory while traveling through and then proceed to learn something about the science of the universe. They also have a good time while learning something.</p>	Against Closure	Email - Scanned	11/17/2016	
427		Fred	Giggenbach		<p>5 possible management scenarios: I choose option number 1.</p> <p>My public comment is for the Observatory to remain funded by the NSF as it has been in the past. It is a great asset to the local community and a leader in scientific advances.</p>	Against Closure	Email - Scanned	11/17/2016	
428		Joshua	Douty		<p>I would like to express my support for the NSF continuing to fund in whole or in part the GBT.</p> <p>The GBT is a shining beacon of science and technology in a state that is in desperate need. At the very least the NSF should continue to work with WVU and the WV state government to continue partial funding. I feel the science being performed at this site cannot be understated.</p>	Against Closure	Email - Scanned	11/17/2016	
429		Dave	Cohen		<p>A lot of good feedback here. I am giving a lecture to our Radio Astronomy club at a local high School, and will ask them to write a response as well. I am also planning my own response. I'm not sure if there will be an official SARA response, although there certainly should be. I would be happy to write one, as long as the officers are okay with that. I already crafted an official response to the FCC on behalf of SARA (on an unrelated topic). I guess it went okay.</p> <p>I'm at SARA's disposal on this one, I just need the "GO" command.</p>	General	Email - Scanned	11/17/2016	

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430	a	Don	Latham		<p>The Green Bank Telescope (GBT), is presently the largest fully steerable radio telescope in the world. It cost 96 million dollars to build and has been in operation for only 13 years, hence is in excellent condition. The staff has continuously improved and maintained the facility.</p> <p>The telescope and grounds should be kept alive for several reasons:</p> <ul style="list-style-type: none"> -as a working telescope for scientific use, -as a working telescope for amateur use. (Kitt peak and the 100 inch are optical telescopes that function well this way), and -as a resource for public education involvement, through on-line and in situ programs. <p>Destruction or mothballing this outstanding facility would simply be a disservice to the nation and to the scientific community.</p> <p>I think I am asking for a truly deliberate action in the case of the GBT rather than a fund-grabbing operation. Interesting that Areceibo is under consideration as well.</p>	Against Closure	Email - Scanned	11/17/2016	
430	b	Don	Latham		<p>Surely there is a way to accomplish these ends using cooperation between NSF and the citizens it serves. In particular, two of the alternatives listed in the EIS can certainly be combined, that is are not mutually exclusive: Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope Collaboration with interested parties for operation as a technology and education park.</p> <p>There are public groups ready to assist in operations with labor and funds.</p> <p>There is always the possibility for international cooperation, especially in the scientific community.</p>	Alternatives Consideration	Email - Scanned	11/17/2016	
431		John	Wickline		<p>I would ask that you please consider keeping the Greenbank telescope fully functional and working. Not only does it provide jobs for the region, but it serves as an inspiration for students across our state to dream big and reach for the stars. My son visited there as part of a field trip in the fourth grade, and he is now pursuing a science degree. I would hope there are countless others who visited there and are now studying ways to search the stars.</p> <p>These jobs are ones that cannot leave the United States for foreign lands. To teach our future astronomers, we need science teachers. We need engineers to design and build telescopes, biologists, geologists, etc. Space exploration and study once launched America to the forefront under Kennedy. We can do it again and do it even better because we now know the technology exists.</p>	Against Closure	Email - Scanned	11/17/2016	
432	a	Daniel	Keeney		<p>I ask that, beyond questions raised as to compliance with the intent and purpose of the public scoping process, you reconsider any thoughts to close the Green Bank Observatory, which is and has been of such importance to all.</p> <p>Beyond the direct benefit to science, the greater concern for society should be the inspiration of our children: Have considered the GBO's impact upon them? As to the unimaginable possibility that the National Science Foundation might actually erase this treasure from our world? The impact upon places of historical importance are obvious: Green Bank Observatory IS one, in and of itself.</p> <p>The NSF may choose to close Green Bank, or even dismantle it and perform site restoration, effectively erasing much more than a treasured monument of historical significance. After all ... it is still being useful and productive, even as I type today.</p>	Against Closure	Email - Scanned	11/17/2016	Save-Green-Bank-Observatory.pdf
432	b	Daniel	Keeney		<p>""The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identifying viable alternatives.""</p> <p>Insufficient time has been given for the public to even become aware that the NSF may close, or even dismantle, the GBO (i.e. the same reporter at the Charleston [WV] Gazette that covered the October 18 changes did not report of your October 19 filing until 10 days before these meetings were to take place). Please do see: http://slatyfork.us/Save-Green-Bank-Observatory (also attached .pdf copy of this page)</p> <p>On October 19, the National Science Foundation (NSF) filed notice in the Federal Register¹ that it was initiating the public scoping process² for a ""Draft Environmental Impact Statement"" regarding the Green Bank Observatory (GBO), as not reported until October 31 by the same reporter.</p> <p>Dr. Karen O'Neil, Director of GBO, explained this to be a ""standard part of the divestiture recommendation process,"" and ""...was not aware that [they] would need to go through this [process with the NSF]."" None of us were.</p>	General	Email - Scanned	11/17/2016	Save-Green-Bank-Observatory.pdf
433	a	Kelsi	Boyd		<p>I'm a young business owner in West Virginia. I recently left my job as a research analyst in order to start up my own "green" company. More so, I've been helping other young individuals engage in entrepreneurship to help bring diversity to our state. You see, being a woman in West Virginia isn't easy. There are a small group of individuals in my community that share the same beliefs and appreciation for science as I do. We are in desperate need of creative individuals with innovative ideas to help stimulate our economy. As much as we need to prove to ourselves that we are and can be a progressive society, we need others to acknowledge this, too. The GBT supports a forward way of thinking. For many, it provides jobs, but for the rest of us, it serves as a symbol and a reminder of how far we have come. I'm asking that you please not take this away from us, because we are already struggling.</p>	Against Closure	Email - Scanned	11/17/2016	

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433	b	Kelsi	Boyd		We need to encourage the state's youth to engage and participate in STEM fields. If you take this away, it will be another loss that will contribute to the region's overall sense of defeatism. Right now, we need to be inspired, and we need to direct our children towards a brighter future. The GBT can help us do that.	Against Closure	Email - Scanned	11/17/2016	
434		Brian	Kent	NRAO Scientific Staff	<p>As options are considered for "Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations", I wish to voice my experience with Green Bank, underscoring its importance with the forefront of scientific research and STEM initiatives.</p> <p>As a West Virginia native and WVU undergraduate I as given the opportunity to be an NSF Research Experiences for Undergraduates (REU) student in 2002 at Green Bank. Working with the scientific staff afforded me valuable and practical research experience that inspired me to become a professional scientist and astrophysicist. It started me on a path of technical knowledge and understanding that has served me well throughout my early career, becoming an NRAO scientist and using our nation's astronomical facilities, including the Green Bank Telescope.</p> <p>Green Bank is an state-of-the-art institution for cutting edge research and development and source of pride for the state of West Virginia and the United States. STEM development activities are critical to the nation's infrastructure, and students MUST be provided the opportunities (as I was) to engage with working scientists, engineers and software developers outside of the classroom. Green Bank provides these opportunities to students from middle school through higher education.</p> <p>The expertise and institutional knowledge provided by the hardworking and dedicated Green Bank staff have made a huge difference in my career. No group of people are more committed to the operation and mission of a scientific facility. I must recommend the option of "Continued NSF investment for science-focused operations (No-Action Alternative)" for the future of Green Bank.</p>	Against Closure	Email - Scanned	11/17/2016	
435	a	Richard	White	Vice President, ViGYAN, Inc	<p>I am a 66-year old aerospace engineer from the West Virginia University class of 1972. I can directly trace my interest in science, space, and engineering to Green Bank.</p> <p>There are three major issues regarding Green Bank's ongoing operation - science knowledge; effects on science, technology, engineering, and math (STEM); and economic impact on West Virginia. While not all three of equal priority to NSF, they should be considered in what would be a momentous decision.</p> <p>1. This is an exciting time in astronomy and cosmology. The controversial decision to close the telescope, based on a desire to "" maintain money in the grants program [Daniel Eisenstein]"" , would appear to be shortsighted in light of the fact that grants do depend on having advanced facilities with which to conduct research. Having the world's largest steerable radio telescope meets the criterion of an important national resource. It should also be mentioned that other countries (such as China) are rapidly building/using facilities that match or exceed ours. It would be shortsighted to mothball or destroy the GBT.</p>	Against Closure	Email - Scanned	11/17/2016	
435	b	Richard	White	Vice President, ViGYAN, Inc	<p>2. Back to my earlier personal encounter with Green Bank: as a high school junior, one of the highlights of my young life (mid 60s) was a personal tour of the 140-foot ""polar mounted"" telescope, courtesy of a neighbor and his friend, a senior staffer at the observatory. I still remember the excitement of seeing the observatory and the 140- foot telescope up close; this solidified my interest in science and led to my career as an engineer. The importance of such ""big science"" facilities and projects cannot be exaggerated as we strive to interest K-12 students to pursue STEM careers. Do we really want the attendees at the WV National Youth Science Camp to see the GBT being disassembled because we "can't afford it?"</p>	Against Closure	Email - Scanned	11/17/2016	
435	c	Richard	White	Vice President, ViGYAN, Inc	<p>3. Aside from the obvious and critical economic importance of the GBT to Pocahontas County and surrounding areas, the observatory and the GBT plays a critical part in supporting West Virginia as a place for other than coal mining. Regardless of your political affiliations, it is obvious that other economic opportunities must be made available to its citizens in the future; Green Bank offers an example and a magnet for future higher-tech economic growth for the state.</p> <p>My recommendation would be some blend of options 1 through 3. While operations as originally intended (option 1) would be preferable, in light of the current fiscal environment some compromises that would keep the GBT open and functioning are acceptable. The GBT is an invaluable national asset and it is vital that it be kept open to make the discoveries of the future.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
436		Paul	Vanden Bout	NRAO, retired	<p>I am writing to urge continued support by the National Science Foundation (NSF) of the Green Bank Observatory (GBO), specifically, the 100-meter Robert C. Byrd Green Bank Telescope (GBT), for astronomical research. The NSF is to be commended for its long, strong support of radio astronomy. NSF's founding of the National Radio Astronomy Observatory initiated the development of facilities that are envied around the world. NSF and NSF alone is responsible for this achievement. Among these facilities, is the GBT - the largest fully steerable telescope in the world, with an offset feed that minimizes source confusion by providing a clean beam, and an adjustable surface that operates efficiently to wavelengths as short as two millimeters. It's site in the National Radio Quiet Zone is also unique, offering excellent protection from radio interference. The GBT is far more capable today than the time of NSF's Portfolio Review (arXiv 1610:02328). This observing power was achieved at considerable expenditure of NSF funds and effort. I suggest that it is imprudent to abandon it prematurely, long before it is superseded by facilities yet to be built.</p> <p>In my opinion, the high-priority applications for which the GBT is particularly suited are:</p> <ul style="list-style-type: none"> · The study of pulsars, which informs fundamental questions in nuclear physics, and which is a potential means for detecting gravity waves; · Global Very long Baseline Interferometry, for which it is a large aperture anchor, essential at millimeter wavelengths to the Event Horizon Telescope; · Spectroscopy at all wavelengths, providing "zero-spacing" data complementary to the interferometric data of the Jansky Very large Array and AIMA. Details on research applications can be found in arXiv 1610:02328 and arXiv 1610>09014. <p>Of the five preliminary alternatives to be considered in refining the Environmental Impact Statement regarding the GBO, the first two alternatives allow for future use of the GBT in astronomical research. The first alternative is highly preferable in that it allows for the maximum use of the GBT for astronomical research. The second alternative might allow for limited research on the top priority applications, but only if very carefully managed, for example, by NSF supporting the total operations and "selling" telescope time for non-astronomical purposes to partially offset their costs through interagency transfers. (I note that radio telescopes managed by organizations whose prime mission is non-astronomical have had difficulty producing significant results in astronomy. The prime examples are the Haystack Observatory 37m Telescope and even more the Deep Space Network 70m telescopes.)</p> <p>In conclusion, I urge NSF to adopt the first alternative. It maximizes the scientific return and continues to provide an opportunity, especially for young people, to conduct research and publish results whether or not they have an NSF research grant or any other research support.</p>	Against Closure	Email - Scanned	11/17/2016	
437		Nils	Linz		<p>My name is Nils Linz and I'm a M. Sc. student at the Argelander-Institute for Astronomy in Bonn (Germany).</p> <p>I am writing in strong support of continued full science operations of the Green Bank Observatory. I would like to concur with the points raised in the support letter sent by Dr. Karim (from my department) on November 7 2016.</p> <p>Being in the early stages of my career, I would like to stress that my longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	
438		Brandon	Curnutte		<p>I am writing to express strong opposition to closing the Green Bank Observatory. This facility is keeping West Virginia and the United States on the forefront of discovery and closing the facility would be devastating to my home state, our great nation, and the scientific community as a whole. We would not only lose jobs, West Virginia would lose it's place among scientists and astronomers around the world. Please, do what you can to keep this facility going for the sake of our state and our nation.</p>	Against Closure	Email - Scanned	11/17/2016	
439	a	Sue	Helton	Pocahontas County Commission	<p>As you know, the National Science Foundation (NSF) is in the process of preparing an Environmental Impact Statement addressing the future of the Green Bank Observatory (GBO) located in northern Pocahontas County, West Virginia. The Pocahontas County Commission is writing this letter to urge the NSF review committee to consider retaining the existing operation of the facility. The role of the GBO is one of the components to the advancement of science, engineering and educational opportunities at the facility itself, as well as in the classrooms around the world. This Commission truly believes that educational opportunities and science research advancements offered by the GBO are deserving of future investment of this facility at the national level.</p> <p>It is the Commission's hope that the National Science Foundation will determine to continue to invest in science-focused operations at the facility (No-Action Alternative). By continuing the operation of the GBO, the National Science Foundation will assure science, engineering and educational opportunities well into the future.</p> <p>In closing the Commission wishes to express its full support for the ongoing research of science and education provided by this facility, and urges the National Science Foundation to continue to invest in the operations at the Green Bank Observatory.</p> <p>William S. Beard, Jr. President</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
439	b	Sue	Helton	Pocahontas County Commission	The Green Bank Observatory employs approximately 100 full-time employees (60% of whom are local residents) and significantly more employees during the summer. Its workforce contributes approximately 11 million dollars to our local economy. Additionally, the nearly 50,000 visitors/tourists to the facility each year have a great economic impact on all of Pocahontas County. The loss of this facility and the jobs it provides will have a catastrophic effect on our County as well. Suspension of operations in a manner such that operations could resume at a future date or deconstruction and site restoration will most certainly create adverse environmental impacts on our communities' abilities to survive.	Against Closure	Email - Scanned	11/17/2016	letter of support for green bank observatory 11-15-16 scan.docx
440	a	Rachel	Friesen	Dunlap Fellow Dunlap Institute for Astronomy and Astrophysics	<p>I am writing in response to the announcement of a public comment period for the planned environmental impact statement and proposed changes to Green Bank Observatory (GBO) operations. I am a Canadian citizen and am currently based at the University of Toronto in Canada, but was previously employed in the United States as a postdoctoral fellow and may return to the US in the near future.</p> <p>I have been a user of the Green Bank Telescope (GBT) throughout my career. As a graduate student in Canada, my PhD thesis depended strongly on analysis of GBT observational data. I benefited greatly from the hands-on nature of GBT operations, traveling to the GBO site multiple times - first for my own training, and later to train others. This type of telescope operation is quickly becoming more rare, but is incredibly beneficial to students. Students take ownership of their scientific research from data acquisition to published article, and gain a deeper understanding of the technology that enables their science. Because of this experience, GBT users may also go on to careers building instruments, either in astronomy or in private industry.</p> <p>These observations were, and still are, simply not possible with any other radio telescope. The GBT is the world's largest fully steerable radio telescope. It can thus view a larger fraction of the sky than larger, fixed radio telescopes like Arecibo. It is located in a protected, radio-quiet zone. Because of the GBT's active surface and large and varied instrumentation suite, its sensitivity and capabilities are unparalleled, even compared with similar-sized dishes like Effelsberg. At the shorter centimetre and millimetre wavelengths, NSF-supported instrumentation development has enabled the fast, sensitive mapping of large areas of the sky in just the past few years. The promise of these new receivers and spectrometer, unavailable during previous evaluations of the GBT, has not yet been fully realized. Furthermore, at these wavelengths the GBT is a critical complement to the Atacama Large Millimeter/submillimeter Array (ALMA). The GBT is able to detect the large-scale structures that remain invisible to the interferometer, providing needed context to ALMA's exquisite high-resolution results. More generally, the GBT and the Jansky Very Large Array (VLA) share the same synergy. There is no other telescope that can provide the same complementarity to either ALMA or the Jansky VLA.</p> <p>The GBT is a very young telescope, and was completed only sixteen years ago. It has enabled many new discoveries about our universe, on topics as varied as the fundamental physics of the Universe to the formation of our own solar system. I am confident that the GBT will be instrumental in many more if open science time continues to be made available. Without NSF support at previous levels, the search for alternate funding has already decreased the amount of telescope time available to researchers. Overall, the GBT is in danger, due to the lack of available long-term funding sources other than the NSF. I request strongly that the NSF reconsider maintaining support of this unique, scientifically-important facility.</p>	Against Closure	Email - Scanned	11/17/2016	GBTletter.pdf
440	b	Rachel	Friesen	Dunlap Fellow Dunlap Institute for Astronomy and Astrophysics	<p>As a postdoctoral fellow in the USA and now in Canada, I have continued to utilize the GBT to advance my scientific goals. To date, postdoctoral fellows such as myself have been able to compete for significant amounts of GBT observing time to address key questions in astronomy. Right now, I am the Primary Investigator of one such Large Program, leading a team of approximately two dozen Canadian, American, and international collaborators, including multiple undergraduate and graduate students. I am currently searching for a permanent position as a University faculty member or research scientist at an observatory. If I am successful, it will be in no small part due to my ability to lead such a project. The cut in National Science Foundation (NSF) funding to the GBT is already impacting significantly the amount of time that is allocated to 'open-skies' science, making this kind of opportunity for early career researchers, like myself, significantly more rare.</p> <p>Astronomy makes people excited about science. The GBO has led an impressive program of Science, Technology, Engineering and Mathematics (STEM) education to the general public, and students of all ages. The GBO's efforts to bring STEM outreach to underrepresented minorities and women are wonderfully successful and sorely needed. The GBT dominates the GBO site, and is thus a cornerstone for the GBO's excellent public education programs that attract thousands of people each year.</p>	Against Closure	Email - Scanned	11/17/2016	GBTletter.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
441		Chelsea	Walker	Events & Group Coordinator	<p>I ask that you continue to support the GBO through options #1) continued NSF investment for science- focused operations (No-Action Alternative) or option #2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope. Options #3) mothballing of facilities, #4) deconstruction and site restoration and #5) collaboration with interested parties for operations as a technology and education park, are unacceptable and would negatively affect not only the community, but the various industries that the GBO impacts annually.</p> <p>Here at the Pocahontas County Convention and Visitors Bureau, we are committed to framing Pocahontas County as an ideal tourist destination for families both looking for exciting outdoor adventures and unique, one-of-a-kind experiences. For years, the Green Bank Observatory has remained one of the most popular and sought after attractions our great county has to offer. While the predominant purpose of the Green Bank Observatory is not tourism, the Green Bank Observatory hosts over 50,000 visitors each year who spend roughly 7.5 million dollars annually. In a county where the population is sparse, with only 8,719 residents, the revenue that the Green Bank Observatory contributes to the community is exponential.</p> <p>In a rural area, we are limited on what we can market to the average tourist. We are lacking in conveniences such as shopping, cell phone service and large highways. Destinations such as the Green Bank Observatory, the Cass Scenic Railroad and Snowshoe Mountain Resort appeal to many visitors, both nationally and internationally. Removing one of these attractions, especially one as popular as the Green Bank Observatory would staggeringly impact the tourism industry in our county. As an industry that contributes over \$100,000,000 to the economy, negative impacts such as mothballing tourist attractions such as the Green Bank Observatory cannot happen.</p> <p>At the Pocahontas County Convention and Visitors Bureau, we strongly urge the National Science Foundation to support alternative actions #1 or #2. The proposed implementations #3, #4 and #5 would ergo detrimental affects to the tourism industry, businesses and even local schools here in Pocahontas County. Not only would these proposed changes affect socioeconomics, they would harm health, safety, education and cultural aspects of our community as well.</p> <p>The Pocahontas County Convention and Visitors Bureau asks that National Science Foundation continues to support the Green Bank Observatory through funding. The benefits that an entity such as the Green Bank Observatory brings to not only Pocahontas County, but the state of West Virginia is tremendous. The Green Bank Observatory hosts thousands of visitors annually, and provides families in our local community with comfortable and sound careers. I strongly urge the National Science Foundation to take into consideration all of the wonderful advantages that arise from funding a special site such as the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	GBOletterofSupport.pdf
442		Mark	Riggs	Associate Professor Astronomy, Mathematics, Physics, and Statistics Ashland Community and Technical College	<p>As a community college faculty member in a neighboring state I strongly support the first option:</p> <p>Continued NSF investment for science-focused operations (No- Action Alternative)</p> <p>The Green Bank facility has provided many profession developmental through hosting the Society of Amateur Radio Astronomy (SARA) conferences and University of Dayton classes. The facility is also important in this area for hosting the Star Quest optical star party.</p>	Against Closure	Email - Scanned	11/17/2016	
443		Benjamin	Magnelli	Argelander-Institut fur Astronomie, Universitat Bonn EU AIMA Regional Centre (German Node)	<p>I am writing in strong support for ongoing regular, ideally internationally open-sky science operations at the Green Bank Observatory (GBO). The Green Bank Observatory constitutes an important cornerstone for my scientific strategies and those of my broader scientific community. In particular, next generation instruments like the MUSTANG-2 bolometer array, offer unprecedented survey capabilities when used in combination with this large dish.</p>	Against Closure	Email - Scanned	11/17/2016	
444		Dwayne	Shiebel		<p>I was sorry to read that the NSF would even consider to destroy the GBT. It is such a good antenna there has to be many uses for it. It would be best if the NSF would do the first option, no-action alternative. The next best would be the second option. All other options would end the GBO as we know it today.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
445		Anton	Zensus	Direktor - Max-Planck-Institut für Radioastronomie	<p>Herewith we suggest the continuation of GBO operations and we provide a justification based on its importance for mm-VLBI science. The use of the GBO in Very Long Baseline Interferometry at .millimeter wavelength (mmVLBI) is essential for high-fidelity imaging of the vicinity of black holes (BHs) and for studies of the origin of extragalactic radio jets. In VLBI the technique of earth rotation aperture synthesis is used. This requires that participating telescopes continuously observe the target source tracking on time scales of 6-12 hrs for a given VLBI experiment. Global VLBI at 3mm wavelengths provides highest angular resolution (down to 50 microarcseconds) in a spectral domain where synchrotron-self absorption becomes smaller. Therefore mm-VLBI can map compact radio sources and the jet formation in Active Galactic Nuclei (AGN) with unsurpassed spatial resolution. Spatial scales of 5 gravitational radii are reached in the case of SgrA* and M87. This allows us to probe regions in the ultimate vicinity of the nearest extragalactic Black Holes. In more distant AGN, the broad line region (BLR) is reached. The mm-VLBI imaging of the BLR facilitates a better understanding of the high- and very-high energy gamma-ray emission in AGN. At present 3 mm VLBI is performed either with the Long Baseline Observatory (LBO, former Very Long Baseline Array, VLBA) or more globally with the GMVA (Global Millimeter VLBI Array). The later combines the European telescopes with the LBO, the GBO and ALMA. Similarly to the LBO and ALMA, the GMVA is operated under open skies policy and relying on the contributions of the participating observatories. In order to operate ALMA as a 'single' VLBI telescope, the VLBI phasing capability was recently added in a large international effort (so called APP =Alma Phasing Project). The implementation of the VLBI phasing for ALMA since cycle 4 is motivated not only by adding ALMA to the mm-VLBI networks, but also by the need to further improve the sensitivity. In an interferometer optimum sensitivity can only be achieved, if the collecting area on both sides of the interferometer arm is increased. Without the large collecting area of the GBO, the investment into the VLBI phasing capabilities of ALMA would not be as beneficial as original intended and proposed. 3 mm VLBI observations are also important to complement 1mm VLBI imaging with the EHT (Event Horizon Telescope), which consists of a smaller number of telescopes and consequently will deliver VLBI images of lower fidelity than achievable by the GMVA. The combination of the VLBI maps provided by the two arrays allows to determine the spectral shape and Faraday rotation (between 3 mm and 1 mm) of the ultra-compact emission regions near the BH. In particular, polarimetry and Faraday rotation analysis will depend critically from the array sensitivity, and ultimately from the availability of the GBO. The Faraday rotation analysis will determine the particle composition (leptons vs. protons) and the magnetic field strength near the event horizon and in the jet-launching region of super-massive BHs. The future and continued participation of the GBO in 3 mm VLBI therefore is not only important due to its substantial sensitivity enhancement, but also in combination with observations of ALMA and the Event Horizon Telescope (EHT), which observes at 1 mm wavelength. In the past, the GBO has been an important partner for VLBI with different arrays, such as the Global Array (cm-VLBI), the HSA and the GMVA. At 3mm wavelength, only 8 out of the 10 LBO telescopes are equipped with 3mm receivers. Since at 3mm wavelength the sensitivity requirements are higher than at the longer wavelengths, the GBO has a particularly strong impact. It compensates for the loss of 2 LBO stations, it adds missing uv-coverage and sensitivity. The combination of the GBO with the LBO at 3 mm not only adds a VLBI station in the North-East (Hancock has no 3mm receiver), but it lowers the baseline detection limit by a factor of 5-6 over that of the standalone LBO. In combination with the sensitive European telescopes (IRAM, Effelsberg), the GBO even pushes the detection threshold down to 30 mJy, which is a factor of 3-5 better than on corresponding IRAM-LBO baselines. In combination with ALMA, the LBO offers initial fringe detection on the 30 mJy level, while the addition of the GBO yields 8 mJy, a factor of 4 better. VLBI imaging heavily depends on the closure phases and their accurate measurement with high enough SNR. The so-called global fringe fitting (GFF) algorithm is used to recover the station based visibility phase using a least-square fit approach on the combination of the baseline solutions over all possible station triangles. The success of the GFF depends on the sensitivity of the reference station, a role usually taken by the GBO. It allows to recover weak interferometry signals to a remote station, e.g. on any triangle between Hawaii, one continental LBO station and the GBO.</p> <p>We further note recent successful 3 mm VLBI experiments, in which the GBO, the Large Millimeter Telescope (LMT) and the VLBA (now LBO) observed for the first time non-zero closure phases for SgrA* (the BH in the center of our Galaxy). The addition of the GBO in such triangles lowers the phase noise by about a factor of 2. Another factor of 2 will be gained, when the GBT, the LMT and ALMA are combined in the near future.</p> <p>In summary, we note that the GBO is a critical element in 3 mm VLBI, whose loss would not only substantially limit present and future research on BHs, but also affect the efficient use of ALMA in mm-VLBI. Furthermore, high fidelity 3 mm VLBI with a better uv-coverage, may be essential to understand and interpret the expected results at 1.3 mm from the EHT. Since (for logistical reasons) global 3mm VLBI is performed less often than VLBI at longer wavelengths, the observing time demand for global 3mm VLBI with the GBO would be comparatively low (approx. < 170 hrs/yr). We therefore ask not to discontinue the use of the GBO in combination with the GMVA.</p>	Against Closure	Email - Scanned	11/17/2016	N/A
446		Tom	Hagen	Vice President, Society of Amateur Radio Astronomers	<p>My name is Tom Hagen and I'm Vice President of the Society of Amateur Radio Astronomers. SARA has been holding its annual conference at GBO since the 1980's and we would certainly be disappointed if GBO were no longer available for our meetings. We have had a wonderful relationship with the staff over the years and we consider access to this venue to be a great inducement for members to join SARA.</p> <p>I personally have many fond memories of GBO since I joined SARA in 2010. The opportunity to use the 40 foot telescope is truly outstanding as are the tours up to the top of the GBT. I have noticed that there is a lot of traffic to the visitor center and that the public really appreciates the opportunity to learn about radio astronomy too.</p> <p>GBO is most decidedly valuable as an educational and technological facility and it would be a shame for our country to lose this fabulous and historic place.</p>	Against Closure	Email - Scanned	11/17/2016	
447	a	Terry and Dodi	Shore		<p>We do not need to remind you of the cultural and historical significance of the Green Bank Observatory. That heritage is well established and forever will be a part of the scientific community's group memory. And while we understand that the reasons for soliciting public input on the fate of the observatory are budgetary and concern the ability of the NSF to adequately fund future science, that history must be a consideration in any determination of the value of Green Bank.</p>	Against Closure	Email - Scanned	11/16/2016	
447	b	Terry and Dodi	Shore		<p>We do hope to remind you, however, of the present significance of the facility. The Robert C. Byrd Green Bank Telescope, brought online just sixteen years ago, is just as vital to astronomical discovery today as it was when it heard its first pulsar. Its sensitivity, scalability, and versatility are unmatched in the world, and astronomers continually compete for research time on the GBT. In support of that instrument, the observatory has developed world-class engineering and operations teams, known for innovative solutions and quality craftsmanship. Then there is the unique, protected location of the campus itself. Few places on earth can compete with the NRQZ, allowing virtually unmatched clarity for radio wavelength research.</p> <p>In the New Worlds, New Horizons decadal survey, much has been made of the need to safeguard funding for new research at new facilities. We would hope that instead of relegating the Green Bank Observatory to its well-deserved place in history, you would see it as a perfect location for that new research. If new facilities are needed, construct them here! If cutting edge instruments are planned, build them here! If new ideas need development, nurture them here! Use this place. Work this place. Allow Green Bank to continue to lead and innovate the way it has for more than half a century. The foundation for the future is already laid in Green Bank. You just need to build upon it.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
447	c	Terry and Dodi	Shore		No discussion of the Green Bank Observatory can be had without consideration of its impact on the scientific mind of the public. To our knowledge, the outreach and educational achievements of the organization are unmatched anywhere. Students from grade school through university enjoy eye-opening exposure to science and the opportunity to engage in real discovery – in many cases cementing their futures in the field of astronomy. Untold future PhDs have felt their scientific curiosity quicken here, setting them on a path of discovery they otherwise would not have known was possible.	Against Closure	Email - Scanned	11/16/2016	
448		Douglas	Cook		<p>I am writing to voice my opinion in favor of continued NSF investment for science-focused operations (No- Action Alternative) for the Green Bank Observatory in West Virginia.</p> <p>Some of the reasons include:</p> <ul style="list-style-type: none"> - GBT is the world's largest steerable radio telescope - location, location, location- West Virginia is within 500 miles of more than half of the U.S. population (wvcommerce.org) including reasonable driving distance to Washington D.C. - Being close to population centers yet in a remote area is ideal in an age of increased vulnerability of infrastructure assets - Desperately needed economic anchor in an economically disadvantaged area (Appalachian Regional Commission data) - Too much invested in infrastructure to throw it all away <p>Infrastructure spending was frequently mentioned in the recent Presidential campaign, including maintaining existing infrastructure. I feel confident that creative ways of funding the continued operation of the Green Bank Observatory can be secured to avoid the tragic loss of this most valuable research center.</p>	Against Closure	Email - Scanned	11/16/2016	
449		Catherine	Lally	Jet Propulsion Laboratory Earth Science and Technology Directorate Sentinel-6 SWOT Jet Propulsion Laboratory	<p>My name is Cathy Lally and I am a native West Virginian currently working at the Jet Propulsion Laboratory in Pasadena, California. During my previous work experience at the NASA West Virginia Space Grant Consortium, I became very familiar with the Green Bank Observatory and had the opportunity to spend a weekend there during a board of director's meeting in 2012 (see attached photo).</p> <p>Recently, I became aware that the National Science Foundation will be evaluating the environmental impact of the GBO which will result in operational changes at the facility. Obviously, I am concerned about the "deconstruction and site restoration" option and here is why:</p> <ol style="list-style-type: none"> 1. The Observatory is crucial for maintaining STEM (Science, Technology, Engineering, Mathematics) outreach and opportunities in the state of West Virginia. 2. The Green Bank Telescope is a historical landmark. 3. The Observatory is a source of pride for the state of West Virginia. <p>The people of West Virginia are in dire need of support from the science community. Organizations like the NASA WV Space Grant have spent countless hours on cultivating STEM opportunities for children and adults in our state. To consider deconstruction of a facility that significantly aids in that effort would be a devastating blow to the state. The sense of pride that is associated with the GBO, as well as the historical importance, is undeniable and so obvious that it does not require explanation.</p> <p>I understand that operational changes at the facility are inevitable. However, I implore the NSF to not pursue the route of deconstruction.</p> <p>Thank you for your time and consideration regarding this matter.</p>	Against Closure	Email - Scanned	11/16/2016	GBO.jpg
450		Jamie	Cutlip	Concerned citizen	<p>I support the options that keep GBO operational as it is an important and unique asset to our great state.</p> <p>Please do not consider "mothballing" or deconstructing GBO. Many people and businesses can benefit from GBO remaining operational, and the amount of knowledge that could continue to be obtained from GBO studies is invaluable.</p> <p>Thank you for your time and consideration in saving GBO!</p>	Against Closure	Email - Scanned	11/16/2016	
451		Leslie	McLaughlin	Resident	<p>I am writing this email expressing my concern regarding the funding & support from the NSF for the Green Bank Observatory. It would be such a shame to see such a wonderful facility defunded and possibly shut down. This facility has served many over the years. The shutting down of this facility would be devastating to the community of Green Bank as well as Pocahontas County as a whole. It would create a ripple effect not only for the many people and families who would lose employment but also income for the surrounding businesses and funding for the schools. This facility and site are unique in nature. Why would an organization/foundation put money into a facility and then scrap it. Where is the common sense in this? Please do not defund the GBO but let it continue to allow it to serve the community, our state, our country and the world.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
452		Michael	Busch	Research Scientist, SETI	<p>My name is Michael Busch. I am a planetary astronomer currently based at the SETI Institute, where I study near- Earth asteroids using radar and radio techniques. As part of this work, I have been a user of the GBT for the past 8+ years. I would like to emphasize the importance of continued science-focused operations at the Green Bank Observatory for asteroid science and for addressing the asteroid impact hazard. Radar observations have provided the best available information on the trajectories, shapes, and spin states for hundreds of near-Earth asteroids. Radar transmissions from the Arecibo Observatory in Puerto Rico and the Goldstone Deep Space Network site in southern California can provide images of asteroids in radar time delay and Doppler echo frequency with spatial resolution as fine as 7.5 m and 3.75 m respectively.</p> <p>However, for some potentially-hazardous asteroids, single-station monostatic radar observations with Arecibo or with Goldstone are either not possible or not desirable. For objects passing within 1-2 lunar distances of Earth, the round-trip travel time of the radar signal is less than the time required to switch from radar transmit to radar receive at Arecibo or Goldstone. Such radar targets, which always are classed as potentially hazardous because their orbits will bring them near to Earth's orbit again in the future, can only be observed in a bistatic configuration with one antenna transmitting continuously and a second antenna receiving continuously. The GBT has been crucial as the most sensitive telescope available for bistatic radar receive observations of many asteroids. One example is the 80-m-long potentially-hazardous asteroid 2015 HM10, which was observed with Goldstone transmit and GBT receive in July 2015: https://public.nrao.edu/news/pressreleases/radar-2015-hm10 . Following the radar observations of HM10, we are now able to rule out any possibility of Earth impact by it until at least 2427.</p> <p>Bistatic radar observations have an additional advantage over monostatic observations: monostatic delay-Doppler radar images are limited in frequency resolution to one over the round-trip-travel time to the asteroid, while bistatic radar observations are limited in frequency resolution only by rotational blurring as a radar target spins. For a number of small or slow-spinning asteroids, bistatic observations with GBT receive have provided detailed geologic information when monostatic observations would only have provided a one-dimensional measurement of the asteroid's extent along the radar line-of-sight.</p> <p>The information provided by bistatic radar observations between Arecibo or Goldstone and GBT is crucial for understanding the shapes, trajectories, and spin states of individual potentially hazardous asteroids. It also is important to understanding the overall properties of the near-Earth asteroid population, with implications for models of the early solar system and of the history of the asteroid belt over the past 4.5 billion years as well as for upcoming tests of asteroid-deflection technologies (the ARM and AIDA projects). The number of known near-Earth asteroids is increasing rapidly, with more than 15,000 objects now catalogued. There is a corresponding increased need for follow-up radar observations of potentially hazardous asteroids.</p>	Against Closure	Email - Scanned	11/16/2016	
453		Erica	L.		<p>From a high school student:</p> <p>The only time I have visited the Green Bank Observatory was in elementary school, but it was still something that sticks with me. The observatory is not only important for research, but education as well. Destruction of the Green Bank Observatory would be detrimental to the younger generations of West Virginia and the entire country.</p>	Against Closure	Email - Scanned	11/16/2016	
454		Michael	O'Brien	Director, Pocahontas County Homeland Security & Emergency Management E-911	<p>I am writing this email to express my concerns of the potential shut down of the Green Bank Observatory. Since its conception in the 60s the Observatory has been a great asset to the Community and Pocahontas County. It serves a Shelter for disasters (Red Cross Certified). This facility has the infrastructure to provide such a shelter with its staffing, generators and standalone city water system. We have used this facility in the past for many disasters and it always goes flawless. Some of the things we have used the facility for in the past is a place for the disabled to plug in their oxygen concentrators or a place to house incoming power company works to restore power during a major power outage. It has served as a command center during major events most rememberable being the February 2010 Navy helicopter crash on Cheat Mtn. This facility is the only source for a pressurized fire hydrant for nearly 8 miles (saving the local residents money on their home owners insurance). The air strip serves as a secure landing zone for medical flights. Having a secure landing zone has saved hundreds of lives including my own in 2011. The facility serves as first class training center for Emergency services.</p> <p>The radio interference team is second to none they have assisted 911 on numerous occasions with finding interference causes to the 911 radio system. Many people would think having the observatory within our county would be a hindrance to radio communications for emergency services. I would be lying if I said it didn't create some challenges but the personnel in the interference department always has the attitude of let's see what we can to make this work rather than simply saying no. A shut down of this facility would be catastrophic to Pocahontas County. I plead with you to find funding options to keep the facility open.</p>	Against Closure	Email - Scanned	11/16/2016	
455		Michael	Haid	Executive Director, WV Society of Professional Engineers	<p>let the record reflect that the WV Society of Professional Engineers supports the Green Bank Observatory and is hopeful that the powers that be keep the facility operational and productive.</p> <p>This facility is a tremendous asset for so many in the region, especially the nearby National Youth Science Camp.</p> <p>The region is identified with this amazing structure and it has become a legendary landmark in the community. To take it offline would be a travesty.</p> <p>Thank you for consideration and for adding this comment to the public record.</p>	Against Closure	Email - Scanned	11/16/2016	
456		Matthew	Okasinski		<p>I toured the Green Bank Observatory as a delegate of the National Youth Science Camp in 1986. Those were the days before smartphones and Wifi were pervasive throughout our communities. Having a radio telescope facilities within the National Radio Free Zone fosters astronomical research that can't be completed elsewhere within the country. NSF should continue funding research at the GBO.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
457		Linda	Kerr		<p>I was privileged to be a part of an NSF grant - Investigating the Universe- while I was a junior high/ middle school teacher in Warwood, WV during the 90s. I can tell you that experience changed my life and the way in which I taught my science classes throughout the rest of my teaching career.</p> <p>Thankfully, Dr. Patricia Obenauf had the foresight and knowledge to write a grant to utilize the 40 foot telescope so teachers could get an idea of what true science / astronomy entails. My students were the beneficiaries of problem-based learning, collaborative approach, failure, success, exhaustive research, contact with actual working astronomers and authors of astronomy books. My experience at Green Bank translated into every area of science I taught. My certifications include biology, earth, physical science and home economics. Because of my experience, I was one of twenty-four teachers selected statewide to teach these science hands-on methods to hundreds of others throughout our state. The ramifications of continuing teacher training at Green Bank are far reaching and should be given grave consideration concerning the state of science and math education in our country.</p> <p>Please give all aspects of utilizing The Green Bank Observatory your deepest consideration. We are on the verge of making America great again. Please be a part of that process!</p>	Against Closure	Email - Scanned	11/16/2016	
458	a	George	Seielstad		<p>The GBT's uniqueness includes: (1) coverage of the full sky above the horizon (85 percent of the celestial sphere); (2) largest collecting area, providing the greatest sensitivity over that entire available portion of sky; (3) unmatched frequency range, 0.2-115 GHz, for a telescope in the world-class category; (4) location in the National Radio Quiet Zone; (5) a history of leadership in electronics development and installation, in particular low-noise receivers, spectrometers, and time-sampling devices; (6) open access to scientists from a variety of disciplines, institutions, and nations.</p> <p>A major advantage of all filled-aperture telescopes is their versatility. Because they have a single focal plane, changes in response to new scientific developments can be installed quickly and less expensively than on multiple-element arrays. This versatility maximizes flexibility for research avenues yet to be recognized, which is perhaps the most important investment a forward-looking NSF can make. The general-purpose GBT is poised to respond to the future discoveries that radio astronomy's past has provided in abundance.</p> <p>Multiple-element arrays are vital to radio astronomical research, but the spectrum of research they conduct relies heavily on information gained from single-dish research. Surveys over large regions of sky, or over the frequency spectrum, or in the time domain are essential to providing the targets for which arrays can explore the details. In addition, low-brightness, extended emission regions are heavily resolved by arrays and best studied by single dishes. Array measurements of many such diffuse regions rely for completeness on the so-called zero-spacing (i.e., single-dish) measurement. The Green Bank Telescope fulfills another vital contribution to arrays by being the most sensitive element in international very long baseline arrays. These continue to probe the frontier of science at the extremes of gravity, today's most exciting research area.</p>	Against Closure	Email - Scanned	11/16/2016	Green Bank Telescope.docx
458	b	George	Seielstad		<p>Lockman et al. (arXiv:1610.02329v1) and Bally et al. (arXiv:161009014v2) have made compelling cases for the science that can be conducted with the GBT. Most notable is that the science spans the disciplines of physics, chemistry, and, of course, astronomy. In addition, forefront engineering is involved. The astronomical community alone therefore may not be inclusive enough to weigh the GBT's value. A particularly relevant example is the new field of observational gravitational wave astronomy. The scientific world is at the dawn of a new tool for exploring the universe and the fundamental laws that guide it. The remarkable discoveries by the Laser Interferometer Gravitational-Wave Observatory (LIGO Scientific and Virgo Collaborations, Phys. Rev. Lett. 116, 061102 (2016)) need now to be augmented by detecting waves at periods to which LIGO and forthcoming space observatories are not sensitive. Pulsar timing is the best known way to explore periods of years. Removing the GBT from international pulsar-timing arrays would not only be a serious blow to a scientific field at its inception, but not understandable either.</p>	Against Closure	Email - Scanned	11/16/2016	
458	c	George	Seielstad		<p>Among the resource areas the NSF has identified in its public scoping process for potential impacts are cultural resources. Having lived nine years in Green Bank, West Virginia, I can testify that the observatory there, and now specifically the GBT, have enormous cultural significance to the state and region. The GBT is a source of pride to many West Virginians. It is the iconic image of big science in the state. For the National Science Foundation to eliminate its support adds to a narrative of the federal government ignoring WV's residents, if not belittling them. Damage to education would be especially pronounced. The observatory in Green Bank has been open to students at all levels, significantly as a place where they can experience the true practice of science as opposed to reading or hearing about how it is done. The observatory has also been a major museum and tour site for the general public. For the NSF to consider abandoning its support for the science severely undercuts the educational experience, signaling it will no longer be as inspirational as it has been for generations of West Virginia students. The Foundation risks declaring a state and region too scientifically impoverished to deserve support.</p>	Against Closure	Email - Scanned	11/16/2016	
459		Kurtis	Brown		<p>I have become aware that the National Science Foundation is considering the future funding of the Green Bank National Radio Astronomy Observatory. Whether to continue its full operation, or to reduce or entirely eliminate the facility. I understand recent Observatory funding has been reduced 60%, and that FY 2017-2018 funding may be reduced by another 30%.</p> <p>I strongly encourage you to continue fully funding the Observatory operation and to continue its vitally important science missions to explore space and discover as yet unknown universes.</p> <p>The Radio Astronomy Observatory in Pocahontas County is not only a source of pride to all West Virginians, but also a major asset to the greater science community.</p> <p>Please give consideration to my concerns and those of many others. Thank you.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
460		Robin	Sizemore		<p>This letter is to express support for the Green Bank Observatory (GBO). In fact, I urge funding at the highest possible level.</p> <p>As a teacher, I attended professional developments at the Green Bank Observatory, and the experiences picked up where my college courses left off. The facilities, educators, and scientists at Green Bank provided information and opportunities to educators from around the country. The content and pedagogy which was included in the programs enabled each of us to return to our classrooms with a better understanding of Earth and Space Science. And the first hand experiences and details about the Green Bank Observatory, the GBT, and science phenomena gave us credibility and impressed our students- not an easy thing today when educators compete with so many other distractions.</p> <p>My students visited Green Bank for an overnight field trip. They spent time in the Education Center and were taught to use the Forty-foot telescope. Over the course of the night, teams of students traveled to the telescope to collect data. In the morning, Education Director Sue Ann Heatherly guided the students through an analysis of their data. Some of my students later described the event as the best field trip they had ever been on.</p> <p>More recently, Green Bank has been the setting for the ESS Passport, an MSP funded, professional learning opportunity which assists West Virginia educators in understanding and implementing the new Earth and Space Science standards. Participants have spoken highly of the experience. During the West Virginia Science Teachers Association Conference last month, the participants presented a Share-a-Thon session. Many great ideas were described to and demonstrated for the other educators.</p> <p>I have mentioned just a few of the many services and opportunities which have been provided at the Green Bank Observatory over the years. It is necessary to provide such opportunities for educators and students if we are to instill a love and pursuit of science and STEM careers. And that is necessary to address our local, state, and national economic, environmental, and defense needs.</p> <p>Please keep these in mind as you make decisions about funding the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/16/2016	
461	a	Kathryn	White		<p>When the first mention of the divestment of the Green Bank Observatory occurred, the citizens of Pocahontas County and West Virginia as a whole were unsure of its implications. As the plan has moved forward and realization has set in many are appalled by the inconceivable lack of foresight involved in this decision. I wish to say I fully support option one.</p> <p>I could write to you about the importance of Green Bank Observatory from many perspectives: spouse of a GBO engineer, mother of two (who have worked at, researched and received scholarship support from this site), or as a science educator at the local high school. Instead I only wish to discuss some perspective and ask a question. When you tell people you are a West Virginia native the public perception does not immediately think of adjectives like highly educated or science oriented. That is the stereotype. From my own background which includes generations of coalminers, my family has produced doctors, nurses, biologists, engineers, and computer technology specialists. Stem fields are the hope of many who come from this tremendous natural laboratory called West Virginia.</p> <p>When my husband and I attend family functions here in West Virginia inevitably my brother-in-law who is a doctor wants to know "What is it exactly you do? What are my tax dollars paying for?" My husband is patient and instead of taking offense, he replies "We do science." As he explains the significance of the work at Green Bank he does more than offer a standard uninspiring explanation. It is then that his fervor for the scientific endeavors of Green Bank help engage and educate others about the amazing work done in this small rural setting.</p> <p>The first time I met my future mother and father-in law, residents of North Carolina, they remarked on how living in Green Bank was like living at the end of the earth. I didn't take offense to this. For when you walk out into the dark of the night and look up, what is revealed is the cosmos in all her glory, how can one disagree? What individual can look at the skies and not wonder about its origins and its secrets. Standing outside, the hum of the Green Bank telescope providing night "music" for viewing the stars, I think back to that comment and I know that my in-laws were so wrong. Green Bank is not the end of the earth but the entrance to our universe and the Green Bank Telescope the tool for unlocking its secrets. The Green Bank Observatory is vital for bridging the gap between the scientific exploration and the perceptions of the public.</p>	Against Closure	Email - Scanned	11/16/2016	
461	b	Kathryn	White		<p>Finally, I come to my question, if an agency is charged with "advancing science and engineering (S&E) in the United States across a broad and expanding frontier, " Why would it ever consider removing a facility that is doing that very objective? The Green Bank Observatory is not IBM or Apple where it seeks to place the next new gadget into the hands of the public or one of the big pharmaceutical companies where development of a new drug will rake in millions for their investors. This facility provides information and research opportunities that are available for all mankind. Is this not the very reason the National Science Foundation was created? So, why would an organization that is charged with protecting, advancing and encouraging science on new frontiers seek to walk away from an instrument and facility that embodies its own mission statement? Perhaps it's time this agency took a page from the book of medicine and "first do no harm." For these reasons, I strongly ask that you select option one. Thank You.</p>	General	Email - Scanned	11/16/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
462		Dwayne	Cochran		<p>I grew up on the high planes of west Texas, son of a WW II veteran who came home and did the best he could to provide for his family. I once asked Dad if we were poor and he told me no, we just didn't have any money. By the eighth grade, he told me I needed to have a dream, and he encouraged all of us to go to college, an opportunity which slipped away from him with the outbreak of the war. By the time I was going into high school I was interested in science and some of us guys decided to pile into a friend's truck and go see the McDonald Observatory. I will never forget how the astronomers there made us feel welcome and asked what we wanted to see. I wanted to see the canals on Mars. They brought me up, helped me adjust the settings and let me search. After several minutes of fruitless searching they told me that the man who wrote about the canals had used the same magnification and that Jules Verne's intent was to fuel the imagination about the possibilities of space exploration. That day made such an impression, that I went on to major in plasma physics at Texas Tech University.</p> <p>In my final years, I find myself living in the great state of West Virginia. The people here have been kind and caring. But I do see a real lack of critical, empirical thinking skills necessary to pursue careers in engineering, technology, or any other scientifically based 21st century profession. The chemical plants which used to line the Kanawha River, which provide an endless supply of scientifically trained mentors, have disappeared. The political thinking here has retreated to a longing for the past with fear and suspicion of the future. The Greenbank Observatory is a world class diamond in a stable of other worthy gems. I realize that funding cuts have to come from somewhere, but in a small state like West Virginia, there is no other scientific asset which could fill the void produced by its loss. I understand that the most recent research calls into question the validity of the premise upon which the closure would be based. So, as you must then necessarily review your determination, I would ask you, in addition to continuing the tradition of outstanding discovery, to think about the impact of snuffing out the one beacon of inspiration for countless children of the Appalachian Mountains as they search for their dreams. The future of science cannot be uncoupled from producing future scientists, or at least a scientifically literate electorate. I cannot think of another part of the country where the NSF could achieve a bigger bang for the buck.</p>	Against Closure	Email - Scanned	11/16/2016	
463		Gabriel	Norris	Virginia Class of 2020 Aerospace Engineering & Astronomy-Physics	<p>I am writing this to express my deep concern at the possibility that the Green Bank Observatory might lose funding. Beyond its sentimental value for me personally, I feel that there is still quite a lot of science that Green Bank is uniquely capable of doing. As the largest, steerable radio telescope in the world, as well as being nearly as far from human-generated RFI as possible, the GBT is immensely valuable in all fields of radio astronomy, including the search for signals from intelligent extraterrestrial life and studying the composition of nebulae.</p> <p>There is yet immense knowledge that we can gain from the cosmos; please consider continuing to fund the science done at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/16/2016	
464		Ciprian	Sufitchi		<p>Thank you for the opportunity to express my opinion about the Proposed Changes for Green Bank Observatory Operations.</p> <p>As amateur astronomer and professional in IT and telecommunications, I strongly believe that the largest fully steerable radio telescope in the world should continue its journey to empower scientists, engineers and students to work at the outermost frontiers of knowledge. This is also a mission of National Science Foundation. With its unmatched sensitivity at higher frequencies, GBT is uniquely qualified to study molecular building blocks in nebulae and other gas clouds, probe the nature of matter at extreme densities, map diffuse clouds of intergalactic gas (only detectable in radio frequencies), calibrate cosmic distance scales, only to name just a few researching areas that the telescope is involved with.</p> <p>This instrument cost \$96 million to build and has been in operation for only about 13 years, and in this short period of time the list of scientific discoveries and support given to space exploration programs have made GBT bring shades of science fiction into reality. Considering the value of scientifically research and discoveries in astrophysics, a budget of \$10 million is very small, especially compared with other NSF projects and federal budget as a whole.</p> <p>Please also consider the message the NSF and United States would send to the public by only proposing to cease operations of the largest fully steerable radio telescope in the world, at a time when the Chinese Five-hundred-meter Aperture Spherical Telescope (FAST), now the largest radio telescope in the world, has just launched. If GBT would disappear, just think about what loss would be if other possible sources of intelligent extraterrestrial signals would need to be surveyed (just like Tabby's Star - KIC 8462852), and the most sensitive steerable radio instrument is no longer around. How could we, as humanity, miss that opportunity to detect life in the Universe?</p> <p>I urge the National Science Foundation to consider continuing full support to the GBT. A part of mankind's future depends on what space has to tell us. We must continue to discover and to do that we need tools such as the Green Bank Telescope and Observatory.</p>	Against Closure	Email - Scanned	11/16/2016	
465		Denzel	Buchner		<p>I am e-mailing with regards to the funding of the Green Bank Observatory. The Observatory project is a great scientific achievement. It's thus far contributed to great scientific discovery, and will continue to do so if given the opportunity.</p> <p>It is a project that inspires the young the become scientists and engineers, and as we all know, science and technology is one of the primary drivers of the economy. It is one of the reasons that the USA is as great as it is - because it is a global leader in science and technology.</p> <p>In the short term, the Green Bank Observatory employs many people who will become jobless if the decision is made to backtrack on the funding, which will further impact the local area and economy very negatively. These employees will have to look for jobs elsewhere, and would need to relocate, which in turn will drain the local economy and put pressure on the businesses and shops in the area.</p> <p>I implore you to please vote for the Continued NSF investment for science-focused operations (No-Action Alternative).</p>	Against Closure	Email - Scanned	11/16/2016	
466		Jennifer	Kenzior		<p>Please do not dismantle this ageing but still useful radio telescope. It still has many discoveries left to give us. \$10 million is practically pocket change for a facility of this value. Sell it if you must but please don't tear it down.</p>	Against Closure	Email - Scanned	11/16/2016	

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467		William	Brezinski	Graduate Student, Glass Research Group, University of Arizona, Chemistry & Biochemistry	<p>I am writing today in regards to the funding of the Green Bank Telescope – a NSF facility that does double duty as a state of the art radio astronomy lab and a platform for STEM outreach to an under served, rural part of America. If the telescope installation is lost, it is not only a blow to astronomy but also to the children who will lose their only chance to see such magnificent display of science in action.</p> <p>I grew up in Athens, West Virginia, just a few hours away from the Green Bank Observatory. I visited the site shortly after it's opening when I was just twelve years old. I can still remember the awe I felt seeing the scale of the place – it seemed to hum with an energy made of equal parts curiosity and discovery. It was something I had never felt before, at least not to that degree. It's the same energy I feel today when I step into my lab at the University of Arizona to pursue my Ph.D. in chemistry.</p> <p>That trip to Green Bank was the first – and only – exposure to a real research centre that I would have. Situated in one on the least populous counties west of the Mississippi, the observatory provides an opportunity for kids with an interest in science to see what is possible. It shows that there are opportunities beyond their small town, beyond their state, beyond even our own limited understanding of the universe. When you consider funding the Green Bank Observatory, I hope you will not only consider the science it can produce but also the scientists it will inspire.</p>	Against Closure	Email - Scanned	11/15/2016	
468	a	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>I am writing in regards to the proposed changes to the Green Bank Observatory and wish to state the important socioeconomic, educational, health and environmental contributions it has made to this area and my family.</p> <p>I have lived in this community for 36 years and the Observatory has played a significant role in my life. It afforded me the opportunity to work part-time, year-round for 17 years as one of the Observatory librarians while also working a full-time job as a teacher. The extra income from my Observatory job allowed me to pay for my daughter's education at an expensive, private college. She relinquished earning a six-figure income, outside of Pocahontas county, to begin her practice as a physician's assistant here in Green Bank.</p> <p>The loss of jobs from closing the Observatory would drastically affect the few local businesses in our county as well as our school student and staff populations in a negative manner.</p>	Against Closure	Email - Scanned	11/15/2016	
468	b	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>In recent years, I have been employed part-time as a lifeguard at the GBO swimming pool. This pool has been utilized many years for Red Cross lifeguarding classes certifying students to work as lifeguards thus allowing them to earn money for their college educations. My daughter worked 2 summers as a NRAO lifeguard to help pay for her college tuition. In addition, Lauren Bennett, Director of Pocahontas County Parks and Rec, and I have taught many children how to swim in this pool during summer swim lessons that were open to the public. The U.S. Master's Swim Club uses the GBO pool as well.</p> <p>The GBO and its employees have sponsored the annual Space Race Bicycle Rumpus to help financially support the Northern Pocahontas Community Wellness Center. Dr. Karen O'Neil, GBO Director, has served as the president of the Northern Pocahontas Community Wellness Center since its inception. The collaboration between the GBO and the NPCWC has been vital, with slow but steady progress, towards a proposed new Wellness Center building adjacent to the Green Bank School on GBO property.</p> <p>The GBO has served as the site for mini triathlons, 4th grade Bike-a-thons, the Turkey Trot 5K run/walk, Step Aerobics, Zumba, Ballroom Dance, Ballet and Yoga classes. My family, guests, and I have long enjoyed walking, running, biking, and cross-country skiing the grounds of the Observatory. The infrequent vehicular traffic and wide open spaces make it an excellent place to walk our dog, teach children how to ride a bicycle, and prospective drivers how to parallel park.</p>	Against Closure	Email - Scanned	11/15/2016	
468	c	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>The GBO and its employees have supported the Pocahontas County School system in major ways.</p> <p>Sue Ann Heatherly, Education Officer, and I co-authored and received a \$250,000 grant from Apple Computer several years ago. This grant funded new Apple computers for the Green Bank School. During summer months the Observatory used the computers for their summer education camps and teacher workshops. Visiting scientists from Russia, Japan, Australia, and Germany, have been invited to our school to share their country's culture with our students on numerous occasions. My daughter was fortunate enough to be involved with the weekly after-school "Hands-On Science" program staffed by NRAO employees. I attribute this program as initially inspiring her to choose a math/science track in school in order to become a healthcare provider.</p>	Against Closure	Email - Scanned	11/15/2016	
468	d	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>The GBO is a wonderful, environmentally exceptional place. We have watched beavers in Deer Creek, surprised bobcats on the trails, observed eagles at the deer carcass behind the Green Bank School, kept our distance from rattlesnakes, watched Canadian geese, and sighted many black bears on this property - unique opportunities few people experience in today's world.</p>	Against Closure	Email - Scanned	11/15/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
469	a	Bart	Wakker		<p>The GBT is a unique telescope. Discontinuing it would be a travesty and would further undermine the competitiveness of US science. Advanced radio telescopes are currently being completed in many places, e.g. ASKAP in Australia, MEERKAT in South Africa, FAST in China. Building such advanced telescopes first used to be a hallmark of US science, but now the US is behind the curve in constructing new instruments. Yet, the GBT still has unique qualities that are unmatched by any of these other telescopes. For instance, while ASKAP and MEERKAT will have higher angular resolution, their sensitivity is not even close to that of the GBT (being worse by a factor 100). The FAST telescope will have higher angular resolution and similar sensitivity, but is very limited in the amount of sky it can observe and thus will not be a generally useful instrument; it is also unfinished and it is unclear how much observing time will be available. I have read the white papers by Lockman et al. (arXiv:1610.09014) and Bally et al. (arXiv:1610.02329). While these papers list many good possible observing projects that can be executed using the GBT, they only barely touch upon the possibilities. For instance, in the past I have used the GBT myself to obtain very deep 21-cm HI spectra in the direction of quasars, in order to determine the properties of gas accreting onto the Milky Way. The formation of galaxies and the manner in which intergalactic gas flows into them is a field of research that is just beginning, now that cosmological hydrodynamical simulations are finally becoming detailed enough to make testable predictions about galaxy formation, while at the same time the Cosmic Origins Spectrograph (COS) on the Hubble Space Telescope (HST) is finally producing a large database of observations of gas around galaxies. Until very recently we did not know where to look and what to expect. Now that progress is being made, we will need a telescope like the GBT to learn more about the environment of galaxies. No other telescope in the world has the required combination of angular resolution, sensitivity, stability and (especially) lack of confounding instrumental problems - because of its construction the GBT has very low sidelobes and thus (unlike other telescopes) it does not produce a false impression; something that is especially important when looking at the limit of the possible. For the future I hope to be able to use the GBT to map individual intergalactic clouds that will be found by the ASKAP-WALLABY survey. WALLABY will map the 21-cm sky from redshift 0 to 0.1, at 16 km/s and 30 arcsec resolution. But with a detection limit of only about $N(\text{HI}) 10^{19} \text{ cm}^{-2}$. It will map many galaxies and will reveal the bright spots in many interesting structures in those galaxies' halos. However, to fully understand those, and their role in constructing galaxies, many other observations will be needed. For instance absorption-line studies against background quasars, observations of ultraviolet emission lines, and also maps of the neutral hydrogen. ONLY the GBT will be capable of obtaining sufficiently deep observations (down to a factor 100 fainter than ASKAP can achieve) to map such objects after they have been found. Without the GBT we will miss a crucial factor in such studies of galaxy formation. The projects I have in mind will only be possible if the GBT remains a publicly-available observatory. Therefore, discontinuing NSF support for GBT would be a grave mistake, only resulting in the further decline of US scientific leadership. It would be a penny-wise, pound-foolish decision, whose effects will reverberate over the next few decades and result in preemptively conceding major discoveries to other countries. It is clear to me that NSF needs a broad portfolio and not restrict itself to only certain area of astronomy that are popular at present. It would be especially foolish to shut down one of the few world-class observatories that is a US-only observatory rather than an international collaboration.</p>	Against Closure	Email - Scanned	11/15/2016	
469	b	Bart	Wakker		<p>The 2011-2012 NSF portfolio review (page 107) recommends that US astronomers use the publicly available time on the similar-sized Effelsberg dish. I have personally used both Effelsberg and the GBT, and I have several times run into major issues with Effelsberg data due to its very-bad sidelobes and other instabilities. On the other hand, observing the same fields with the GBT usually resolved the interpretation problems. Even upgraded, the Effelsberg telescope is no match for the GBT when it comes to observing faint extragalactic HI clouds. I therefore interpret this recommendation from the portfolio committee as based on the advertised properties of each telescope, rather than on actual experience in having used both. Looking further at the 2011-2012 NSF portfolio review, the section about research on galaxies has a large subsection on how galaxies form and evolve. At the time the COS instrument on HST had not yet produced data, nor had ASKAP been conceived. But at present it is clear that the GBT can play a unique role in specifically this kind of research. Following the recommendation to discontinue support would thus have been shortsighted and would have preemptively made some of the recommended research impossible.</p>	Against Closure	Email - Scanned	11/15/2016	
470	a	Michael	Lam	NANOGrav Physics Frontier Center Postdoctoral Fellow West Virginia University	<p>I am writing in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to operations at the Green Bank Observatory (GBO). GBO has been and remains a unique institution nationally and internationally. It remains unique on a culture, scientific, and educational level and is economically important for the State of West Virginia. You have undoubtedly received many similar letters outlining its importance in these areas.</p> <p>I started my undergraduate career at a small, liberal arts college where the opportunities for astronomy research were very limited. In the summer of 2009 after my sophomore year, I worked at NRAO Charlottesville in Virginia for a Research Experience for Undergraduates program. Not only did I use data from the GBO (the then Green Bank Telescope, GBT), our entire group was given telescope time so that we could learn how to plan our own observations, carry them out, and perform data reduction and analysis. All of the members of the program were students from around the country who were given an incredible opportunity to learn radio astronomy and truly become radio astronomers because of the GBT. Almost all of the people that I know who have gone through that program have stayed in STEM research or industry fields, several in astronomy. For me personally, with that experience in hand, I ended up going to graduate school for astronomy at Cornell University and am now a professional radio astronomer, working as a postdoctoral fellow in West Virginia for the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), an NSF Physics Frontier Center.</p> <p>One of the major contributing factors for deciding to come to West Virginia was use of the GBO. Observational astronomers tend to go where telescopes exist and the entire astronomy side of the Department of Physics and Astronomy at West Virginia University (WVU) is here, as is the Center for Gravitational Waves and Cosmology, because of the GBO. It is a prime hub for NANOGrav because one of the GBO's key science goals is observing the low-frequency gravitational wave Universe. Astronomical research in West Virginia happens because the GBO is here. Grant money that is spent on funding personnel such as myself trickles down into the local economy because all of us live here. Scientific outreach and education that is performed here by us happens because the GBO exists for us to be here. The GBO is the premier science facility in West Virginia and any reduction in funding to the observatory destroys opportunities for West Virginians. However, the GBO does not merely impact Pocahontas County, West Virginia and it does not merely impact US single-dish radio astronomers.</p> <p>Complete funding and open skies (option 1 of the EIS) is absolutely critical. And with improved funding, instrumentation, and support, it could continue to thrive for many years to come. I request that the NSF considers the broad impact of damaging the US single-dish radio astronomy community, and pulsar timing array astronomy especially as we are in the very recent opening of the gravitational wave Universe.</p>	Against Closure	Email - Scanned	11/5/2016	mlam_letter.pdf

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470	b	Michael	Lam	NANOGrav Physics Frontier Center Postdoctoral Fellow West Virginia University	The GBO is not the facility that was reported in the 2012 NSF Portfolio Review. Its upgrades, both past and continued, make it a modern institution capable of achieving a unique set of scientific goals. No other observatory can compete with its combined sensitivity and range over the Northern sky.	Against Closure	Email - Scanned	11/5/2016	
470	c	Michael	Lam	NANOGrav Physics Frontier Center Postdoctoral Fellow West Virginia University	...It has local, national, and international socioeconomic effects. It impacts scientists, students, and the general public all around the world. In close, I implore the NSF to continue funding this absolutely crucial observatory for its scientific and socioeconomic impacts. For questions or further information, please do not hesitate to contact me.	Against Closure	Email - Scanned	11/5/2016	
471		Anthony	Winston	Professor Emeritus Department of Chemistry, WVU	The dismantling, or a reduction of services of Greenbank Observatory would be a great loss to astronomy, to science, to education, to the department of physics at WVU, and to West Virginia itself. Greenbank has been a fixture of West Virginia for 60 years and astronomers come here from all over the world to work with the telescopes. I have visited the observatory many times and the tours are well filed. I hope that funding at the present level will be continued.	Against Closure	Email - Scanned	11/15/2016	
472		Norman and Ruth	Broski		We am writing to protest the demolition of Greenbank The observatory is heavily used by many people. It is a unique facility and offers many educational opportunities to old and young people alike. It is the home of the largest fully steerable radio telescope. Being that it is the largest in the world, why would we give up this honor and reputation to some other country. Something that we as West Virginia residents can be very proud to say is located in our beautiful state. We do realize that there are many things that have to be considered for public funding. With the benefits that many can enjoy at this wonderful "Greenbank", it would be a terrible waste and greatly missed by many. We do hope that strong consideration will be given to this facility. Thank you for considering our plea.	Against Closure	Email - Scanned	11/15/2016	
473		Norris	Long		My schedule prevented my personal attendance at the EIS meetings held November 9, 2016 at GBO. I am grateful to have the opportunity to voice my concerns in this manner. I believe it would be detrimental, socially and economically, to the community and Pocahontas County with the dissolution of the facility. In an area where even 30 people have a job; they spend money, they send their children to school here, they buy or own homes here. Without that employment opportunity, the community will wither and die, not unlike the coal communities of southern West Virginia. The educational value of the facility has lead to the discovery of new things in outer space. The facility is a host to thousands of visitors to the site each year. Those visitors contribute financially to the County. To lose this will affect every person living in Pocahontas County. While reflecting on the alternatives being offered, I am adamantly against the last two. I would prefer alternative #1, making no changes. Alternatives #2 & #3 would have to be considered in a smaller context. As a final statement, the NRAO has served our community well. It arrived here after the shut down of the lumber mill at Cass, and subsequent closings of the two tanneries, offering employment opportunities to many local individuals who otherwise would have had to leave the area.	Against Closure	Email - Scanned	11/15/2016	
474		Vereese	van Tonder		The Green Bank Telescope is a world renowned telescope. Observatories across the world come to Green Bank for telescope critical operations training, including safety training. If the observatory were to cease to exist then it will limit training opportunities for new Observatories across the world. Additionally all the scientific and technical staff from the Green Bank Observatory would need to move out of Green Bank in search for other job opportunities. These employees contribute greatly to the social and economic status of the area. Employees support local businesses such as the bank, farmers, and local shops. These businesses would loose the support from these employees if they were to move away. Green Bank Observatory have great educational and public outreach programs, all which cannot exist without the observatory staff. Students from across the country visit Green Bank to enrich their careers in various programs. Furthermore the Observatory is a great asset to the county and state and has a positive connotation to it. Visitors to the Green Bank Observatory contribute to local businesses such as guest houses, shops, and restaurants. Without the Observatory these businesses will loses the contributions from such customers. I sincerely hope the NSF opts for the "Continued NSF investment for science-focused operations (No-Action Alternative)" as I think this would be the best option for the local people of Pocahontas county, the people of America, and the international astronomical community.	Against Closure	Email - Scanned	11/15/2016	

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475	a	Brent	Shapiro-Albert	Graduate Student, WVU	<p>My name is Brent Shapiro-Albert and I am a first-year graduate student at West Virginia University in the Department of Physics and Astronomy. I am currently doing research in pulsar astronomy, a field that benefits greatly from the Green Bank Observatory (GBO). I would like to encourage the NSF to continue its funding for the GBO. One of the reasons I wanted to come to West Virginia and WVU was to have the opportunity to use the Green Bank Observatory. I have not had the opportunity to be trained on the telescope yet, but observing with the GBO is one of the things I was the most excited about doing coming to WVU.</p> <p>One of the things I would like to do after I graduate is have a post-doctoral research position at a large observatory like Green Bank. As I have learned more about the observatory and the impact it has on the community, I have felt more and more like it would be a great place for me work after obtaining my PhD. Having the opportunity to work with an instrument like the Green Bank Telescope everyday would be a fantastic opportunity. The amount of outreach with the community in West Virginia and with students who come from all over the state also seems unique to me. It is much easier for people to go to Green Bank than it is for them to go to, say, Arecibo, and would offer much more opportunity to inspire students to study not only astronomy but other STEM fields.</p> <p>While I have only been at WVU for a couple of months, the amount of outreach that the university has done in cooperation with the Green Bank Observatory has astounded me. The Pulsar Search Colloboratory (PSC) is a fantastic way to get high school students involved in astronomy. Not only that, they get to use one of the best instruments in the world, an experience that I would have loved to have had in high school. Until I came to WVU and learned about the PSC I always thought that you needed to be at least a graduate student to have even the chance to use a telescope like that. Additionally I have run a help center this past semester for the class taught by Prof. Kathrine Williamson. Most of these students are not STEM majors or even minors, but Prof. Williamson gives them the opportunity to use the Green Bank 20 meter telescope to take their own data via Skynet. When I was an undergraduate I had the opportunity to do something similar during a summer research project, but only a handful of students in our physics and astronomy department ever got a chance to do something like that. Allowing non-STEM students to take their own data and do experiments like finding the galactic rotation curve and evidence for dark matter is something unique that Green Bank can offer students. All they need is access to the internet and for thier professor to procure observing time on the 20 meter telescope. I can hardly think of a better way to inspire students to pursue STEM fields than letting them take thier own data.</p>	Against Closure	Email - Scanned	11/15/2016	
475	b	Brent	Shapiro-Albert	Graduate Student, WVU	<p>I would also like to say that I was the Public Meeting at the GBO on November 9th, from 6:00 pm to 8:00 pm and I would be remiss if I didn't mention how inspiring I found the comments from the community to be. I expected all of the students associated with WVU to strongly support continued NSF funding for the telescope, but I was impressed by how much of an impact the GBO has had on the community in Green Bank. The people who live there, whether they were directly associated with the observatory or not, have all been touched by it and had nothing but good things to say. While I do not live in Green Bank, it seemed to me the observatory kept the community alive and vibrant, and I think that the amount of support I saw from members of the community says more about the GBO's impact than I can say on my own.</p> <p>I strongly encourage the NSF to continue support for the GBO. Not only does it affect me personally, but it has had a hugely positive impact on the community in Green Bank and on the Department of Physics and Astronomy at WVU. I would like to thank the committee for allowing me the opportunity to contribute to the discussion about the Environmental Impact of the GBO and the continued support of the NSF to the GBO.</p>	Against Closure	Email - Scanned	11/15/2016	
476		Emily	Jordan	Geologist	<p>I am writing to voice my opinion in favor of the GBT funding in West Virginia. The telescope, a steerable scientific marvel, unparalleled in its field, is also a source of tremendous state pride and a beacon of inspiration for STEM students throughout Appalachia. Please consider keeping the facility funded and operational, for the good of local communities and the progression of scientific research.</p>	Against Closure	Email - Scanned	11/15/2016	
477		Dana	Balsler		<p>My name is Dana Balsler and I have been a professional scientist for over 20 years.</p> <p>The Green Bank Observatory (GBO) is a unique facility. It operates the worlds largest fully steerable telescope within the national radio quiet zone, and includes an active scientific staff with a science center used for education and public outreach. I advocate for the "continued NSF investment for science-focused operations" alternative for the environmental impact statement (EIS).</p> <p>Here I focus on the socioeconomic resource area. As we move into the 21st century, it is critical to increase the number of students that have careers in STEM fields for the success of the nation. Astronomy is arguably the best field to connect to young students based on several metrics: movies, news articles, enrollment in college classes, etc. For decades the GBO has inspired and trained students about science through a variety of programs. I have encountered many young students currently pursuing a STEM career who were inspired by their experience at the GBO. These were relayed to me through conversations with students, research for undergraduate (REU) applications, blogs, etc. Yet such stories are rare with other facilities. Why? I think the difference is due to several factors. First, seeing and climbing on a 100 m telescope, the GBT, is cool. There is no substitute for such a connection. Second, the national radio quiet zone combined with a remote site isolates students in a way that is rare in today's world. There are no distractions and students are focused on doing science and talking to the staff and each other. Third, a working scientific staff that is engaged with students. Students do research at the GBO and interact with active scientist. Again, there is no substitute for a young student to be engaged with a real scientist. lastly, an education program with a long history of success. The GBO has been training students for decades and they have a proven track record.</p> <p>In summary, if the NSF does not invest in the GBO for science then this important resource will be lost. I therefore strongly recommend that the NSF continue investment for science-focused operations.</p>	Against Closure	Email - Scanned	11/15/2016	
478	a	Robert	Gronan	N/A	<p>Thank you for the opportunity to comment on the future of the Green Bank Observatory (GBO). Of the five alternatives being considered, since the first is unlikely due to budget constraints, I urge adoption of the second "Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope."</p>	Against Closure	Email - Scanned	11/15/2016	

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478	b	Robert	Gronan	N/A	<p>There is an important provision required for the success of Alternative two. That is that the observatory must attract much larger numbers of paying visitors for its operations, and I hereby propose a way that can be done.</p> <p>The National Radio Quiet Zone, in which the observatory is located, is unusual in another way that is also a function of its location. That is that it already is a relatively dark sky area within close proximity to large populated areas of the U.S. Although GBO's radio observations are not adversely affected by visible light, designation of the Green Bank region as a dark sky area would attract many more visitors, and they would of course be staying overnight in the area, contributing greatly to the local economy.</p> <p>A designation as an International Dark-Sky Association "Dark Sky Reserve" (DSR) would perfectly complement the astronomical themes of GBO. Please see http://darksky.org/wp-content/uploads/bsk-pdf-manager/IDSR_Guidelines_Oct2015_22.pdf Studies of astro-tourism have shown that this designation attracts more visitors and contributes significantly to the local economy, as is discussed at http://darksky.org/3-benefits-of-a-dark-sky-designation/ The local people around Green Bank already understand and accept the benefits of the radio quiet zone, so the relatively modest changes in visible light shielding would be accepted as worth while. However, it would require an ordinance by the Pocahontas County Commission for this to be successful.</p> <p>Look at the NASA/NOAA night satellite view of the eastern US https://www.nasa.gov/mission_pages/NPP/news/earth-at-night.html and you will see a single dark area centered on Green Bank, WV, surrounded by the bright lights of the DC/Baltimore, North Carolina, and Ohio megapoli, and within an easy day's drive of them. If this attribute of Green Bank, unique in the mid-Atlantic area, was to be utilized to advantage, it could generate the increased visitors needed to maintain the economic viability of GBO and its surrounding communities.</p>	Alternatives Consideration	Email - Scanned	11/15/2016	
479		Joseph	Schaeffer		Keep it open!	Against Closure	Email - Scanned	11/15/2016	
480	a	Svetlana	Jorstad	Senior Research Scientist IAR,	I would like to express my deep disappointment with one of the conclusions of NSF's Division of AST's portfolio review committee, which in 2012 found that the Green Bank Telescope (GBT) ""capabilities are not as critical to New World New Horizons [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." I vehemently disagree with this statement. The GBT is the most sensitive single-dish radio telescope at short wavelengths in the world, and hence is invaluable to exploration of the universe.	Against Closure	Email - Scanned	11/15/2016	
480	b	Svetlana	Jorstad	Senior Research Scientist IAR,	<p>With recent detection of gravitational waves by LIGO, one of the main goals of the New World New Horizons science is to reveal potential sources of these waves. These potential candidates are primary sources studied with the GBT, such as black holes, neutron stars, pulsars, and supernova remnants. In addition, participation of the GBT is crucial in Very long Baseline Interferometric observations at 3mm that allow scientists to study jet properties in the vicinity of the event horizon of black holes. Furthermore, the great sensitivity of the GBT makes it a unique tool to complement space science missions.</p> <p>A facility such as the GBT is easy to destroy but very difficult to build. From five alternatives to be evaluated in the EIS, I vote for item I: Continued NSF investment for science-focused operations (No-Action Alternative).</p>	Against Closure	Email - Scanned	11/15/2016	
481		Alan	Marscher	Professor, Department of Astronomy, Boston University	<p>I am writing to express my support for continued scientific operations of the Green Bank Observatory. The GBO operates the Robert Byrd Green Bank Telescope (GBT), the most sensitive single-dish telescope at short radio wavelengths (microwaves) in the world. It is a relatively young facility that is a key component in astronomers' attempts to understand cosmic phenomena.</p> <p>My own interests are in extremely energetic objects and events in the universe. Many of these are related to black holes in galaxies. Last year, LIGO detected gravitational waves with the pattern predicted for two black holes merging in a distant galaxy. Jets of high-energy particles streaming out of the centers of galaxies with super-massive black holes at near-light speed are the most luminous long-lived objects in the universe. These and other phenomena that play a major role in the dynamics and radiation of the cosmos need to be studied at a variety of wavelengths: gamma-ray, X-ray, visible-light, infrared, and radio. By closing sensitive instruments such as the GBT, we would become blind in some of these wavelength regions.</p> <p>In my own research, I use the GBT as part of a global array of radio antennas that forms an Earth-sized telescope that probes the time-variable emission coming from the jets (mentioned above) down to the event horizon of the super-massive black holes. The high sensitivity of the GBT at short radio wavelengths is critical to such observations</p> <p>The GBT represents a major, fairly recent scientific investment by the US. It would be a tragedy to destroy such a fine facility. From five alternatives to be evaluated in the EIS, I vote for item I: Continued NSF investment for science-focused operations (No-Action Alternative).</p>	Against Closure	Email - Scanned	11/15/2016	

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482		Richard	Rand	Professor Department of Physics and Astronomy University of New Mexico	<p>Regarding the EIS for the Green Bank Telescope, I support the first proposed alternative: Continued NSF investment for science-focused operations (No-Action Alternative).</p> <p>As a professional astronomer with a focus on radio astronomy, I can clearly state that the Green Bank Telescope (GBT) is a unique resource for US astronomy, and any threat to its existence will lead to a significant reduction in forefront astronomy research productivity, hurting the ability of the US to compete in this area. Not only the quality of the dish itself, but the versatility of the instrumentation, allows the GBT to attack some of the biggest problems in astrophysics today, such as the indirect detection of gravitational waves, the process of galaxy and star formation, and the nature of black holes. It provides capabilities to address these problems which do not exist anywhere else.</p> <p>In my own research, I am part of a team of about 40 astronomers worldwide which is studying the energetic environment surrounding galaxies as clues to their evolution. We are currently using the GBT to compliment our main data set from the Karl G. Jansky Very Large Array (VLA). We cannot fully understand the structure of the galaxies we are studying from our VLA data alone - the GBT is essential to making maps which provide all the information we need. I have a doctoral student whose main task will be to combine GBT and VLA data to make the best maps possible of our galaxies. The GBT is unique in providing these necessary data.</p> <p>The GBT has also carried out other observations that directly impact my research, having to do with, among other things, whether our Milky Way galaxy is still growing by accreting gas, a vital question.</p> <p>In summary, the GBT's scientific mission must be protected because it is an indispensable asset in our search to understand the universe, and the physical processes that led to the formation of galaxies like our Milky Way and stars like the Sun. In other words, the GBT is helping us to understand how we came to be.</p>	Against Closure	Email - Scanned	11/15/2016	
483		Ben	Kessler	WVU Senior CDC/NIOSH Data Analyst	I am writing your foundation to please ask you not to shut down Green Bank Observatory. As a resident of WV, it is horrifying to see our foundations of science and knowledge crumble before our eyes. Please do not close it down. Fight for science, fight for our future.	Against Closure	Email - Scanned	11/15/2016	
484		Youngmin	Seo	NASA Postdoctoral Program Fellow Jet Propulsion laboratory, NASA	<p>As a radio astronomer working at Jet Propulsion laboratory of NASA, I would like to address my experience and my support to the Green Bank Observatory to continue its science operations.</p> <p>I study star formation in nearby molecular clouds using radio telescopes and numerical modeling, and the 100 meter Robert C. Byrd Green Bank Telescope (GBT) have been crucial to my research. In star formation, a current key issue is to understand how molecular clouds to form progressively smaller dense filaments and cores and how physical properties of a molecular cloud affects star formation in dense cores within the cloud. My Ph.D. dissertation directly targeted these questions by observing the Taurus molecular clouds. One of the practical difficulties I have faced during my Ph.D. is that I needed a telescope that can map the Taurus molecular clouds (a few degrees in the sky) and simultaneously spatially resolve dense cores (a couple of arcminutes). I found that the 100m GBT is the most efficient instrument for my study since it provides the best capability for surveying large area in the sky with a good spatial resolution. Famous interferometer telescopes such as AIMA and VLA have better spatial resolutions but they were practically impossible to use for my project since their mapping speeds are relatively slow due to their narrow field of views. With the fast mapping speed of the GBT, the observation during my Ph.D. resulted in the largest ammonia map toward a molecular cloud. Furthermore, my colleagues and I are currently carrying out a larger project that observes most of the nearby molecular clouds using the 100m GBT. This will result in the largest and most detailed maps of nearby star-forming regions along with important scientific findings. With my past experience using the 100m GBT, I strongly believe that the GBT not only has played an important role in my Ph.D. dissertation but also will be crucial to my future studies and other key studies in star formation.</p> <p>As a scientist with a foreign national working in the US, I would like to point out an aspect of national interest. I earned my Master of Science in astronomy in South Korea and worked three and half years at the Korea Astronomy and Space Science Institute. One of the difficulties I had in Korea was a limited access to high-quality data due to a small number of observatories in Korea. This has considerably limited of students to have experience with most advanced technology and high-quality data. When I came to the US for my Ph.D., I was able to use the 100m GBT and made important scientific findings which led me to get a postdoctoral position at NASA. The GBO is one of the most advanced facilities around the world with an easy access to astronomy students in the US, while AIMA and VLA are considerably over-subscribed and have relatively limited access to students. I think that an easy access for students to the highest quality data and the most advanced research facilities like the GBO has been one of the strongest advantages in nurturing the brightest minds in the US and also bringing the best researchers to the US from other countries. I believe that keeping the GBO at its full scientific capacity will absolutely contribute to making the US lead in science and technology.</p>	Against Closure	Email - Scanned	11/15/2016	
485		Jennifer	Weidman	Project AWARE Community Coordinator Department of Social & Behavioral Sciences School of Public Health West Virginia University	<p>Please reconsider your decision to defund the GBT in West Virginia. With our coal industry dying, West Virginia must move forward in a progressive direction. The STEM field and jobs can provide a sustainable future that WV so desperately needs. It's often hard to see the fruits of labor in an industry where breakthroughs can take decades to occur. But defunding this would lead to negative consequences almost immediately.</p> <p>We need to keep and fully fund the GBT!</p>	Against Closure	Email - Scanned	11/15/2016	

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486		Richard	Bradley	<p>Scientist / Senior Research Engineer (NRAO)</p> <p>Research Professor of Astronomy (U. Virginia) Visiting Assistant Professor of EE (U. Virginia)</p> <p>Associate Editor: Radio Science Immediate Past Chair: Commission J Chair</p> <p>U.S. National Committee of the National Academy of Sciences International Union of Radio Science (URSI) Vice-Chair: International URSI Associate Director of the Mid-Atlantic Region</p> <p>Sigma Xi - The Scientific Research Honor Society</p>	<p>As a research engineer with the NRAO Central Development Laboratory, I am writing in support of continuing operation of the Green Bank Telescope (GBT) as an important asset for the radio astronomy community. Its unique style and functionality sets it apart from all other telescopes in its class. In addition, since the beginning of scientific operations in 2001, the GBT has consistently outperformed other telescopes with its high sensitivity and incredibly small systematic errors, thus enabling the scientific discoveries that have been well-documented in peer-reviewed journals. However, we must constantly sharpen our technological edge to maintain our scientific relevance, a value that is directly correlated with instrument capability. As a research engineer tasked with pushing the state-of-the-art in weak signal detection, major advances are only possible through harnessing the unique attributes of instruments such as the GBT - a well-designed platform for evaluating new approaches and techniques. While the GBT has already made significant contributions to the state-of-the-art in single dish astronomy, plenty of engineering challenges remain in key areas such as sensitivity, field of view, and signal processing. Improvements to the reflecting surface model through advances in controlling the movable surface panels while incorporating the laser metrology system could further enhance pointing accuracy and aperture efficiency, particularly at the high end of the frequency band. The field-of-view of the telescope can be improved by adding multiple compact feed horns or synthesizing virtual beams at the focus. Signal detection can be improved by exploring the effectiveness of novel signal processing techniques that target specific types of signals such as transients, pulsars, spectral lines, and thermal noise, all in the presence of radio frequency interference. The GBT's unique functionality and intrinsic low systematic errors make it possible to uncover subtle issues affecting new technologies that would otherwise be masked by conventional telescopes.</p> <p>The availability of the GBT for studying advanced signal detection techniques helps to stimulate our young researchers to try new ideas. For example, my University of Virginia graduate student and I developed a low noise, wide bandwidth feed that is capable of operating over a 10:1 frequency range. As a result of this work we received U.S. Patent #9,054,516 issued on June 9, 2015. As part of his Ph.D. thesis, another student studied the GBT's quadrant detector as an aid to improving feed arm modelling. The challenge of such projects helped motivate both students to perform at their very best - as a result, both students are currently employed at NASA JPL, working in areas of weak signal detection and Earth sensing.</p> <p>Within this growing spirit of nationalism, it is vital for us to maintain a strong research and development presence and the weak signal detection requirements of radio astronomy push the bounds of engineering methods and techniques. The GBT is well positioned to provide the unique platform that fosters innovation in several key areas of national interest while addressing difficult measurement problems in radio astronomy. This synergy motivates our young researchers to excel. Therefore, I strongly recommend that the GBT remain as a functioning radio astronomy facility for many years to come.</p>	Against Closure	Email - Scanned	11/15/2016	
487		Dennis	Egan	Assistant Fire Chief BFD Fire and Rescue	<p>I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. The Green Bank Observatory's support for the Fire and Emergency Rescue services is essential. Without both the Observatory's explicit and indirect support it is difficult to imagine how we could maintain anything like an adequate service.</p> <p>The Observatory's explicit support includes:</p> <p>Air evacuation Landing zones – The Observatory's landing strip is regularly used as a landing site for medivac services.</p> <p>Emergency operations staging areas – In the event of a large emergency, equipment and personnel are often staged there.</p> <p>Emergency Evacuation Center – The Observatory is a Red Cross Evacuation Center. During Floods or storms the observatory has often been the only place with electricity, a must for heat or medical oxygen generators. Its facilities can handle the logistics of caring for a large portion of the area population, a service that unfortunately our county has needed several times in the last few years, once for a week following a severe derecho when the area was without power and for a couple of days following a bad snowstorm.</p> <p>Emergency equipment repair – The facilities at the Observatory can mean a piece of critical equipment can be put back in service quickly in an emergency</p> <p>Water – Without the Observatory's available water facilities during fires we would be forced to draw water from local streams, the nearest municipal water system is Durbin, about an hour's round trip in a tanker truck.</p> <p>Meeting and Training Facilities – The Observatory's classrooms are often used for training.</p> <p>In addition to the indirect support provided by the Green Bank Observatory, there are several ways the Observatory provides implicit support:</p> <p>Personnel – A significant percentage of our Fire and Rescue personnel in the county, especially on the north end are Observatory employees. These employees are especially valuable to us because of:</p> <p>Management Expertise – Management and communication skills are important to fill the officer ranks, a significant number of the Chief Officers are Observatory employees.</p> <p>Technical Expertise – Maintenance of communications radios and pagers by our volunteers who are Observatory's would be irreplaceable. This is a skill not readily available elsewhere in our area and would certainly disappear if the Observatory began downsizing.</p> <p>The Observatory's support, particularly their available water supply has a direct effect on the ISO rating and the fire insurance rates for the Green Bank area. Largely due to GBO's water availability we were able to get this area's fire rating improved. Green Bank fire insurance rates within 6 miles of the Observatory, are 15% to 20% lower due to the support from the Green Bank Observatory.</p> <p>Without the support of the Observatory and its employees our ability to provide adequate service would be severely impaired resulting in a substantial increase in risk to life and property. Thank you for your attention.</p>	Against Closure	Email - Scanned	11/15/2016	
488		Keiichi	Umetsu	Professor Institute of Astronomy and Astrophysics, Academia Sinica (ASIAA), Taiwan	<p>I write in support of the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they have been performing. The Green Bank Telescope represents the largest movable single-dish telescope in the world. As such, it is a critical resource to the research community. The community will harness its unique, sensitive capabilities to advance into the new discovery region.</p>	Against Closure	Email - Scanned	11/15/2016	

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489		Mark	Morris	Professor of Astronomy, UCLA	<p>To those considering the range of proposed changes to the operations of the Green Bank Observatory:</p> <p>As a user of the Green Bank Telescope (GBT) for over 10 years, I am writing to express my strongly held opinion that the GBT is an exceptionally valuable and sensitive scientific facility that serves the US community of researchers in astronomy in a remarkably wide variety of ways. I and my students have used it to study astrochemistry, Galactic chemical evolution, and the thermal properties of molecular clouds in the Galactic center. Many of my colleagues use it for cutting-edge scientific projects in other domains, and on all cosmic scales. Others find the GBT essential for its capabilities that are complementary to those of the Jansky Very large Array radiotelescope, one of the other premier facilities available to the US community.</p> <p>During the past decade, I have worked with three students whose PhD research was based on observations with the GBT, and I am but one of many research advisors who oversee students using the GBT, so it has played an important role for training the next generation of scientists.</p> <p>The only other radiotelescope in the world that has comparable capabilities for many purposes is the Effelsburg 100-m Effelsburg radiotelescope operated by the Max-Planck Institute for Radioastronomy (MPIfR) in Germany. The scientists and government there have continued to invest in that observatory, and have reaped a rewarding scientific return by doing so (as a member of their external advisory committee, I have been able to follow the German developments closely). Retiring the (more sensitive) GBT would represent an unfortunate loss of research capability for the US community, and it would reduce our competitiveness in several important branches of astronomy.</p> <p>I sincerely hope that the NSF can find a way to maintain scientific operations at the GBT.</p>	Against Closure	Email - Scanned	11/15/2016	
490		Adam	Gellert		<p>I'd like to encourage the continuation of funding to the National Radio Astronomy Observatory in Green Banks, West Virginia. I am writing to you as a senior who attends Grosse Pointe North High School in Grosse Pointe Woods, Michigan.</p> <p>As I stumbled out into an open field, I would look up into the night sky and be filled with awe by the enormity and grace of it. At my young age, I was always intrigued by the most random of things, but this was different. Not only was it the view that amazed me, but the pondering that occurred while I tried to comprehend the complexity of the sky. It wasn't until sophomore year in high school that I tried to demystify the elusive concepts that surrounded the universe by taking an astronomy class. Although I learned a bountiful amount of information, the class made me realize that there was still much more that I wanted to learn.</p> <p>This pursuit of knowledge led me to join the school's astronomy club, being the Radio Astronomy Team. I have now been in the club going onto three years and am now president. In this time I have learned a wealth of information about astronomy in general and what it's like to be an astronomer. There is, however, one special event that has made this possible, and that is our annual trip to what used to be the National Radio Astronomy Observatory in Green Bank, West Virginia. During the three night and two day stay there, I had the opportunity to not only control the Forty-foot, but get an inside look at what it's like to work at NRAO. Being able to see what it's like to control and maintain the Green Bank Telescope and hear it from those that actually do it is truly an impressionable and irreplicable experience. It gave me the sense of awe, as I was able to meet people that were doing what they loved and working on solving the secrets of the universe. Suffice to say, the annual trip to NRAO has served as a catalyst for my decision to pursue science as my future career, as I was able to experience the joys of working with and observing cutting edge tools to advance the knowledge of society.</p> <p>My story is not the only one like this, as the Radio Astronomy Team has been going to NRAO since 1989. In those years, there are multiple stories to tell as to just how the place has changed the alumni's perception of their future. The National Radio Astronomy Observatory in Green Bank, West Virginia, serves as a beacon of STEM advancement in the middle of the Quiet Zone. It is vital to continue funding to this awe-inspiring place as to continue the stories and experiences being shaped there, just like the one I painted for you above.</p>	Against Closure	Email - Scanned	11/14/2016	
491		Rosa Martha	Torres		<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/14/2016	

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492		Miriam	Borns		<p>While scrolling through Facebook the other day, I came upon a moving, heartfelt request from one of the TechCrunch contributors I follow regularly on science and space news. Emily Calandrelli, or @TheSpaceGal, asked her audience to write letters regarding the uncertain future of the most sensitive radio telescope in the world, Green Bank Observatory in West Virginia, her home state. I've visited the web site in the past looking for information about how to build a radio telescope that school kids can try and found out about this great resource. Someday, I hope to visit this scientific instrument with my kids to show them that the universe not only reveals its secrets visually, but also in the form of radio waves we can hear. This concept fascinates me not only because of the amount of data that can be retrieved from this form of type of observation, but also because I'm an advocate for people with disabilities in my everyday life. We all sense the world in our own way. What a wonderful resource this observatory is show people that all our senses are important when it comes to learning about our world.</p> <p>If the National Science Foundation can not fully fund the GBO or if private funding comes up short, maybe compromising with a part scientific purpose, part scientific center to the public can keep the data coming and the public educated on this gem of engineering and a STEAM symbol for the people of West Virginia. Two scientists that could be featured in your visitors center could be Robert Alexander (here is a NASA article on him Sonification of Data) and Wanda Diaz Merced (feature on scientists with disabilities listening to the Stars). I know that these two scientists study how data can be represented by sound rather than what the GBO does in capturing and focusing energy to be analyzed, but there are so many other examples out there that could be used to help provide our kids with interactive STEAM exhibits under the wise dish of this fine radio observatory.</p> <p>If other scientific sites see how successful this partnership could be, even more precious scientific resources could be saved for generations to come not just in the field of astronomy, but a full range of scientific subjects.</p> <p>Please consider the value of the GBO and it's necessity for the prosperous future of West Virginia, our nation, and the global scientific community. Thank you for your time.</p>	Against Closure	Email - Scanned	11/14/2016	
493		Nancy	Egan	Durbin Community Library	<p>Hello, I am Nancy Egan, Librarian at Durbin Community Library. Durbin is a small town 20 minutes from the Green Bank Observatory. We recently built a new library building with the help of Habitat for Humanity, who directed the raising of the walls but the follow---on volunteer labor to construct the 3,600 sq. ft. facility included the expertise of the carpenter, electrician, painter and others from the Observatory. Some of the labor donated by the Observatory but the majority accomplished outside of working hours. To have the craftsmen, educational staff, and the leadership of the administration, kept current with industry and academic standards, available for consultation for the common good of the community at large has really kept Pocahontas County a place to be proud to say we live.</p> <p>In a community which is natively suspicious of evolutionary science the availability of the educational opportunities with many of the homegrown staff promotes the understanding of cosmology and our place in the universe within the diversity of personal religious framework and works harmoniously and naturally to create understanding. Our school children are benefiting.</p> <p>Some of the other positive side---effects of the Observatory are as follows. The requirements of the Observatory influence the quality of the broadband we receive through the work of those who can advocate for local needs of the surrounding small, scattered population. The availability of healthy vegetable--- rich, reasonably priced prepared food at the Café is good competition for the local less healthy places to eat. Athletic fields for children behind school and adjacent to Observatory property are maintained. Five to ten miles of natural and paved walks on flat land for running, walking and biking, a pool for community swimming lessons during the summer, and many other benefits accrue to the community, shared in measured and structured ways.</p> <p>In conclusion the Observatory staff, opportunities of scale, and the beauty and use of the grounds all benefit the community at large. Thank you for regarding the community feedback in your decisions and planning for the future of this facility.</p>	Against Closure	Email - Scanned	11/14/2016	Green Bank Obs. feedback letter.docx

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494	a	Deana	White		<p>Each time my family and I have visited, I am more and more convinced this place is magical. Bear with me -to start simply - just from using your senses you can see the beauty - the juxtaposition of the technological wonders of each decade represented by each of the telescopes against the majestic, quiet mountains. Imagine taking a walk down the Observatory Road - listening to the breeze whispering through the pines, seeing the sun reflect at different angles off the hills and the telescopes - when ever so quietly, one of the telescopes turns to its next observing target. Right there and then - in the peace and beauty of your evening stroll - it could be that the next discovery of an exotic binary pulsar system, the secret to dark matter - or even the first sign that we are not alone - could be happening. That is exciting, awe inspiring - Magic. Looking out from behind the visitors desk in the Science Center - you see people from all over - maybe nearby Virginia, or further Canada or even further Great Britain - stopping by to see just what is this place with curiosity written across their faces. They eagerly accept an invitation for a tour or a walk through and - upon returning - inevitably are smiling and excited about what they have just learned - full of praise and "I had no idea" type comments. That curiosity converted to a renewed or enhanced enthusiasm for the possibilities of scientific understanding and discovery along with their recognition of the world class facility that they just discovered- is Magic.</p> <p>During a working day, stroll through a tour, a conference, a science talk at the Jansky lab - and you will feel you are immersed in the middle of a metropolitan city - bustle aside - where diversity is all around - people from all over the world are busy conveying their thoughts, research, and ideas. While many may speak from their native lands such as Germany, China, Great Britain, Australia, South America -on and on -the language that is spoken is common, specific to their craft - one of complicated scientific terms and concepts. Yet, even though you might not understand at first - each is eager to explain and bring you along into their world. The beauty of the diversity working together and being so inclusive to those who are curious - young or old - is Magic.</p> <p>If you are of a certain age, and even if you are not, this place is hallowed grounds for those fans of Carl Sagan and Frank Drake. To visit the 'Drake' lounge where they wrote the famous Drake equation or recently hear Dr. Alex Wolscszan of PENN state, quietly talk about how he discovered the first exoplanet which just so happened to be around a pulsar - that is Magic.</p> <p>To be lucky enough to have this opportunity to give back to the Green Bank Observatory by participating in a grass roots support group of it and hear the individual stories of how this place has impacted them and their families, and the call by many to the historic place the Observatory has in our hearts as well as the excitement in its future - is Magic. And, may I just say - yesterday we had an election - and many might say we are divided - but I have to tell you the response to the importance of keeping the Green Bank Observatory fully funded by the NSF such that it can continue to remain a shining example of breakthrough discovery and excellence in education - has been bi- partisan and heartening. We all share a common goal of a better future, of learning more about the mysteries of the Universe that unlock potential advancements for us as a civilization, retaining valuable jobs in our communities, and most importantly in the engagement and bright futures of our children. That is also - Magic.</p>	Against Closure	Email - Scanned	11/14/2016	
494	b	Deana	White		<p>Seeing a group of young students gathered together around a display in the Science Exhibit Hall, receiving instruction from a staff member, participating in a STEM activity - or independently operating the 40-foot telescope - is Magic. This is not your typical COSI experience - it is beyond that - young minds are learning and being challenged to learn concepts, operate equipment, and analyze data in a way that is satisfying - by seeing real, unique results that only their decisions and actions yield. College undergraduates have the opportunity to design features that will be put into place at an actual operating facility. High school students have the opportunity through the Pulsar Search Collaboratory to analyze data that could yield fascinating new discoveries. Middle school students from all over the country representing minority and female future scientists can participate in a Physicists Inspiring the Next Generation (PING) camp each summer. There are many more unique programs available here that thousands of students have had the opportunity to participate in and regain an excitement about learning and problem solving that our more traditional methods of teaching are struggling with. This is Magic.</p> <p>To see my own daughter and son, both who have always been artistically inclined, to grow and learn from their experiences at the Green Bank Observatory - has been utter Magic. My daughter has had the amazing opportunity at 16 to work alongside an undergraduate student from Oregon Tech and under the mentorship of a highly accomplished astronomer to learn computer coding, statistical analysis, research paper protocol, and presentation skills. She has been inspired to pursue a career in engineering and science from her first visits to the Green Bank Observatory and these experiences are only increasing her enthusiasm about the field of study. My son, a computer animator and enthusiast, is encouraged by his exposure to the multiple uses of computers and coding to process and analyze the tremendous amount of data generated from observing with the GBT. The Green Bank Observatory inspires students of all backgrounds to learn about or even pursue careers in science, technology, engineering, and math. The inspiration experienced at Green Bank in turn enriches those fields by benefit of incorporating art and other talents to solve our future challenges. This - again is Magic.</p>	Against Closure	Email - Scanned	11/14/2016	
494	c	Deana	White		<p>To learn about distinguished scientists whose careers began at the Green Bank Observatory - particularly two accomplished women - one a Research Scientist with the Planetary Science Institute who works onsite on NASA projects, including the Dawn mission to Ceres and previously on the Phoenix Mars lander, and the other a Princeton educated PhD in Civil and Environmental Engineering who now works at the Delaware Geological Survey at the University of Delaware - both of whom will readily tell you the invaluable experiences they had gaining a foundation in research methodology and presentation skills as local high school students - is inspiring. The Green Bank Observatory's astronomers, engineers, software engineers, machinists, technicians, and education staff are not only at the top of their fields - they are open to sharing and mentoring what they have learned to the next generation of our problem solvers - including young people from these rural West Virginian communities and students from all over the country of different economic and ethnic backgrounds. That is Magic.</p> <p>To experience and get to know the unique family atmosphere of these communities in and around Green Bank - working and serving together - communities that are hardworking, quiet and caring, knowledgeable and talented, cooperative and respectful of all - is refreshing and yes - Magic.</p> <p>So, the Green Bank Observatory - rising in the midst of this rural, out of the way, radio quiet zone - where ground breaking scientific discovery and innovation is happening, where students are being inspired, satisfied by their contributions, and challenged to think deeper and in more complicated ways, where a community thrives from its very existence - must be fully funded by the NSF to continue to provide this magical experience.</p>	Against Closure	Email - Scanned	11/14/2016	

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495		Ellie	White		<p>I would like to voice my strong support for full NSF funding and continued operation of the Green Bank Observatory. Ever since I first became interested in the fields of astrophysics and technology, the GBO has been an absolutely tremendous resource, in so many ways. As a young student from rural West Virginia, the Green Bank Observatory's education and Science Center staff have provided me with so many amazing and inspiring educational opportunities, like none other in this state and region. From starting out with the Radio Astronomer for a Day and Skynet Junior Scholars programs, to getting to participate in a summer- long radio frequency interference mitigation project under a talented and accomplished radio astronomer, all of these opportunities have continued not only to teach, but to inspire and encourage me to pursue a career in STEM.</p> <p>And I'm not the only one the GBO's STEM educational opportunities have touched. Students of all backgrounds from around the country benefit from these programs and camps every year. One particularly shining example is their Physicists Inspiring the Next Generation (PING) camp, which brings underserved minority and female students from across the country together and gives them extremely valuable exposure to a world-class research facility, and introduces them to many fields of science.</p> <p>Over the time I've been coming to Green Bank, I've started hearing stories of other young people - particularly two young women from rural West Virginia - whom the GBO has inspired to pursue careers in STEM. These two women worked on projects here at the Observatory as high school students, and went on to get their PhD's and pursue successful careers with the Planetary Science Institute and the Delaware Geological Survey. These scientists are an inspiration to me and many others, and are a great testament to the tremendous effectiveness of the GBO's educational programs.</p> <p>As a young female hoping to pursue a career in a historically male-dominated field, my experiences at the GBO have been extremely heartening - the atmosphere is very open and all-inclusive. In my time here I have had many very rewarding interactions with scientists and students, and never felt that I was treated differently because of my gender. In a similar vein, it is very unusual and exciting that the GBO is currently home to three female postdocs from around the world. Clearly, the GBO is helping grow the next generation of women scientists, from grade school to grad school and beyond.</p> <p>I see the Green Bank Observatory as playing a key role in ensuring that in the future, the scientific community will fully reflect the world's diversity and thus grow from that inclusiveness. In addition to this, the GBO is also a top-of-the-line science facility with uniquely versatile and cutting edge capabilities for research on everything from planet formation to cosmology to searching for life outside the Earth.</p> <p>Therefore, I think it is absolutely essential to the state of West Virginia, the U.S., and the entire scientific establishment that the GBO continues to receive full NSF funding for years to come.</p>	Against Closure	Email - Scanned	11/14/2016	
496		Cara	Battersby	NSF Postdoctoral Fellow Harvard-Smithsonian Center for Astrophysics	<p>I am emailing to state my support for the Green Bank Observatory. Green Bank is a treasured facility in the astronomy community. In my field of observational star formation in our Galaxy, Green Bank provides unique capabilities not offered by any other current or planned facilities, that is critically important scientifically. In my view, Green Bank continues to provide high-quality, unique observations that regularly result in high-impact publications.</p> <p>In particular, aspects of Green Bank that are valuable and not achieved elsewhere:</p> <ul style="list-style-type: none"> * The large dish size and the exquisite angular resolution it provides * The frequency ranges covered * The high-quality and flexible instrumentation, in particular, the new W-band receiver ARGUS * and the environment of the radio-quiet zone. <p>Simply put, I cannot state my regard for Green Bank and its importance for the astronomy community highly enough. I would be very happy to answer any questions you have or to give more specific reasoning and examples if requested.</p>	Against Closure	Email - Scanned	11/14/2016	
497		Jeff	DeBellis	Course Director, The Mountain Institute	<p>I was unable to attend the meetings about the Observatory last week but I wanted to send a note in support of the facility. I have worked at a variety of education non-profits within an hour's drive of Green Bank and having the Observatory here is a tremendous asset. It is part of a vibrant experiential education community in this part of West Virginia. It brings tourists to the area and it exposes kids to career options that would otherwise be quite intangible for them to understand. It is one of a number of attractions that people visit in this area. With one less thing to visit, less people will come, and other businesses in the region will suffer as well. In nearby Pendleton County, we already have one government facility that may very well get mothballed (Sugar Grove Naval Station). To have another would push us closer to the economic dark ages.</p>	Against Closure	Email - Scanned	11/14/2016	
498		Zoey	Lightbody	Grosse Point North Radio Astronomy Team	<p>The Green Bank Observatory has had a large impact on the Grosse Pointe North Radio Astronomy club, and many other clubs and organisations for a very long time. I personally as a member of the Grosse Pointe North Radio Astronomy club to tell you how important, and impactful GBO has been to us as a club. It has been an incredible and intriguing experience, as a student to have real experience with a fully operative radio telescope, and how much I would hate for other students with a passion for radio astronomy to miss out on this wonderful experience. For many students in this club this has been the educational experience of a lifetime, and I hope to one day be able to send my kids to NRAO for the amazing experiences that I had. Our clubs experiences at NRAO not only expanded our knowledge of radio astronomy, but brought us closer as a club. This decision will not only effect us as a club, but it will have a large impact on students that will be robbed of the experience of using a real radio telescope, and furthering their knowledge of radio astronomy. Not only is it an educational experience for youth interested in the field of science, but it is an exploration opportunity for the whole astronomy community, it opens up a world of opportunity beyond optical astronomy. Radio astronomy allows a graph to be made of the radio waves given off of space objects that you can't see with an optical telescope. I ask that you please take this into consideration, and I thank you for your time.</p>	Against Closure	Email - Scanned	11/14/2016	

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499		Wanda	Lucas		<p>Please consider continuing funding for the Green Bank facility. Personally I would love to see increased funding as we give thought to the importance of space exploration and travel.</p> <p>Green Bank has been invaluable in the past for increasing our knowledge of astronomy and radio communications. It is still valuable for education in our local school districts as most WV students will never visit NASA. It is also a valuable tourist destination for our state and surrounding regions and thus contributes to our state economy.</p>	Against Closure	Email - Scanned	11/14/2016	
500		Robert	Welsh	Assistant Professor, Physics & Astronomy Bucks County Community College	<p>I am writing with response to comments made concerning the possibility of closing NRAO Green Bank Observatory.</p> <p>I began my graduate work there in 1987 and continued in 1988. I was a Research Experience Teacher during summer 2000 working under Dr. Glen Langston on the GPA survey.</p> <p>During that summer employment, I created a teaching web page dealing with the Milky Way Galaxy that is now used at both the high school and university levels.</p> <p>I returned to NRAO Green Bank as a high school physics teacher to enhance the opportunities for my students through the Chautauagua program. Lessons learned there are used in my classes.</p> <p>I cannot believe that the Federal government would consider closing this facility. Not only does it perform outstanding scientific research but NRAO Green Bank's educational outreach is beyond compare.</p> <p>I will do whatever is necessary to aid the continued work of this facility.</p>	Against Closure	Email - Scanned	11/14/2016	
501		Rodney	Waugh	President, Kanawha Valley Astronomical Society	<p>... KVAS operates the Breezy Point Observatory that is equipped with a 16-inch reflector telescope on a fully go-to Astro- Physics mount. We practice outreach astronomy for any public group. We have never charged for a star party at our observatory. Our website is: www.kvas.org. We have held Astronomy Weekend at Blackwater Falls State Park for 28 years and partnered with the Central Appalachian Astronomy Club (www.caacwv.com) that is based near Clarksburg, West Virginia to hold Starquest at Greenbank for 13 years. Both events are geared toward observation and education. Speakers come in from local universities and from across the United States. The most famous speaker was Alan Bean. He came to Greenbank Starquest in 2009. He was the fourth man to walk on the moon. As a lifelong resident of West Virginia, I am very proud of the Greenbank Observatory and the research that takes place there. The employees are friendly, informative, motivated, you can almost see their love for astronomy in their eyes. I traveled to Greenbank to attend and speak at the November 9th National Science Foundation Environmental Impact Meeting. My speech was short, please read my thoughts listed below.</p> <p>Green Bank Observatory (GBO) contributes to the community in many ways. It is the largest employer in Pocahontas County, works with local emergency services, serves as an evacuation center and contributes to the county tax base. This can be a tough place to live, CB antennas are attached to the fire hydrants to aid in their location in heavy snow. As wireless is banned in the community, the Observatory works with the schools and library to wire internet so the public can have access. The Greenbank Observatory is largely responsible for the astronomy department at West Virginia University. Through the years, dozens of students have taken part in research at Greenbank.</p> <p>In my opinion, there are only 2 viable options. I prefer the first.</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science focused operations (No-Action Alternative) 2. Collaboration for interested parties for science and education-focused operations with reduced NSF-funded scope. GBO could continue to work with colleges, universities, SETI, Breakthru Listen and other qualified groups that can contribute to the funding of GBO. <p>No other options are acceptable. The other three options would be a giant waste of taxpayer dollars; it would slow or stop important research and reduce America's standing in astronomy research.</p> <p>With the removal of the Cherry Grove Navy Base, the Radio Quiet Zone is now anchored to the Greenbank Observatory. If GBO were to be shut down, the 13,000 Square Mile Radio Quiet Zone would be lost. It would be very hard to replace it in the future. Science, in one form or another, accomplished by one individual or large institutions is responsible for inventing or improving every manmade object. We do live comfortable lives... If America is to remain in the lead, we must continue to promote scientific research. You just never know where the next discovery will take us.</p>	Against Closure	Email - Scanned	11/14/2016	
502		David	Thompson	Multiwavelength Coordinator Fermi Gamma-ray Space Telescope Project	<p>Since its launch in 2008, the Fermi Gamma-ray Space Telescope has continually pursued multiwavelength studies in cooperation with a wide variety of telescopes, because we learn so much more about the Universe by looking at cosmic objects in a variety of ways. Surprisingly, gamma rays, the shortest-wavelength form of light, and radio waves, the longest-wavelength form, are frequently produced in the same extreme astrophysical environments The combination of radio and gamma-ray observations reveal where and how powerful energy releases take place throughout the Universe.</p> <p>As a specific example, the unique capabilities of the Green Bank Radio Observatory have been crucial in our cooperative studies of pulsars, the rapidly rotating neutron stars representing endpoints of stellar evolution. The overwhelming majority of gamma-ray "stars" in the Milky Way are pulsars – understanding the high-energy nature of our home galaxy is hopeless if we do not first master the pulsars. Unidentified Fermi gamma-ray sources have become prime targets for radio pulsar searches, revealing many new black widow/redback pulsars, a 'missing link' in the evolution of millisecond pulsars. We have also found a new pulsar with radio, gamma-ray, and optical emission, and millisecond pulsars stable enough to be valuable additions to pulsar timing array searches for nanoHertz gravitational waves such as the NanoGrav program. Many of these discoveries were only possible with the broad range of radio capabilities at Green Bank.</p> <p>The Fermi observatory will continue operation for at least several more years, making use of improved performance introduced last year, but it does have a finite lifetime. We look forward to continuing the ongoing cooperative projects with Green Bank, convinced that important scientific discoveries involving the synergy between Fermi and Green Bank will be made. Retaining the scientific capabilities of Green Bank is clearly essential to this process.</p>	Against Closure	Email - Scanned	11/14/2016	GBTletter_final.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
503		Dave	Huber	Director of Program Operations NROCKS Outdoor Center	NROCKS Outdoor Adventures, along with our parent company Endless Horizons, are very interested in the continual operation of the Greenbank Observatory(GBO). For over 30 years, Endless Horizons has focused on creating lifelong learning and growth opportunities for our Nation's youth through our operation of Summer Camps, Outdoor Learning Centers and Job Corp Centers in both Virginia and West Virginia. Throughout our endeavors, we continue to invest in our local region and its people. NROCKS Outdoor Adventures, located in Circleville WV, is an extension of this work. Since 2009 we have continued to invest and expand within Pendleton County. We would not be as successful without our regional partners such as the GBO. It is the combination of attractions and activities in our region that have set us apart as a destination experience. Without such a key player as the GBO, we will all certainly feel the consequences. Beyond the scientific significance of this site and the economic impact to the region, a closure of this facility would result in a negative impact on WV's educational system. As we have reviewed the various alternative uses, we believe the only two options that are viable are continued funding at the current level, or Option 2 - collaboration with interested parties and only a slightly reduced rate of funding from the National Science Foundation. We support the continued operation of the GBO and look forward to a successful resolution to maintain the current level of operations.	Against Closure	Email - Scanned	11/14/2016	Correspondence, GBO Support; 2016-11-14.pdf
504		William	Jordan	Branch Manager, Citizens Bank of West Virginia	I am William E Jordan, President of the Pocahontas County Chamber of Commerce and Branch Manager for Citizens Bank of West Virginia. I attended the meeting on November 9, 2016 at the GBO. I am writing this letter in support of options 1 or 2. I am very concerned with options 3, 4 and 5; this would be devastating and a huge impact to our County and economy. The GBO is a very unique and amazing place for youth and adults to visit and offer educational classes. The GBO employs around 100 full time and 40 part time people and their spouses work in the community as well. If options 3, 4 or 5 happen then not only would the employees leave, but the family would go too. It is a trickledown effect. Every business, schools, and individual will be affected. Not only is the GBO important for employment of 5% of Pocahontas County workforce, it also brings visitors to the area that stimulate the economy; they spend the night, eat, and shop locally. Pocahontas County is Nature's Mountain Playground and GBO is a very big attraction that supports the community. Scientists from all around the world do research onsite. Please consider options 1 or 2 and save our community.	Against Closure	Email - Scanned	11/14/2016	GBOIETTER.pdf
505	a	Sean	Bryan	SEES/Cosmology/Physics Arizona State University	The US is a leader in the worldwide effort to use millimeter wave observations to understand the world around us. In astronomy, millimeter waves let us see all the way out to beginning of the universe, nearby regions where stars are forming, and galaxies in between. In addition, millimeter waves have a wide range of past, current, and future remote sensing applications for both civilian and defense use. Astronomy and remote sensing compliment each other well, both in terms of technology development and training US personnel. The Green Bank Observatory and specifically the 100-meter Green Bank Telescope (GBT) are unique resources to the scientific and academic community. At centimeter and millimeter wave frequencies (20-115 GHz), the GBT is an extremely valuable complement to the AIMA interferometer, and is operated at only a fraction of the cost. As a single dish, the GBT provides faster mapping speeds and a larger field of view than AIMA, and serves as a valuable source finder for detailed high-resolution interferometric follow-up. I therefore write in support of the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they are now performed, including adhering to the Open Skies policy. The GBT is an important US resource, especially in the context of other US capabilities, as well as international teams with strong US participation. Thank you for considering continuing these important activities.	Against Closure	Email - Scanned	11/14/2016	
505	b	Sean	Bryan	SESE/Cosmology/Physics Arizona State University	Please see the high-frequency GBT science case recently presented in Bally et al. 2016, available here: https://arxiv.org/abs/1610.09014 (submitted 27 Oct 2016). As noted in this white paper, the most impressive upgrades to the GBT have only recently been commissioned or are still undergoing commissioning, keeping the GBT poised for great discoveries unique to its capabilities.	Against Closure	Email - Scanned	11/14/2016	
506		Mike, Katrina, Mica & Noa	Yoder		We are writing to express our support for keeping the Green Bank Observatory operating, and our belief in the importance of the work that the facility makes possible. Our family feels that closing the observatory would be a step backward for this field of science. Please continue to support the research emerging from this unique observatory.	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
507		Adam	Ginsburg	Jansky fellow, National Radio Astronomy Observatory	<p>The Green Bank Telescope provides a unique resource for the radio and millimeter astronomy communities. No other telescope has comparable capabilities in terms of overall sensitivity, resolution, and image fidelity in the range it covers. Some of the telescope's most powerful and unique capabilities have only just become available to the community, so the GBT's impact is likely to increase if it continues to operate. I am therefore writing in support of the 'No-action alternative' to continue science operations as they are now performed, including the open skies policy.</p> <p>Two new instruments are just now becoming available to the astronomical community: the ARGUS high-frequency heterodyne array and the MUSTANG-II bolometer array. Both of these instruments are exploring entirely new parameter space in frequency and area covered, and beyond their stated science goals (see http://www.gb.nrao.edu/argus/ and http://www.gb.nrao.edu/mustang/), they are likely to yield new and unpredicted discoveries. MUSTANG also provides a critical complement to AIMA, filling in the short-spacings in the continuum that AIMA is unable to observe.</p> <p>GBT's most important capabilities for the star formation and interstellar medium communities is its ability to perform large area surveys. With ARGUS, MUSTANG, and the KPFA, the telescope is the most efficient and capable machine at mapping large areas of the sky at millimeter and centimeter frequencies with useful spatial resolution. AIMA can never achieve similar areal coverage, and smaller telescopes can never provide the resolution needed to identify individual forming stars. These large programs (e.g., GAS, KEYSTONE, MGPS) bring together an international community and permit collaboration to answer questions critical for understanding both the origins of solar systems and galaxies. Without the open skies policy and continued science operations, such collaborations will be fractured and the US community will be left isolated and without the necessary tools to continue in this field.</p> <p>The GBT also serves as one of the last available training grounds for young astronomers to learn radio astronomy in the US. The GBT allows and encourages students to visit the telescope and learn to use it and understand its instrumentation. No other radio telescope serves this function. If the US is to continue having a role in radio and millimeter astronomy in the future, such training is needed. If anything, the capabilities and accessibility of the GBT should be expanded.</p>	Against Closure	Email - Scanned	11/14/2016	
508		Erik	Rosolowsky	Assoc. Professor • Dept. of Physics	<p>I am writing to advocate the "No Action Alternative" for the future of the Green Bank Telescope (GBT). As a radio astronomer who uses telescopes globally, I find that the GBT is the world's best single-dish radio telescope operating in the critical wavelength regime of 2.6 mm to 10 cm and provides excellent capabilities at longer wavelengths.</p> <p>The GBT serves a central role in my research program that studies the missing links in our understanding of our cosmic origins through the process of star formation. Recent upgrades to the GBT spectrometer and receiver suite provide excellent spectral line capabilities that allow for wide area mapping of this process of star formation. This flexible multi-line, multi-beam receiver capability is simply unmatched at other facilities.</p> <p>I recognize that we must operate in a constrained science funding environment. However, previous decisions that other facilities were higher priority than the GBT (e.g., Arecibo, Effelsberg) appear, from my perspective, to be wrongly decided. In my experience, the GBT is easier to use than these comparable facilities and provides better data.</p> <p>The GBT also provides a critical single-dish complement to the US and Canadian national investments in the Jansky Very large Array (VLA) and the Atacama large Millimetre/submillimetre Array (ALMA). The GBT provides the zero-spacing information that allows these interferometers to see a complete and accurate picture. More importantly, the single-dish survey capabilities of the GBT are critical for determining where the VLA and ALMA should look. Without the GBT capabilities, these observatories will become less efficient and produce less accurate data.</p> <p>I am also grateful for the NSF support for the GBT that has provided many of the central discoveries in my research career. While I completed my research training in the United States, I have since moved to Canada. As more funding opportunities become available here in Canada, I will be seeking Canadian support for the GBT, extending the beneficial relationship we have established through the North American Partnership for Radio Astronomy. The capabilities of the GBT for high quality science are simply too great to lose.</p>	Against Closure	Email - Scanned	11/14/2016	
509		Traci	Knabenshue	Sustainability Director, Facilities & Services	<p>I urge you to continue funding the Green Bank Telescope in southern West Virginia for several reasons.</p> <ol style="list-style-type: none"> 1) There seem to be many scientists in agreement that the 'movable' aspect of the telescope makes it valuable in ways that other telescopes with similar capabilities are not. 2) Researchers at WVU have been utilizing the telescope to do important and ongoing pulsar research. 3) The telescope is a shining example of STEM for West Virginia's youth and general citizens. These students need these examples in their backyard to show them the potential of STEM careers. 	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
510		Chris	Thibodeux		<p>I'm writing to express my thoughts on the Green Bank Observatory as a scientific research site.</p> <p>Specifically, with regards to the Green Bank Telescope: its astronomical capabilities are still unmatched worldwide. With an off-axis focus design, the GBT provides greater dynamic range than the similarly-sized Effelsberg Radio Telescope. With its active surface, imaging data are remarkably clear. Being fully steerable, it can quickly obtain large-scale mappings. And with its suite of receiver instruments, including its recent capabilities in the 3mm dust- continuum regime, the GBT has an impressive domain of observing frequencies. Consequently, it is capable of mapping neutral atomic hydrogen and dust emissions-and certainly myriad molecular species of relevance to galactic evolution.</p> <p>It's probably not a surprise to hear from an astronomy grad student who's stating that an astronomy facility is great, but the GBT, and the entire Green Bank Observatory, are far better than just "good enough." The telescope and the facility are a point of pride for all of West Virginia-in particular, the astronomy program at West Virginia University benefits greatly from its access to the site. The Observatory hosts a number of outreach events, and also offers Research Experience for Undergraduates program opportunities that have allowed me and many others in my field-and even in my department-to gain scientific experience and skills that are crucial to our careers as astronomers.</p> <p>To put it bluntly, the GBO excels at both scientific research and scientific outreach. My scientific career and the future careers of many up-and-coming undergraduate and graduate astronomy students will benefit hugely from the internship and research opportunities the Observatory offers. I urge the NSF to continue funding the Observatory by choosing the option of "No-Action."</p>	Against Closure	Email - Scanned	11/14/2016	
511	a	Paola	Andreani	European AIMA Regional Centre Manager European Southern Observatory Garching, Germany.	<p>this email is to support the scientific case of the Green Bank Observatory and specifically the 100-meter Green Bank Telescope (GBT), which is the largest steerable single dish telescope in the world, are unique resources to the scientific and academic community.</p> <p>As AIMA scientist I would like to stress the importance of the GBT at high frequencies (20-115 GHz), in particular as complementary facility to the AIMA array. As a single dish, the GBT provides faster mapping speeds and a larger field of view than AIMA, and serves as a valuable source finder for detailed high-resolution interferometric follow-up.</p> <p>I am writing to support the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they are now performed, including adhering to the Open Skies policy.</p> <p>Please consider the future of U.S. mm-wave and radio instrumentation as you debate the future of this unparalleled resource. Please also consider the important precedent the NSF has maintained, for the U.S. and the world, of outreach programs, cutting edge science, and the Open Skies policy that anyone with a great science case can obtain observations on the GBT.</p>	Against Closure	Email - Scanned	11/14/2016	
511	b	Paola	Andreani	European AIMA Regional Centre Manager European Southern Observatory Garching, Germany.	<p>I have read recently the high-frequency GBT science case presented by Bally et al. 2016 (https://arxiv.org/abs/1610.09014) and I am convinced that the impressive upgrades to the GBT recently commissioned or still undergoing commissioning keep the GBT at the verge of great discoveries unique to its capabilities. In addition to this, and eventually more important, the GBT is a rare resource in education and training of the next generation of astronomical instrument scientists. This is achieved primarily through outreach to the local West Virginia community and through the PI- instrumentation program.</p>	Against Closure	Email - Scanned	11/14/2016	
512		William	Cotton		<p>I would like to express my support for Greenbank option "no action" (continue current status).</p> <p>In my 45+ years as a professional astronomer I have used many world class telescopes all over the world; the GBT certainly ranks among the best. I have used the GBT to great advantage in my own research. The excellent quality of the instrument at its highest frequencies gives it unique capabilities in terms of resolution and sensitivity. At the lower frequencies, the National Radio Quiet Zone gives it a great boost. The GBT represents a very substantial investment by the NSF and the astronomical community and it would be a great shame if this resource were lost to the community.</p>	Against Closure	Email - Scanned	11/14/2016	
513		Christian	Hores		<p>Please keep the Green Bank Observatory open. It is vital to humankind's understanding of the universe.</p>	Against Closure	Email - Scanned	11/14/2016	
514		Mackenzie	Waldo		<p>Please do not close down the Green Bank Telescope. I remember learning about it in High School and had friends that got to spend a weekend there. I always hoped I would have the chance to visit so I am hoping you will consider leaving it open so that I have a chance to see it and my children do too.</p>	Against Closure	Email - Scanned	11/14/2016	
515		Mark	Sykes		<p>Blank email; Subject line is: Green Bank Observatory</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
516		Philip	Meyers	Senior Astrophysicist Smithsonian Astrophysical Observatory Cambridge, Massachusetts	<p>I am writing to advocate continuing NSF support of the Green Bank Telescope (GBT).</p> <p>In the EIS to evaluate potential environmental effects of proposed changes to operations at the Green Bank Observatory (Federal Register/Vol. 81, No. 202, October 19, 2016 Notices), five alternatives are listed.</p> <p>I am writing to support the first option, the "No-Action Alternative" for continued NSF investment for science- focused operations.</p> <p>The GBT is a world-unique and outstanding scientific instrument, with great potential for advancing our understanding of fundamental physics in the areas of gravitational wave radiation, interstellar molecules, solar system studies, star formation, and stars and galaxies. Some of its outstanding accomplishments and capabilities are detailed in the white papers arXiv:1610.02329 and arXiv:1610.09014.</p> <p>As a scientific researcher for the past four decades, and as a user of the GBT, I believe it is extremely important to the advancement of our scientific understanding of the universe for the US NSF to provide the maximum possible support to the GBT.</p>	Against Closure	Email - Scanned	11/14/2016	
517	a	Thomas	Epling		<p>I wish to submit a letter of support for the continued National Science Foundation (NSF) investment for science-focused operations for the Green Bank Observatory in Green Bank, West Virginia. This letter is contingent on the assumption that the observatory continues to provide innovative and relevant scientific research opportunities for the world's scientific communities.</p> <p>I am a resident of Pocahontas County, West Virginia. I live within a half-hour drive of the Green Bank Observatory. I believe that the Green Bank Observatory is an integral part of Pocahontas County and the State of West Virginia. Beyond its value as a world renowned research facility, the Green Bank Observatory provides invaluable assets to our community economically, for safety reasons, and for education.</p> <p>The Green Bank Observatory is a huge economic asset to our County and our state. The telescope employs numerous people who have higher education and skills than many other people in our county. This employment certainly raises the economy of the region. In addition, the observatory attracts a huge number of tourists to the region, thus contributing to its economy. The employees of the observatory contribute priceless assets in the form of volunteer work to the community. They work as scout leaders, government participants, charitable and philanthropic organization members, EMT personnel, wildlife promoters, and arts enthusiasts.</p> <p>The machine shop at the Green Bank telescope is a tremendous asset for the community. Its employees are available to provide expertise and help for many residents in their times of need.</p> <p>The campus of the Green Bank Observatory provides a great recreational opportunity for residents. There are miles of road-ways and trails open to the public that are used for hiking, bicycling, as well as for running and cycling events. Numerous arts and entertainment events make use of the venue as well.</p> <p>The Green Bank Observatory is a tremendous asset to Pocahontas County and the state of West Virginia. I can not envision this region without its presence. I ask that the NSF continue its investment in this facility.</p>	Against Closure	Email - Scanned	11/14/2016	
517	b	Thomas	Epling		<p>The Green Bank Observatory is a critical resource for the safety of our community. Not only do its employees contribute to safety by volunteering as EMTs, but the observatory offers its facilities during weather related crises, such as floods.</p>	Against Closure	Email - Scanned	11/14/2016	
517	c	Thomas	Epling		<p>The Green Bank Observatory is a very important asset to our educational community. It provides valuable resources for science teachers in our school system. It provides a research radio telescope for the use of students. It sponsors and supports local science fairs. One student was recently featured in a local newspaper article for having participated in a science fair at the observatory, who continues to be fascinated by her project, and will likely pursue a career in science as a result. The observatory has a goal in which it states that it wants to touch the life of every student in the state of West Virginia. West Virginia ranks at the bottom of the nation in its school funding and school performance. The mission of the telescope, in light of this, is a tremendous asset for education in our state. The Green Bank Elementary and Middle School are located next to the Green Bank Observatory. Observatory employees have, on numerous occasions, provided services to the school in the form of labor and equipment.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
518	a	Judith	Clark		<p>I'm writing in support of continued NSF funding for the Green Bank Observatory. The Observatory's presence in Northern Pocahontas County forms the foundation for the welfare and quality of life of all persons living in the surrounding area. My husband & I moved to Pocahontas County in October 2008. We live in Dunmore, about 10 miles from the Observatory. Prior to moving here we had enjoyed hiking, camping and bicycling in this area each summer. Like many seasonal visitors, we didn't know any local residents. Our first friends were residents who worked at the Observatory. An Observatory employee introduced himself and told me about the Deer Creek Book Club to which all interested persons are invited. My husband and I joined and have been members of this group ever since. Many members of the Deer Creek Book Club are also active in another book club called "The Ladies Book Social" to which I belong. We attend Square Dances and Jamborees held at the Dunmore Community Center. Many of the musicians are employees at the Observatory. The same is true about the events at the Opera House in Marlinton. Performers and also the lighting and sound crews work at the Observatory and volunteer their skills at the Opera House. Below is a list of many other ways the employees and facilities at the Observatory enrich and benefit the community:</p> <p>The Observatory provides shelter for area residents who need help with water, electricity, heat and air conditioning when the community loses power. The Observatory grounds are open to hikers and bicycle riders. Maps and a pamphlet offering advice about what to do if one encounters bears or other wildlife can be found at the Tour Center. My husband & I have walked and bicycled the trails. Unfortunately we haven't yet seen any bears. This year, the Observatory grounds hosted a new project: growing potatoes as part of a West Virginia statewide program to encourage agriculture. We have sampled these potatoes and fully support this use of the beautiful property we have hiked and biked.</p> <p>The Observatory's educational department offers astronomical research opportunities to students of all ages ranging from searching for pulsars to constructing robots from Legos. The Observatory Tours and special events draw visitors from around the world, adding to needed Tourism dollars for Pocahontas County.</p> <p>The Observatory provides jobs for over 100 employees, who along with their family members help support many local services and businesses. Without the Observatory employees, those of us who also live here would need to travel at least 50 miles to shop and to receive medical and dental care. Continued below is a list of many of the services, shopping opportunities, community events and benefits that result from the Observatory's presence and that would probably disappear if the Green Bank Observatory had to close. MEDICAL & OTHER SERVICES...ORGANIZATIONS... SHOPPING... OBSERVATORY TOURIST ATTRACTIONS... OBSERVATORY EVENTS...OBSERVATORY GROUNDS USED FOR Community Events</p>	Against Closure	Email - Scanned	11/14/2016	
518	b	Judith	Clark		<p>The 13,000 square mile National Radio Quiet Zone was declared decades ago to ensure that the Observatory's radio telescopes had minimal radio interference. Today the Quiet Zone also provides sanctuary for over 50 residents who seek reduced exposure to Electromagnetic Radiation for their health. Other Electro - Sensitive persons come to Pocahontas County for respite from the ever-increasing harmful radiation in their home and work environment elsewhere. These special residents and visitors gratefully describe the relief they gain from being in the National Radio Quiet Zone. They also contribute to economy of Pocahontas County during their short stays here. Our county is almost the size of Rhode Island, yet there are only 8,607 residents. The refugees and their families make up a noticeable part of the population.</p>	Against Closure	Email - Scanned	11/14/2016	
519		Lee	Kass	Adjunct Professor, Dept. of Biology, & Division of Plant and Soil Sciences, WVU	<p>I write on behalf of the students of West Virginia University and the people of West Virginia. The Green Bank Observatory is an important economic asset for the region, our state and our country. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy. West Virginia is currently depressed due to its reliance on coal production, which is no longer a viable alternative. Students come to WVU specifically to use the facilities at Green Bank. West Virginia and our nation takes enormous pride in the remarkable scientific research performed at the observatory.</p> <p>For over half a century, the observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in WV and an important economic engine in the region. The Green Bank Observatory, is a world class facility and the work of their talented researchers provides a window to the universe.</p> <p>The Green Bank Observatory employs West Virginians, gives our children incredible opportunities, and brings millions in investments to our state. The Green Bank Observatory is important to WV and to our country. Nestled within our nation's "Quiet Zone", radio astronomers can listen to remote undertones from the universe, in order to discover answers to astronomical questions.</p> <p>Teachers and students rely on this facility for teaching and research, from elementary to graduate school: http://greenbankobservatory.org/</p> <p>Please consider further funding for this gem of science.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
520	a	Jon	Wallace		<p>Thank you for the opportunity to give you my perspective as you consider how to move forward with GBO.</p> <p>As I understand it, the alternatives you are considering range from fully funding the maintenance and operation of the Ob, to funding its deconstruction. And while I understand that the NSF has many demands on its resources, I do not see the logic in the idea of decommissioning the GBO by turning it into a theme park, mothballing it or tearing it down. Those alternatives are in contradiction to the goals of the NSF and, quite honestly, would seem like a terrible waste of the taxpayer dollars recently invested in new telescopes.</p> <p>Part of your mission is to "provide funding for research centers, instruments and facilities that allow scientists, engineers and students to work at the outermost frontiers of knowledge." The GBO offers just that. It is home to the Green Bank Telescope (GBT), the largest, fully steerable radio telescope in the world. It cost 96 million dollars to build and has been in operation for only about 13 years. Since its construction the staff at GBO has continually invested in low-cost upgrades and improvements, making the telescope many times more powerful than originally designed. It is uniquely qualified to study molecular building blocks in nebulae and other gas clouds; probe the nature of matter at extreme densities; map diffuse clouds of intergalactic gas (only detectable in radio frequencies); and calibrate cosmic distance scales. Lastly, researchers are provided thousands of hours of open-access time each year to the GBT. For example, gravitational wave researchers are using the GBT. Their research would provide supporting evidence to the data being collected by LIGO and perhaps would offer other avenues for exploring this brand new branch of astronomy. Since the NSF has stated that funding research grants is another major priority, the GBO seems to provide a place for the NSF to fulfill two of its goals.</p>	Against Closure	Email - Scanned	11/14/2016	
520	b	Jon	Wallace		<p>"Another essential element in NSF's mission is support for science and engineering education, from pre-K through graduate school and beyond." That is a major goal for the GBO as well. Estimates of up to 65% of current astronomy knowledge were gained through the use of radio telescopes, yet few people understand radio astronomy despite its enormous contributions to our knowledge. The continued efforts of the educators at the GBO and the people they train are our best chance to get this information out. The facility hosts over 50,000 visitors and 3500 students every year. Groups ranging from students to teachers, researchers and the general public, can spend a night and use the educational telescope, or a week for an educational workshop, or participate in STEM education programs. The exceptional opportunities offered at the GBO and through outreach are among the best I've encountered as an educator and science enthusiast. The staff, especially Sue Ann Heatherly, have developed wonderful teaching and training exercises and experiences. I had the pleasure of working on one, the Itty Bitty radio Telescope (IBT) project with the GBO. As a Society of Amateur Radio Astronomers (SARA) board member, I worked with the person who developed the IBT, creating material for teaching participants how to use the IBT to teach about radio astronomy. SARA and the GBO trained dozens of people and provided IBTs for their use. Many of these people still use these devices to this day, as I do, to teach about radio astronomy.</p> <p>Even a casual visitor to the GBO can learn much about our progress in science simply by walking the grounds. The historical significance of this facility can't be matched anywhere in the world. The Ewen-Purcell horn which was used to detect hydrogen emissions for the first time; Grote Reber's scope, which got radio astronomy started after Jansky's discoveries; a reproduction of Jansky's antenna that actually works and can be used by visitors; as well as so many other items of significance.</p> <p>My experiences at the GBO have been life altering. I was a science teacher for over 32 years and, although retired, I continue to teach in schools, libraries and other venues. I started out knowing nearly nothing about radio astronomy but got inspired to include non-visual physics into my teaching and developed numerous demonstrations and labs for people to experience radio astronomy. I have trained hundreds of teachers over the years and shared these demonstrations, presentations and ideas with hundreds of people worldwide. All of this was because the people of the GBO took the time to nurture my (and innumerable others) interest in science and especially radio astronomy.</p> <p>Please consider your decision carefully. Not only is the GBT a unique, cutting-edge instrument unlike any other in the world, but the history, research, education and support provided by this institution is unlike anything else. Fully funding the GBO may not be possible, but partially funding it until the staff can build a consortium of interested researcher institutions surely is.</p>	Against Closure	Email - Scanned	11/14/2016	
521	a	J.Christopher	Howk	Department of Physics, University of Notre Dame	<p>I am writing to share my strong support for the continued availability of the Green Bank Telescope (GBT) to the worldwide astronomical community. As I understand it, the NSF is considering the future of this unique instrument, including reducing funding for its operations that would make it untenable for the Green Bank Observatory (GBO) to continue to offer it as a general use facility.</p> <p>The GBT is unique in all of radio astronomy. Not only does it represent the largest fully-steerable radio telescope (meaning it has access to the entire northern sky), but its unblocked aperture, exquisite instrumentation, and excellent site make it an incredibly powerful tool for the detection of faint radio signals.</p> <p>All of this is critical for pursuing cutting-edge science, and the GBT fills several niches that no other instrument can. As I see it, chief among these is the study of radio pulsars, a by-product of which will be (I believe) the detection of low-frequency gravitational waves that probe the coalescence of super-massive black holes in the early Universe. While LIGO may have detected gravitational waves from stellar mass black holes (a Nobel Prize-level result), it will shed no light on the more mysterious black holes found at the centers of all galaxies, the supermassive black holes that contain millions or billions times the mass of our sun. The GBT is the world's foremost instrument for studying pulsars, which are probes of the gravitational waves that probe the build-up of these most massive objects.</p> <p>In addition, the GBT fills a niche in mm-wave astronomy; as the largest-aperture mm-wave telescope, it allows the study of objects on scales that cannot be accomplished by the NSF's other (much more expensive) major mm- wave observatory, ALMA. I have also been blown away by the solar system studies (of planets, moons, and asteroids) that the GBT has enabled.</p> <p>The GBT has been very important in my own research. It provides the most sensitive and *precise* measures of the 21-cm emission from neutral hydrogen that we have available. We have used this to study the gas that is falling into the Milky Way from its halo and gas that is being ejected from the Milky Way's disk by massive supernova explosions. Understanding this circulation of material into and from the "atmosphere" of our Galaxy. Without the availability of the GBT observations, several programs we have pursued with the Hubble Space Telescope would not have been possible. Thus, the relatively small national investment in GBT operations have allowed unique studies to be pursued with an Hubble, an instrument that costs 10x more to operate, a good return for relatively little investment.</p>	Against Closure	Email - Scanned	11/14/2016	
521	b	J.Christopher	Howk	Department of Physics, University of Notre Dame	<p>The GBT has also been critical in training graduate students. It is an instrument they can come to understand well and operate even from their apartments as they observe remotely.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
521	c	J.Christopher	Howk	Department of Physics, University of Notre Dame	I hope the NSF can find the resources to continue to provide the GBT as an observing resource to the community. And, I find the title of the recent white paper on the GBT's status summarizes the situation perfectly: ""The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017"" (https://arxiv.org/abs/1610.02329).	Against Closure	Email - Scanned	11/14/2016	
522	a	Meredith	McCain		<p>It has come to my attention through the media that the National Science Foundation has opened a period of time for the public to comment on the future of the Green Bank Telescope (GBT).</p> <p>I strongly feel the need to comment on this because my sister and grandson and I visited Green Bank in August and were duly impressed by the GBT.</p> <p>The reason that we were willing to make the drive from Rockville, Maryland through the mountains to Green Bank, West Virginia is because we found out that it takes only a half a day's drive from the DC Metro area to reach the largest steerable single-dish radio telescope in the world!</p> <p>Our visit became important to me also because I wanted to piggyback on my daughter's trip with my grandson to Hawaii, which they took in part in order to learn all that they could about one of the world's most famous optical telescopes at the Gemini North Observatory on the summit of Mauna Kea in Hawaii. How exciting I thought it would be for my high school age grandson to see another example of a giant telescope in order to learn that, though both telescopes study the universe, they are very different from each other.</p> <p>When we arrived in Green Bank, the GBT Visitors Center expanded our education about the unique differences between these two specific telescopes with a helpful display. We also were able to listen to the sounds from three different pulsars that were recorded by the GBT.</p> <p>The Visitors Center also bused us to the telescope which was an awesome sight. We were shocked to find out even the batteries in our cell phones could actually interfere with the telescope's very sensitive ability to intercept radio waves from space. For this reason we were told by our guide, the GBT is in a federally protected area called the Quiet Zone. All this so close to the Nation's Capital!</p> <p>We were one of the 50,000 annual visitors to come to Green Bank to learn about the work of the GBT. With more public outreach in the DC Metro area alone, I am sure that this number could be greatly increased.</p>	Against Closure	Email - Scanned	11/14/2016	
522	b	Meredith	McCain		<p>We have since learned that the GBT is the birthplace of the National Radio Astronomy Observatory System (NRAO). The NRAO describes the GBT as a premier instrument for research into fundamental physics, star formation, galaxies across cosmic time, and the origins of life.</p> <p>I have watched science programs on television pertaining to other subjects of interest to GBT researchers, such as black holes and extraterrestrial intelligence. In October an article caught my eye entitled, ""The Green Bank Telescope Will Train Its Massive Dish at 'Alien Megastructure' Star"" (newsledge.com). I promptly sent it to my grandson.</p> <p>We were also impressed to learn that 3,500 students have utilized the telescope and that it is a major tool of astronomers world-wide. Nothing that I have read has led me to conclude that the GBT is not equipped with the latest and most up to date technologies, plus the GBT can be positioned anywhere over 80% of the open sky. I have read that stationary radio telescopes cannot be focused on more than 30% of the sky since they are not steerable.</p> <p>I was amazed to find out that the annual budget for the GBT is less than 10 million dollars. I am sure that this is just a drop in the bucket in the NSF's annual budget. In conclusion, I strongly feel that the National Science Foundation should return funding of the GBT to 100%, or at a minimum, fund it at 70%, in partnership with other organizations. Anything less would be wrong.</p>	Against Closure	Email - Scanned	11/14/2016	
523		Brent	Tully	University of Hawaii at Manoa Institute for Astronomy	<p>I am writing in connection with the discussion over the future disposition of the Robert C. Byrd Green Bank Telescope. My standing and interest emanates from many years of usage of the facility and its products.</p> <p>My specific scientific activities involve observations of emission in the neutral Hydrogen spectral line at 21 cm from galaxies. The width of the spectral line is related to the mass of a target galaxy which, combined with optical information on its brightness, gives a measure of the galaxy's distance. The methodology has been used to estimate the size and age of the universe. Recently it has led to the identification of the Laniakea Supercluster. The discovery was highlighted by the NSF at the last General Assembly of the International Astronomical Union.</p> <p>This program involves the observations of many thousands of galaxies and is ongoing. GBT is our preferred radio astronomy facility and it is important to understand why. For unresolved targets, almost always the case with our program, the sensitivity for detection goes as the fourth power of the telescope aperture. Big is much much better. The only serious competition for GBT has been Arecibo Telescope, but that facility accesses only a limited part of the sky, is limited to integrations/day of only a few minutes, and is itself in danger of closure for lack of funding. GBT accesses all but the south celestial pole and can track sources for hours.</p> <p>Much of the progress in astronomy comes from small teams working with diverse observing capabilities. The current trend is to consolidate into a small number of major facilities with a limited range in capabilities that are exploited by large teams. GBT was built at considerable expense and is still young. The cost to maintain this important resource is small compared to the expenses of constructing the next generation observatories. It is bizarre to me to contemplate anything other than continued and decent support for this world-class telescope.</p>	Against Closure	Email - Scanned	11/14/2016	nsf_gbt.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
524		James	Aguirre	Associate Professor Department of Physics and Astronomy	<p>I am writing in response to the public scoping for the EIS for the Green Bank Observatory. I am strongly in favor of the No-Action Alternative of continued NSF investment for science-focused operations. The GBO and the GBT are wholly unique facilities which are enabling cutting-edge science for the entire US scientific community, and which are of enormous importance for the education of the next generation of scientists, and for the development of new technology.</p> <p>I have personally used the GBO as part of my own research, capitalizing on the NRQZ for the development of the NSF-funded Precision Array for Probing the Epoch of Reionization (PAPER), and the Hydrogen Epoch of Reionization Array (HERA). HERA is now a mid-scale NSF initiative which will be the definitive measurement of hydrogen in the early universe, all enabled by the GBO. I have also used the GBT at high frequencies for studies of star formation and as part of the team developing the remarkable instrument MUSTANG (now in version 2), which has provided unprecedented views of the dynamics and physics of galaxy clusters, as well as being a technology demonstrator with relevance to future studies of the cosmic microwave background (CMB), including the CMB S4 program. As a postdoctoral fellow, I used the GBT/GBO extensively, as have my students and those of my collaborators.</p> <p>It is important to understand that both scientifically and technically, the current GBT provides capabilities that were not considered in the 2012 Portfolio Review, particularly the ability to operate at short wavelengths with new instruments like MUSTANG-2, and that shuttering or otherwise impairing the scientific operation of the facility would deprive the US scientific community of a resource which is actively producing exciting, unique science, and which cannot be reproduced in any existing or planned facility.</p> <p>I reiterate my strong support for the No-Action Alternative of continued NSF investment for science- focused operations.</p>	Against Closure	Email - Scanned	11/13/2016	
525		Gordon	Richards	Professor of Physics Drexel University	<p>I would like to express my strong support for continued NSF-supported operations of the Green Bank Telescope. The GBT is a unique national resource that has enable the work and scientific output many researchers and their students. It also provides essential data supporting wide ranging experiments from millimeter observations of the Cosmic Microwave Background (CMB) to X-ray observations of clusters of galaxies both of which are active areas across the country and around the world.</p> <p>While we cannot keep all telescopes operating indefinitely, the GBT is still in its prime and should continue to be fully supported.</p>	Against Closure	Email - Scanned	11/13/2016	
526		Carole	Hanlon		<p>let me add my name with those who feel that supporting the work of the Green Bank Observatory is so profoundly important to the world, that the thought of its closing presents an unacceptable deprivation of humanity's quest to learn its place in the universe. Mankind was meant to explore. To snuff out that trait is unconscionable.</p>	Against Closure	Email - Scanned	11/13/2016	
527	a	Megan	Hanlon		<p>I write to you to voice my concerns over the future of the Green Bank Telescope.</p> <p>I am a native West Virginian. Science and technology have always taken a backseat in this state. Coal and oil decide almost everything. When Robert C. Byrd brought the GBT and other investments to the state it gave our children a different future. The state has long struggled to keep up with the changing times. The GBT is a tangible source of pride that West Virginia can offer more than natural resources.</p>	Against Closure	Email - Scanned	11/13/2016	
527	b	Megan	Hanlon		<p>The geographic location of the GBT is unique. The lack of development in the area is what makes this such a special place. Without electromagnetic interference, the telescope can "hear" more here than anywhere else currently in the world.</p>	Against Closure	Email - Scanned	11/13/2016	
527	c	Megan	Hanlon		<p>Countless school field trips are taken every year to visit Green Bank. Children are awed and the influence it can be to their future is without measure.</p> <p>I urge you to keep the GBT in West Virginia, and keep it operational. I putting my best effort forth in getting the word out to show support for the GBT.</p>	Against Closure	Email - Scanned	11/13/2016	
528		Justin	Fischer		<p>I urge you to continue financial support for the GBT. I have traveled to visit this research facility as a tourist with my family, and it is clear to everyone that it is not only a valuable research asset, but a shining star of hope and pride in a state that has struggled to build a positive image for itself. More STEM facilities should be located in WV, not fewer. I suggest that you reach out to physicists to see how much they value the data produced by this facility.</p> <p>Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
529		Jack	Burns	Vice President Emeritus for Academic Affairs & Research CASA	<p>I am writing as a senior member of the radio astronomy community in response to the NOI to prepare an Environmental Impact Statement for proposed changes to the Green Bank Observatory (GBO) operations issued by the NSF. Of the five alternatives to be evaluated by the NSF, I strongly favor the first which states: Continued NSF investment for science- focused operations (No-Action Alternative). In my opinion, this is the only sensible course of action.</p> <p>The GBO has had a long and impactful history on radio astronomy from planetary science to cosmology. That impact continues today with the Green Bank Telescope as a leading facility to study effects in strong gravity systems around neutron stars and black holes. The Nano-Grav project was highly ranked by the last Astrophysics Decadal Survey and has been funded by the NSF's mid-scale program to test the limits of General Relativity and gravitational physics. This is just one of many such innovative programs.</p> <p>Another potential use of GBO is for a NASA MIDEX mission concept called DARE = Dark Ages Radio Explorer. I serve as PI and will be submitting a \$250 million proposal in mid- December to fly DARE in orbit of the Moon. This radio telescope requires accurate mapping of the antenna beam and we have proposed to use the GBO 140-ft telescope for this purpose. We will contracting with GBO for full-time use of the 140-ft for 2 years starting in 2023 if we are selected.</p> <p>The NSF has a major investment in the GBO which continues to be enormously productive. It will penny-wise and pound-foolish to scale back operations of the GBO when it is still at its peak. Other partnerships with agencies such as NASA will certainly present themselves over time. AUI is actively seeking such partnerships but this is a slow process requiring patience. I urge the NSF to indeed be patient and not make a regrettable mistake to pull the plug on the GBO prematurely.</p>	Against Closure	Email - Scanned	11/13/2016	
530	a	Carla	Beaudet	Engineer, National Radio Astronomy Observatory	<p>In 2012, when the Portfolio Review Committee's recommendation was first announced, my husband, also employed by the Green Bank Observatory, and I, after living in Observatory housing for 10 years, were just completing the construction of a home in Green Bank. Not only is this a home we love living in, and land we love living on, it is also a home we would never be able to sell if the Green Bank Observatory closed. There are no other electrical engineering jobs in Green Bank, nor within reasonable driving distance; if the Observatory closed, we would have to leave our home, and live again like college students in a city apartment somewhere while paying off the mortgage of a house we couldn't live in. We're both 50-something at this point in our lives; would we be too decrepit to enjoy our place by the time we managed to come back to it?</p> <p>The stress of the uncertainty has been with me since the divestment recommendation was made. These human costs, shared by a good number of Green Bank Observatory employees, are hard to quantify, but they deserve a mention.</p> <p>There are other quantifiable costs to the area that come from losing the many volunteer services of Observatory employees, and the sharing of our facilities with the community. Observatory employees volunteer:</p> <ul style="list-style-type: none"> -As Firefighters and EMTs -As Volunteer teachers of Yoga, Aerobics, Zumba, Tae Kwon Do -As Sound and lighting engineers at the Marlinton Opera House -As Soccer, Basketball and Football coaches <p>And that is by no means an exhaustive list. The Observatory partners with the Parks and Rec. office to offer swimming and dance lessons at Observatory facilities for minimal cost. This in a place where nearest municipal pool is at least an hour's drive away. The impact to the community of losing the pool and the exercise room could only be assessed by considering the cost of a municipal wellness facility to replace those services; will your EIS consider that?</p> <p>As my husband and I have been the ones doing sound and lights at the Opera House for the past 12 years, we've looked into the cost of having an outside sound company come in - about \$1500. per show, maybe 14 shows per year. These things can be quantified, and I want to see them quantified in the Green Bank EIS, if only estimated.</p>	Against Closure	Email - Scanned	11/13/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
530	b	Carla	Beaudet	Engineer, National Radio Astronomy Observatory	<p>Somewhat easier to quantify is the socioeconomic impact to the local community under any scenario in which the Green Bank Telescope were to cease operations. The losses need to be estimated in dollars, and these estimates need to make it into the Green Bank Environmental Impact Statement. I have read the Socioeconomics section of the draft EIS for the defunding of the Arecibo Observatory, and a number of things concern me: Under "Housing" it reads: "An indirect effect of Alternatives 3, 4, and 5 [these are the alternatives where the science operations go away] could be an increase in housing vacancies as the workforce potentially relocates over time in search of comparable employment."</p> <p>"Could be". "Potentially relocates". I do not want to see this kind of language in the EIS for Green Bank. A little research will assure you that anyone employed at the professional level and not prepared to retire will have to move to find comparable employment. This will have a significant impact on the local real estate market as it is flooded with homes for sale. This impact can be estimated, and it is your job to do so.</p> <p>In the same section, under "Population", the Arecibo EIS reads:</p> <p>"It is difficult to predict when and how many workforce personnel would relocate; therefore, the potential loss of population is addressed qualitatively in this section."</p> <p>Again, there is no excuse for not estimating and quantifying this loss. If the only costs that can be quantified are the costs to the NSF, then the EIS is designed to support a foregone conclusion. A quick, hand-waving estimate for you: The Green Bank Observatory currently has 108 permanent full-time employees, and offers an additional 40 seasonal positions, which I'll count for X, giving us a nominal 118. Maybe 10% of these employees would both choose and be able to find a way to stay in the area. That's a loss of 106 people in the Green Bank / Arbovale area whose combined population in 2014 was 303, a loss of 34% of the total population. This number is probably inflated because we don't all live in Green Bank or Arbovale, but it's easy to find out where 118 people live and adjust these numbers.</p> <p>In section 4.9, "economy, employment and income" are lumped together, but only employment and income are quantitatively addressed. It reads:</p> <p>"The direct effects of the proposed Alternatives on the employment and income of the population of the Municipality of Arecibo are quantified, while the effects on the economy are qualitatively described to account for secondary (indirect and induced) economic effects."</p> <p>Economic impacts are necessarily the indirect product of employment or lack thereof, and deserve their own section, as well as best effort estimates. I know of at least one community sponsored agriculture operation that would not likely be in business if it weren't for the Green Bank Observatory. You could ask the local branch of First Citizens Bank what the impact would be if they lost all their Observatory employee accounts.</p>	Against Closure	Email - Scanned	11/13/2016	
530	c	Carla	Beaudet	Engineer, National Radio Astronomy Observatory	<p>I cannot finish without expressing my disbelief that this is even happening. The NSF's recommendation to de-fund the GBT left a lot of people, particularly its scientific community of users, completely dumbfounded given the recent construction, innovative design, and scientific vitality of the instrument. Even since the divestment announcement, the GBT's capabilities continue to evolve; it is, in fact, just coming into its own with high frequency, multi-pixel receivers. This is no dinosaur, but rather a cutting-edge instrument with sensitivity unattainable by any array of smaller dishes. Its capabilities are absolutely unique, and in demand from the scientific community. Just not, apparently, from the majority of the scientists selected to serve on the NSF's 2012 Portfolio Review Committee.</p>	Against Closure	Email - Scanned	11/13/2016	
531		Vicki	Kossos		<p>At 60 years old, GBT is still the largest fully steerable radio telescope on the planet. Besides its scientific value, GBT is an enormous source of pride for WV and the entire country.</p> <p>No longer a WV resident, my family visits this engineering marvel as often as possible. I am proud to share GBT with my children as my parents and grandparents shared it with me.</p> <p>\$10 million annual operating costs is a bargain for such an important scientific facility. It also provides jobs, learning opportunities for local children, tourism and other investments to WV.</p> <p>Please keep it open. GBT is beloved!</p>	Against Closure	Email - Scanned	11/13/2016	
532		Barbara	Burdette		<p>The first time I visited the Green Banks NRAO facility, was back in the 70's, before the rusted foot sent the older radioscope crashing to the ground. When I got out of the car on my first visit, I viewed the incredibly beautiful area. It was in the fall so you can imagine the beauty of the leaves changing color on the trees, bright sunny crisp weather day. After emerging from the car I stood there knowing I was about to become immersed into an incredible place to visit and absorb all the information available to visitors. What was immediately evident was the quietness of the surrounding area. I could see birds flying around, children on the nearby school playground but there was no noise. Even the cars passing by on the highway didn't disturb the seemingly muted environment. It was almost disturbing.</p> <p>After the visit, which included a short film about the establishing and purpose of the facility, we were taken on a ride to the radioscope and were able to view the immense radioscope. Wow! Was I impressed and in awe that this facility was situated within the country side of West Virginia. I learned later this one and only one other existed in our country and was established here because of the unique quietness of the area.</p> <p>When the radioscope fell after one of the feet holding it in place rusted and caused the scope to fall, I cried. It was such a devastating tragic event to me. The news was not good concerning the replacement of this radioscope. When after 10 years, the news that it was to be rebuilt even bigger and better, I was truly excited.</p> <p>Those are a few of my memories of the wonderful place. Those memories cross the years from the 70's until now. I have visited the facility many, many time. I'm a substitute teacher in Greenbrier County and over the years have taken many groups of young people to Green banks. Sitting in the theater watching young people and adults move to the edge of their seats while watching a program being presented; seeing many go through the hands on museum moving to each and every exhibit, working or maneuvering what was displayed; riding the buses to the radioscope listening to the driver give a description of the area and what we were about to see; listening to the many awed voices, several from many different countries, when the scope first came into view will always be in my memory, My heart would again break as it did in the 70's if this facility would not continue, grow and improve over the coming years. If my one voice would and can make a difference for the continued funding for this fascinating facility, please let it be heard.</p>	Against Closure	Email - Scanned	11/13/2016	GreenBanks Observatory Statement.docx

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
533		Larry	Selvidge	Field Application Engineer Vision, Robotics, Motion & Lasers Neff Engineering	I am writing in response to an article published on Techcrunch.com regarding the possible closing of the Green Bank Telescope by the NSF. I understand that funding for an installation of this scope is daunting, and that dollars must be appropriated to the projects most likely to give a return. However, I hope the NSF will consider the impact, not only to current research, but to the people outside of the professional scientific community. I have taken several groups of young students from Indiana to visit Green Bank in the past, and plan to continue doing so. The impact this has on students considering secondary education in science and engineering is incalculable. The very presence of the facility creates an understanding that in the United States things that are almost too large and complex to be dreamed are possible; not only possible, but very real. When the function, and the results that are obtained, from Green Bank are explained, students begin to understand that these large, complex facilities are producing very usable results that they may very well use as a resource in their future endeavors. In an area of the country where facilities such as this are few and far between we cannot afford to lose one. In particular, states such as West Virginia and Indiana need these facilities to show students that after they've received their education they can remain in this part of the country and pursue rewarding scientific and engineering careers, thus boosting our economies in places that have been hit hard by economic changes. Again, I am sure this is a decision that will be thought about long and hard, and my hope is that some solution can be found to maintain this wonderful facility, not only for the scientific community, but for the entire region, and the people that need it so badly.	Against Closure	Email - Scanned	11/13/2016	
534	a	Linda	Stalnaker		<p>To put it simply, as an amateur astronomer, I am concerned and distressed over the future of the Green Bank Observatory. In this day and age of ongoing discussions about STEM education the prospect of defunding, decommissioning and/or dismantling the Green Bank Telescope are ways of taking this superb instrument out of the science toolbox. The list of scientific discoveries and support given to space exploration programs have made the largest fully steerable radio telescope in the world bring shades of science fiction into reality.</p> <p>The GBT is an enduring symbol of what the National Science Foundation does. Quoting from the NSF website: "We are tasked with keeping the United States at the leading edge of discovery in areas from astronomy to geology to zoology. So, in addition to funding research in the traditional academic areas, the agency also supports "high-risk, high pay-off" ideas, novel collaborations and numerous projects that may seem like science fiction today, but which the public will take for granted tomorrow."</p> <p>As an amateur astronomer, I have visited the Green Bank Observatory many times. I have toured the Jansky lab, been through the science center displays often, attended the Green Bank Star Quest, and even have been up on the GBT superstructure - a thrilling experience through which I saw the receivers and the nuts and bolts up close. I have used the 40-foot education radio telescope and accompanied Girl Scouts there where they earned an astronomy badge through the observatory's excellent education department.</p> <p>The times I have been at Green Bank the parking lot has been full of cars, vans, SUVs and motorcycles that have brought travelers, enthusiasts and curiosity seekers to see just what the GBT does. It is a scientific tourist attraction bringing folks to the Greenbrier Valley of West Virginia to experience up close how astronomical discoveries are made without the use of optical telescopes. The Green Bank Observatory has been a shining star in the culture of West Virginia, a state not known for its strong education and cultural achievements. As I have often said, we do great science in Green Bank, WV.</p> <p>A budget of \$10 million is the proverbial drop in the bucket when compared to the NSF budget and the federal budget as a whole. What I have seen is the money funding Green Bank is not wasted and stretched as far as it will go by the employees and scientists at the facility. Even the receivers for the GBT have been machined there to specifications reflected in the astronomical endeavors of students, post-docs, and professionals. The observatory has been a breeding ground for budding scientists including school aged children, and even some amateur astronomers, because of actual hands-on experiences that have cost them little to nothing to participate. Perhaps one the saddest days I had was when I found out the observatory had to start charging for public bus tours and information sessions.</p> <p>Let us too not forget how Green Bank got the largest fully steerable radio telescope in the world. The tragedy of the catastrophic collapse of the 300-foot telescope in 1988 paved the way for US Senator Robert C. Byrd to push for a replacement to be built. And it was a replacement built with science in mind with its minimally non-obstructed receiving area and massive steering mechanism.</p> <p>I urge the National Science Foundation to consider continuing full support - and more - to the Green Bank Observatory and even bring it back into the fold of the National Radio Astronomy Observatory. A part of mankind's future depends on what space has to tell us. We must continue to discover and to do that we need tools such as the Green Bank Telescope and Observatory.</p>	Against Closure	Email - Scanned	11/13/2016	
534	b	Linda	Stalnaker		And let us not ignore the White Paper recently authored by Green Bank and National Radio Astronomy Observatory scientists (arXiv:1610.02329v1 [astro-ph.IM]). They have delineated how the GBT of 2012 when the NSF portfolio review was conducted is not applicable to the GBT of 2017, that the radio telescope is indeed already advancing the scientific areas NSF identified four years ago.	Against Closure	Email - Scanned	11/13/2016	
534	c	Linda	Stalnaker		The location the Green Bank Observatory is a great spot made quiet by federal law. The National Quiet Zone (that also benefited the now closed Sugar Grove naval base) helps keep the RFI in check while still allowing a modicum of civilization to exist at Green Bank. No cell phones, but life goes on and the folks there seem no to suffer by their own admission. It is not a desolate spot as compared to where other radio telescope facilities are located.	Against Closure	Email - Scanned	11/13/2016	
535		Min	Yun	Professor of Astronomy University of Massachusetts	The GBT remains the world's premier single-dish radio telescope with a strong science case as noted in recent series of white papers. Given that the new single-dish initiative recommended by the 2010 Decadal Review was not funded by the NSF, it would be prudent to maintain the current NSF investment in GBT for continued science-focused operation ("no-action" alternative) would seem the most logical course of action. Maintaining an access to major survey facilities such as the GBT is essential for maximizing the return on NSF's recent large investments on the Atacama large Millimeter/submillimeter Array (ALMA) and the Jansky Very large Array (VLA) and to maximize the scientific opportunity and productivity of the US scientific community.	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
536		Christina	Lambert		We need to figure out a way to maintain the world's largest steerable telescope. If we can fund multimillion dollar trips to the Space Station, we can save the Green Bank Observatory!	Against Closure	Email - Scanned	11/13/2016	
537		Richard and Mary Alice	Connor		We have had the opportunity to tour the Green Bank Observatory and were very impressed. The tour was conducted in a very professional and educational manner. We are from Minnesota and returned with our grandchildren so they could tour the Observatory. Because of this exposure our 14 year old grandson was so enthralled with astronomy that he has been pursuing the subject ever since. This is a tremendous research facility which stimulates young minds toward the study of astronomy.	Against Closure	Email - Scanned	11/13/2016	
538		Yara	Yousef		I am a prospective astrophysics major from the University of Virginia, and a regular participant in the events of the university's astronomy club. Naturally, I have a deep love of astronomy and the night sky. The Green Bank Telescope is a landmark for astronomical research and outreach. It is a center for renewing interest in a field that is constantly being hindered by a lack of funding and resources. It is a place where people (and astronomy clubs) can visit from all over and be reminded that our universe is incredible, breathtaking, and infinitely mysterious. It simultaneously reminds us how far we have come and how much more we have to discover. This year, the largest number of people signed up for our astronomy club's annual Green Bank trip since the trips began. So many people were interested in going that we had to set up a wait list. I know that tens of thousands of people go to visit the observatory each year. It would be an incredible shame if Green Bank had to close when there is so much growing interest in the observatory, and in the field in general. The Green Bank Telescope means so much to me and many, many others who love astronomy as much as I do, and gives those who have not been able to learn much about the universe a chance to get excited about it and all the promise it holds. I genuinely hope you will reconsider cutting all funding to it.	Against Closure	Email - Scanned	11/13/2016	
539		Deanna	Kay		I am sending my appeal for you to not shut down the Green Bank Telescope. A few years ago, I joined the Astronomy and Engineering Clubs at Howard Community College, of which I am an adjunct professor at, on a weekend trip to the Green Bank Observatory, where we partook of their educational activities. There I discovered that learning in the classroom about radio astronomy did not truly enable me to understand how radio actually works. Having the opportunity to work the telescope (reserved for the public educational activity) and being taught how to analyze the data we gathered made a huge difference in my understanding and appreciation for this science. I can only imagine the world of opportunities this activity must inspire in the younger generations who are able to take part in this! Perhaps the other aspects of the Observatory could remain despite the GBT itself being shut down. But then again, just as a shopping center dies after the grocery store in the shopping center shuts down and is never replaced, I fear that the Green Bank Observatory would likewise die a similar slow death. The loss of the Green Bank Observatory would be a tragic loss to the science of astronomy, the careers of astronomers, the learning of astronomy, the economy of West Virginia, and the benefits to the community the Green Bank Telescope and Observatory provide for them. Please find a way to keep the Green Bank Telescope running.	Against Closure	Email - Scanned	11/13/2016	
540		Brett	McGuire	NRAO Jansky Postdoctoral Fellow	It is with great pleasure that I write today to express my full and unqualified professional and personal support for the Green Bank Observatory (GBO). You will no doubt receive countless other letters detailing the myriad ways in which the Green Bank Telescope (GBT) represents one of the last bastions of American radio astronomy, produces breakthrough science that is not possible at any other facility in the world, and is uniquely positioned among all other radio facilities in one of the most radio-quiet zones on the planet. I completely agree with all of these points. What I wish to emphasize here, however, is the important role that the GBT played in my education and training. I can say with absolute confidence that the accessibility of the GBT to myself as a young scientist played a critical role in my ability to emerge as a vibrant researcher in the field of astrochemistry. I am a chemist by training. When I first entered the world of observational astrochemistry, it was observations with the GBT, guided by the GBO staff, that made a crucial impact in my understanding of the underlying principles of radio astronomy which govern the work that I now do. Without the GBT, I would not be on the successful career path I am on now, being the first chemist to receive the Jansky astronomy prize fellowship. I am now applying for faculty positions, and I look forward to taking my students to the GBO for many years to come, to train the next generation of astronomers and astrochemists. Operator-driven astronomy, such as being conducted at ALMA, has its advantages. But there is simply no substitute to the hands-on experience that comes from learning the ins and outs of a radio telescope and conducting observations. The GBO and GBT provide this unique service to American radio astronomy, and their continued operation is absolutely essential to maintaining American excellence on the global stage. Please do not hesitate at all to contact me for any reason	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
541	a	Danny	Scalise, II		<p>I am very displeased with the thought of any continuing cuts to the National Radio Astronomy Observatory in Green Bank, WV. As someone who has worked extensively within public policy, government at the local, state, & federal levels and within non-profit, I feel public administration is a strength of mine. In my opinion, the constant cuts the sciences are disheartening at best, but more likely a precursor to a society that is failing to be the beacon of scientific discovery it should be. I believe that the unique strengths of the observatory at Green Bank are the combination of educational programs, research staff in science and engineering, and the telescopes.</p> <p>Our country is not developing the vast number of STEM students it should and must look outside our borders for STEM professionals. Because of this, many young West Virginians do not have strong role models in the STEM fields, so experiential learning that can only happen at places like the Observatory is important to the development of STEM students. Students from rural areas, like much of West Virginia, get access at Green Bank to science at work in manners that are not possible at a museum.</p>	Against Closure	Email - Scanned	11/13/2016	
541	b	Danny	Scalise, II		<p>The research professionals at Green Bank make for an academic hub that is unlike any place in West Virginia or maybe even the east coast. Green Bank attracts intelligent, open minded people to rural West Virginia to further scientific discovery and they are pillars of the community.</p> <p>Furthermore, the investment in telescopes such as these is extremely large. For a government or other organization to attempt to build something similar would be too large a financial outlay. The consistent cuts to the observatory may force closure and cause the telescopes to be a relic when they are still very useful in scientific observation and discovery.</p> <p>Finally, the Green Bank Observatory is a magnet for leading scientists from around the country and the world. It assists West Virginians in overcoming the negative stereotypes associated with the Mountain State and has added a great value to the West Virginia highlands. It is ludicrous and insulting to think anyone would want this country to see such an asset go into disrepair or even worse be abandoned. Please reconsider your process and make science a priority.</p>	Against Closure	Email - Scanned	11/13/2016	
542		Lonnie	Carpenter	Mayor, City of Kenova, WV	<p>I remember as a child the trip my family took to see the Observatory and how it peaked my interest in science and the unseen wonders that may one day be understood. In those fifty years later our understanding has become somewhat better, but there are more discoveries to be made and I feel that the Observatory at Greenbank, WV has a place in those discoveries. The science program in schools depend on facilities like Green Bank Observatory which foster the science program to new heighten awareness of the possibility of a future if the student remains in Science.</p> <p>I still look to the sky with amazement and the wonder I experienced when I visited Greenbank many years ago and how Green Bank Observatory was the surrogate that instilled in me the many wonders of the universe.</p> <p>I pray that the NSF can fully fund the Green Bank Observatory for many years to come and instill in the many children who visit and rear about the discoveries to have a place in their minds and hearts a true love for the unseen wonders found close to home.</p>	Against Closure	Email - Scanned	11/13/2016	
543		Paul	Goldsmith	Senior Research Scientist, Jet Propulsion Laboratory, Professor Emeritus of Astronomy, Cornell University, Adjunct Professor of Astronomy, University of Arizona	<p>I am writing this letter to express in the strongest possible terms my support for continued operation of the Green Bank Telescope (GBT) as an astronomical research facility. It has become a cornerstone for a broad range of scientific research projects and with ongoing upgrades to instrumentation will surely play an increasingly important role.</p> <p>It is difficult to enumerate all the areas in which the GBT has made major contributions to our understanding of the universe. These are contained in a detailed "While Paper" recently submitted to the National Science Foundation (NSF). But let me dwell for a moment on the critical role the GBT plays in training young scientists. A single dish telescope like the GBT affords the opportunity for an astronomer to actually go to a research facility and learn what it means to operate a state of the art instrument. Then, he or she sees what actually happens when one writes scripts to control the telescope. Finally, there is dealing with the data. Most importantly, the observer can take advantage of the expertise of the GBT staff in near real time. This is hugely important, as learning is far faster and deeper when one can interact personally, get feedback, and then see the results. This is very different from the help that is available at purely remotely operated facilities. That is not to say that such facilities (e.g. ALMA) do not try their best to answer questions, but the whole experience is entirely different. You can get a question answered in a few minutes at the GBT that you might be too embarrassed to put in an email to a "help desk", and even after having done so, you will likely wait for days to get a response. That is just the difference between hands-on and remote facilities. Of course, expert users can use the GBT remotely, and many do, but for training the GBT really is something unique. I have used a very large range of astronomical facilities, on the ground and in space. I have no doubt that for graduate students working with me, going to Green Bank and using the GBT was a critical part of astronomical training. I had a similar experience at single dish telescopes operated by universities that have since been closed. The GBT is one of the VERY FEW facilities that offers open access to the entire U.S. community, and even supports travel for students and for their stay at the GBT. If this disappears, the entire astronomical community will suffer, since the students who use the GBT are often not pure "radio astronomers", but are often engaged in a research process that requires multi-wavelength data. The GBT is where they can have the real "hands on" experience that will be of real benefit for the rest of their scientific career. I thus urge you take "no action" and thus enable the GBT to continue as a forefront facility for research together with being a unique resource for student training.</p>	Against Closure	Email - Scanned	11/12/2016	support_letter_Nov2016.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
544		Randy	Tephabock		<p>...Anyway I am writing to ask that you reconsider de-funding and deconstructing the valuable telescopes at the Greenbank Observatory for the following reason.</p> <p>With its large 110-meter dish, GBT is able to "hear" incredibly faint radio waves emitted from the universe that smaller radio dishes wouldn't be able to capture. Of course larger dish telescopes, like the stationary 305-meter Arecibo radio telescope in Puerto Rico, can do this as well. It's GBT's steerability that sets it apart. With its ability to move its large dish, GBT can cover 80 percent of the sky. Stationary single-dish radio telescopes must make do with the swath of the universe that passes directly overhead. The Arecibo Telescope can observe about 33 percent of the sky, for example. Another white paper put forward by Green Bank Observatory researchers, argued that recent discoveries in the astronomy field have invalidated the 2012 negative assessment of GBT's usefulness. In particular, the recent discovery of gravitational waves has put pulsar research, an area where GBT is well-known, at the forefront of modern astronomy. Gravitational waves are created by large cataclysmic events that create ripples in the fabric of spacetime. Once scientists proved that they could detect them, it opened up an entirely new way to study the universe.</p> <p>Dr. Sean McWilliams, an astronomer at West Virginia University who was one of the collaborators on the recent discovery of gravitational waves, told TechCrunch that the GBT is a crucial tool for his line of work. McWilliams uses the GBT and the Arecibo Telescope to analyze radio waves emitted from pulsars. By precisely recording the timing of these pulsars, astronomers can look for gravitational waves.</p> <p>"We use the GBT and Arecibo for our timing, and to achieve our science, we need the steerability of the GBT because we really need a large number of extremely well timed pulsars in order to accomplish many of our observational goals." says Dr. Sean McWilliams, Astronomer at West Virginia University.</p> <p>McWilliams noted that larger telescopes like the 305-meter Arecibo Telescope or the 500-meter FAST telescope in China can perform somewhat more precise timing of the pulsars in their line of view. But they're limited in the portion of the sky they can study.</p> <p>"This is a tremendous advantage for the GBT, and given the engineering limitations involved, it is highly unlikely that another facility that is comparable in size to the GBT and also steerable will be constructed in the foreseeable future." says Dr. Sean McWilliams, Astronomer at West Virginia University.</p> <p>With these considerations. ...please reconsider shutting down this facility. I feel it would set back research in this new important field of Gravitational Waves.</p>	Against Closure	Email - Scanned	11/12/2016	
545		Randall	Detra		<p>I have recently heard of plans to scuttle the GBT, specifically the Sen Byrd telescope.</p> <p>This seems an unacceptable solution to budget settling. This is one of the most celebrated instruments of its kind through out the world. Any speculation that it is simply duplicated capability of other scopes in the NRAO inventory is certainly not well advised. Besides the steerability, which means there is no need to wait for the rotation of the earth to line the scope up with important celestial objects, often some remarkable research is done by the cooperation of multiple installations around the planet.</p> <p>When this instrument was first put in service, the excitement was more than palpable and I am sure among most scientists as well as interested and informed public the enthusiasm remains.</p> <p>Certainly, it seems, if there is a need to spread the cost around, there would be other institutions inside and outside the United States which would be inclined to assist in the operating expenses of this fabulous instrument.</p>	Against Closure	Email - Scanned	11/12/2016	
546		David	Burhman		<p>I am writing to urge you to keep the Greenbank Observatory open. This amazing facility is a true asset for both the scientific community and the public. I personally have attended two Greenbank StarQuest weeks during the summer months and I'm constantly sending out-of-state tourists interested in astronomy up to Greenbank.</p> <p>While I understand that budgets are a reality and it may be necessary to impose certain cuts in programs being offered, certainly any solution that doesn't involve a complete shut down should be considered first. You already have a cooperative community at Greenbank and a long time established radio quiet zone.</p> <p>Please make every effort to keep this wonderful radio observatory open.</p>	Against Closure	Email - Scanned	11/12/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
547		Fronefield	Crawford, III	Faculty Don of Weis College House Associate Professor of Astronomy Department of Physics and Astronomy Franklin and Marshall College	<p>I am sending this letter in support of continued operations at the Green Bank Observatory (the “no-action alternative”) in response to the Environmental Impact Statement that outlines possible changes to operations. The observatory’s flagship instrument, the Green Bank Telescope (GBT), is a critical instrument for my research and for a number of my colleagues working in the area of pulsar astronomy. Pulsars have had a very rich history in terms of their scientific impact since their discovery in the 1960s, and very large radio telescopes that operate at “low” frequencies (i.e., at a few GHz or less) such as the GBT are required for their discovery and study.</p> <p>In terms of the specific impact that the GBT makes in my own work, there are two areas in which I depend on the GBT in its current form. The first area is the various pulsar search and timing programs that I participate in with a number of collaborators (including the NANOGrav search for gravitational waves, an NSF-funded Physics Frontiers Project which has seen renewed prominence with the recent LIGO direct detection of gravitational waves). The GBT and its associated instrumental capabilities cannot easily be replaced, and the “open skies” policy of the GBT is absolutely necessary for researchers such as myself at liberal arts colleges: my institution, Franklin and Marshall College, serves undergraduates only and has no access to any private facilities that would be necessary for this work to continue and has no funding on the scale needed to gain access to them. Without the GBT and Arecibo, my research (and the research being conducted by the undergraduate students I supervise) would cease. This would have a serious impact on the next generation of scientists who are being trained to use such facilities, who are working on the resulting data sets, and who are learning the basics of scientific research.</p> <p>The second major impact would be in seriously diminishing the very successful Arecibo Remote Command Center (ARCC) program, in which dozens of undergraduates from 7 institutions from around the country (including Franklin and Marshall College) use the GBT for ongoing pulsar timing and search projects. (Note that even though the ARCC name says Arecibo -- a historical artifact -- the GBT is used just as much in this program). Students operate the GBT remotely from our various institutions to time pulsars for the NANOGrav effort and to search for new radio pulsars in pulsar survey projects. Students also look through the resulting pulsar search data for new pulsars. The ARCC program was started in 2004 at the University of Texas at Brownsville and has recently expanded to include 5 liberal arts institutions (out of the 7 institutions involved!) and is therefore a valuable training ground for students. The ARCC program is also among the top 10 producers of Hispanic physics bachelor’s recipients in the nation (that’s just the ARCC program itself, not counting other non-ARCC students at the participating institutions or in their departments!). This demonstrates the value of ARCC in recruiting and engaging underrepresented groups in real science. ARCC is also a valuable attraction to students who are considering a major in physics or astrophysics at our institutions since it gives them an early exposure to research.</p>	Against Closure	Email - Scanned	11/12/2016	gbt_env_study.pdf
548	a	Arlene	Walton		<p>I have been stationed at the Green Bank Science Center for 14 seasons as an employee of the Pocahontas County Convention and Visitor’s Bureau. The GBO Science Center has been so much to so many people. To lose the GBO would be devastating to the community as well as to the visitors who come there to visit. The specific resources that would be affected by changes to the GBO operations that also would impact tourism would be socioeconomic and the cultural resources.</p> <ul style="list-style-type: none"> · GBO has a \$17 million dollar direct impact locally · GBO has a \$30 million dollar induced impact to the region · 50,000 visitors annually to GBO · The GBO is unique and is a point of pride for West Virginia · The National Radio Quiet Zone creates a significant amount of publicity for the area as well which delivers visitors to the county who not only visit Green Bank but stay in lodging, eat in local restaurants and visit other attractions. · Pocahontas County is a drive-to destination reliant on unique appeal and the GBO is a key attraction that makes our destination unique. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. <p>Please take these factors into consideration. They are important!</p>	Against Closure	Email - Scanned	11/12/2016	
548	b	Arlene	Walton		<ul style="list-style-type: none"> · A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics · GBO is an exceptional educational facility for student engagement - and the reason it positively impacts the students as a learning environment is that it is a working research facility. · The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix in Pocahontas County. 	Against Closure	Email - Scanned	11/12/2016	
549		Miranda	Baumann	Doctoral Student I Graduate Research Assistant Department of Criminal Justice and Criminology Andrew Young School of Policy Studies Georgia State University	<p>Please do not close this observatory!</p> <p>Ask the public for money, and we will do whatever it takes to keep it funded!</p>	Against Closure	Email - Scanned	11/12/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
550		Simone	Traverse		<p>I am writing to you today to ask you to please continue to fund the Green Bank Telescope at 100% (or more). I am not a scientist, I work in non-profit with cancer patients. We as a family though are big science enthusiasts. I went to a science and math academy in high school and started a bio-chem major in college. I eventually went towards non-profit, but still subscribe to Science News weekly and we read it to our kids every night. We were all very excited when gravitational waves were confirmed and made a road trip this summer from Texas to visit the Green Bank Telescope in West Virginia. It was such a wonderful experience. My 4 year old daughter wants to be an astronaut when she grows up and my 8 year old son wants to be a scientist. He was the one who asked to go once we read about it in Science News. We could not have been more pleased with our visit. We learned so much in the well laid out museum and the educational presentations. Seeing the telescopes up close was inspiring. To think that we as humans are exploring sounds from the beginning of the universe is simply mind boggling.</p> <p>We cannot afford to NOT fund this telescope. Science has no borders, and there are so many scientists across the world using this telescope to discover so much. There are no alternative telescopes that scan the same amount of sky as Green Bank. To dismantle or even de-fund something that is helping us discover so much would be a gigantic mistake and a huge step backwards.</p> <p>For the future of humanity and the future of our children, we must continue to invest in science. Especially in the face of recent gravitational wave discoveries this telescope is more important than ever. I want to be able to continue to show my children that we as a country value science, especially in this time of growing anti-intellectualism. The Green Bank Telescope is a symbol of that investment, a symbol that we still want to learn more about our world, and a symbol that we are willing to invest in discovery. If we lose our curiosity and our will to discover more, we will have lost so much as a country and as a species.</p>	Against Closure	Email - Scanned	11/12/2016	
551		Maxwell	Stout	Inactive Attorney Emeritus State Bar of Texas	<p>Please do not close the Green Bank Telescope. It holds great value to me, as a citizen of our Country. It holds great value to our Nation and to the World. We need more radio telescopes in various locations on our planet, not less. look for new funding from other sources, but do not look for closure of this unique facility.</p>	Against Closure	Email - Scanned	11/12/2016	
552		Jon	Cooper		<p>What is the threat to Greenbank? Ref Permalink: http://www.manchin.senate.gov/public/index.cfm/2016/11/manchin-capito-jenkins-provide-information-on-how-to-submit-public-comment-on-the-future-of-green-bank-observatory</p>	General	Email - Scanned	11/12/2016	
553		David	Childress	Professor Coordinator - Computer and Information Technology (CIT) Ashland Community and Technical College	<p>I wanted to lend my support to keep the Greenbank Radio Observatory open and funded.</p> <p>Furthermore, it helps to support universities and their students who can use the telescope's unique abilities to learn and discover new things in radio astronomy. Plus, it supports Science, Technology, Engineering and Mathematics (STEM) in an area that can benefit from it.</p> <p>I hope that you will continue to fully fund and support this wonderful resource.</p>	Against Closure	Email - Scanned	11/12/2016	
554		David	Childress	Professor Coordinator - Computer and Information Technology (CIT) Ashland Community and Technical College	<p>The telescope is unique in that it is fully steerable and can cover so much of the sky. In addition, it is located in an excellent spot of radio astronomy, in the mountains of West Virginia with little radio interference to impede observations.</p>	Against Closure	Email - Scanned	11/12/2016	
555		Jessica	King	Concerned citizen	<p>Please do not close the Green Bank Observatory! West Virginia is already struggling in so many areas. The educational system is failing, the economy is dying, and the people are looking anywhere for a shred of hope for our state. Take the observatory away from us, and we have very little left to be proud of. It is more than a telescope to us, more than a research facility. It represents the spirit of West Virginia and her people. It is a monument to the future, one that is hopefully better and more prosperous than the present.</p> <p>Beyond what the facility does for our state, the observatory is a center for scientific advancement and discovery. With the expansive universe being our last undiscovered frontier, we as a country and as a species need to spend more of our efforts and finances on charting the uncharted. We have a massive amount of information to glean from researching the infinite universe. To throw away such a valuable resource in scientific achievement as the Green Bank Observatory is backwards and foolish. Please reconsider withdrawing funding for the facility. We as a state need this. We as a country need this. Please, don't let us down.</p>	Against Closure	Email - Scanned	11/12/2016	
556		Gina	Ervolini		<p>Greenbank is so very important to have for us and for future generations. Please let's not see this go away.</p>	Against Closure	Email - Scanned	11/12/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
557		EJ	Smith		As a science teacher I can tell you that this facility is a key to the future and not just for West Virginians. It is something WV can be proud of too. Please do whatever is necessary to keep it going. It is important for all of us. When you just think of what all space exploration has brought us then you understand it's importance. For example; Velcro, air conditioning, cell phones, radio and satellite communication, microwave ovens just to name a few things. Did you know the first pulsars and quasars were discovered at Greenbank? We need this facility. Please keep it funded, not just for WV but for technology as a whole. EJ Smith 34 year veteran science teacher and proud of science and proud of Greenbank, our touch of space.	Against Closure	Email - Scanned	11/12/2016	
558		George	Zook		Please keep the green bank telescope open... please thank you from George Zook's brain	Against Closure	Email - Scanned	11/12/2016	
559		Manoj	Kumar		I received information that green bank observatory is to be closed.I am writing this e-mail to do my part in keeping the observatory open.I am an aspiring astrophysicist and these observatories are really important to us.They provide vital information about our information. It is a one of a kind telescope and it can't be replaced.It is an inspiration for kids to pursue science education. One day I wish to work in a observatory. So , I kindly request you to keep it open.	Against Closure	Email - Scanned	11/12/2016	
560		Neil			<p>I was just reading an article about the Observatory and its possible closing: http://www.eham.net/articles/37975</p> <p>I heard about the Quite Zone, once, and was intrigued. I just found out that the Observatory has a procession of visitors, and I'm bothered that I was never one of them.</p> <p>It's possible that increasing your advertising budget would reap increased cash influx. In Queens, NYC, I see advertisements for Myrtle Beach, South Carolina, but I never saw an advertisement for the Green Bank Observatory. Kids love that stuff. Hams love that stuff. Technofreaks love that stuff. The whole world loves Astronomy. Everyone wants their own black hole.</p> <p>Close an observatory at 6 PM?? Yes, you've been self-shot in the foot.</p> <p>You could post Green Bank Astronomy Forecasts, including which upcoming days will have perfectly clear skies, so people can plan nighttime visits that will be most dramatic and beautiful: Put a couple of 3" telescopes on the ground in back of the observatory so people can enjoy the dazzling night skies.</p> <p>One well placed TV advertisement on lawng Island would create a traffic jam in Green Bank. The advertisement can flash the world of radio-telescopes during the day, and the peaceful Jovial Moons and Saturnian Rings at night. Instead of a 10 second TV-spot that says, "It's 10 PM -- do you know where your kids are?" you could have a 10 second spot that says, "It's 10 PM -- the astral viewing at Green Bank Observatory is extraordinary. Just 10 seconds.</p> <p>And don't even mention extraterrestrials. Just tell people what to load into their GPS's, and they will come.</p> <p>You have to be ready to manage the crowds. But if you're afraid of crowds, then you're subconsciously motivated to avoid them. Maybe hire a management agency to coordinate advertising with increasing visitor attendance.</p> <p>life in the big city is exhausting. Some people have never heard of or seen the Milky Way. (I've never seen the Orion nebulae through a telescope.) People need a peaceful getaway in the countryside. It would be awful to lose the opportunity you can provide.</p> <p>Hope to visit y'all. The closest I've come to Green Bank is Winchester VA, while trying to avoid traffic jams on I-95. Wow; smack dab in the middle of the Appalachians, where a city boy can decompress. As Trump would say, "It will be such a beautiful thing. Believe me."</p>	Alternatives Consideration	Email - Scanned	11/11/2016	
561		Helge	Blucher		Please don't close the observatory. I have visited the site and I'm extremely impressed with the science that is conducted and the amazing possibilities for space discovery related to radio astronomy.	Against Closure	Email - Scanned	11/11/2016	
562	a	Brandon	Phillips		<p>My name is Brandon Phillips and I am a dentist and full time resident in Summersville, WV. I am writing to express my concerns over the possibility of defunding the Greenbank Telescope. I can't possibly put into words the devastating consequences that would result in such defunding. The local community is who first comes to mind for me. The entire Pocahontas county region is one of the more poverty ridden areas already in the state of West Virginia. This observatory brings in around \$12 million annually and the loss of that tourism income could cripple a region that is already struggling.</p> <p>In closing, I implore you to consider full funding for not only a scientific treasure, but a heavily depended on local commodity. Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	11/11/2016	
562	b	Brandon	Phillips		If that isn't enough, it is well known within the astronomical community that this telescope has capabilities that others that are similar simply do not. With it being a fully steerable telescope, it can scan approximately 80% of the sky compared to the average 30% of similar telescopes.	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
563		Neil	Jorgensen		<p>I want the Green Bank Telescope to remain open and kept fully funded. When I was a young Cub Scout (now an Eagle Scout), I was taken to the telescope. It was there that I drew inspiration to engorge myself in science. I grew up dreaming about space, the stars, the planets. I took it upon myself at the age of 16 to take a 6 week college course in cosmology at Stanford. This shaped me into what I am today - a data scientist with a strong interest in space.</p> <p>Don't take this opportunity away from the future generations who will also be inspired, like I was. West Virginia, especially, needs this inspiration.</p>	Against Closure	Email - Scanned	11/11/2016	
564		Ashley	Stewart	Technology Integration Specialist and Academic Coach Ed.D. Student, West Virginia University	<p>As a West Virginian native, resident, and educator, I am expressing my concern of the possible defunding or deconstruction of the Green Bank Observatory. Though I am a social scientist and not a physical scientist who directly benefits from the facility, I am a teacher who hears of great academic experiences that the observatory provides to young West Virginians. For many rural students, visits to Green Bank can enrich and inspire a devotion to science, as many youths do not have access to many authentic resources such as the telescope. Our state is struggling both in terms of economy and education; young people are leaving in exodus due to lack of opportunities and resources. Maintaining the Green Bank Observatory would mean maintaining a learning environment that promotes STEM education for a population in need of young scientists.</p> <p>I implore you to continue supporting the Green Bank Observatory and to not allocate the respective funds elsewhere.</p>	Against Closure	Email - Scanned	11/11/2016	
565		Josh	Hereau	Senior Mortgage Planner 1st Advantage Mortgage, a Draper and Kramer company Company NMIS: 2551 loan Officer	<p>I think it's a travesty to consider dismantling the Green Bank Observatory. Please continue to support the project in West Virginia.</p>	Against Closure	Email - Scanned	11/11/2016	
566		Brian	Guetzlaff		<p>Please continue your funding (or at least actively seek private/alternate funding) to keep the Green Bank Observatory operational. Not only is it a truly unique telescope, as you are well aware, but it provides other benefits as well.</p> <p>The media has already covered the ways that the continued presence of this observatory benefits the people of West Virginia financially and educationally. However, it also serves as an anchor for the radio-silence zone around it. Many who live within this area deeply value the fact that they can find solace from much of the man-made radiation in today's world, and these people would almost certainly lose this shelter should the observatory be dismantled.</p> <p>Please seek to preserve this treasure for our nation to the fullest extent of your ability.</p>	Against Closure	Email - Scanned	11/11/2016	
567		C.M.	Tanner		<p>We need someone to step in to straighten the officials out here , they think they can do whatever they want, they aren't for the people of Clay it's about what they can put in there pockets!! Ever since the flood all they have done is run me around in circles!! I went to the County Commissioner to volunteer to help, he told me Clay didn't need help!! I know I need help but no one will help me!!! I came back here from Illinois, I'm disabled so is my brother!!! If you aren't in the click at Clay then it's for get you, there afraid you might find something on them!! The people of Clay needs help!!</p>	General	Email - Scanned	11/11/2016	
568		Jerry	Hubbard	NOGPP	<p>Keep the Green Bank Telescope open. This is basic science. It is economical for basic research. How can our nation even think of closing it?</p>	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
569		Cara	Rose	Executive Director Pocahontas County Convention & Visitors Bureau	<p>The Pocahontas County Convention and Visitor Bureau (CVB) is dedicated to promoting the county as a travel destination and to enhancing the tourism product for the area.</p> <p>Part of this commitment is to support attractions in our area and protect the tourism assets that make Pocahontas County a strong tourism destination. The Green Bank Observatory (GBO) is one of these assets.</p> <p>Pocahontas County is a rural, drive-to travel destination. We don't have four lane highways or shopping malls and the area has limited cell phone coverage. What we do have are unique attractions that make the destination appeal to the potential visitor. These include the Green Bank Observatory, Cass Scenic Railroad State Park, Cranberry Glades and Snowshoe Mountain Resort to name a few. We also have an abundance of recreational opportunities including single track mountain biking, skiing and snowboarding, hiking and kayaking. Just one of these can attract a visitor with a specific interest but bundled together these attractions and activities create a destination. The Green Bank Observatory is a key component to the Pocahontas County destination.</p> <p>The tourism industry is the largest industry in the county contributing a minimum of \$100,000,000 to the economy and the GBO is a vital component of the tourism product. The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix and hosts annually approximately 50,000 visitors. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. GBO tourism facts and contributions to the tourism mix are many including:</p> <ul style="list-style-type: none"> •Educational enrichment: A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics. Tourism is the conduit to reaching the general population and sharing the science and story of radio astronomy with many. • Unique: The GBO is unique and is a point of pride for West Virginia •Field Trips: GBO is an exceptional educational facility for student engagement and the reason it is so positively impactful to students as a learning environment is that it is a working research facility. 	Against Closure	Email - Scanned	11/11/2016	
570		Cara	Rose	Executive Director Pocahontas County Convention & Visitors Bureau	<p>The Pocahontas County Convention and Visitor Bureau (CVB) is dedicated to promoting the county as a travel destination and to enhancing the tourism product for the area.</p> <p>Part of this commitment is to support attractions in our area and protect the tourism assets that make Pocahontas County a strong tourism destination. The Green Bank Observatory (GBO) is one of these assets.</p> <p>Pocahontas County is a rural, drive-to travel destination. We don't have four lane highways or shopping malls and the area has limited cell phone coverage. What we do have are unique attractions that make the destination appeal to the potential visitor. These include the Green Bank Observatory, Cass Scenic Railroad State Park, Cranberry Glades and Snowshoe Mountain Resort to name a few. We also have an abundance of recreational opportunities including single track mountain biking, skiing and snowboarding, hiking and kayaking. Just one of these can attract a visitor with a specific interest but bundled together these attractions and activities create a destination. The Green Bank Observatory is a key component to the Pocahontas County destination.</p> <p>The tourism industry is the largest industry in the county contributing a minimum of \$100,000,000 to the economy and the GBO is a vital component of the tourism product. The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix and hosts annually approximately 50,000 visitors. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. GBO tourism facts and contributions to the tourism mix are many including:</p> <ul style="list-style-type: none"> •Educational enrichment: A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics. Tourism is the conduit to reaching the general population and sharing the science and story of radio astronomy with many. • Unique: The GBO is unique and is a point of pride for West Virginia •Field Trips: GBO is an exceptional educational facility for student engagement and the reason it is so positively impactful to students as a learning environment is that it is a working research facility. 	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
571		Cara	Rose	Executive Director Pocahontas County Convention & Visitors Bureau	<p>The Pocahontas County Convention and Visitor Bureau (CVB) is dedicated to promoting the county as a travel destination and to enhancing the tourism product for the area. Part of this commitment is to support attractions in our area and protect the tourism assets that make Pocahontas County a strong tourism destination. The Green Bank Observatory (GBO) is one of these assets. Pocahontas County is a rural, drive-to travel destination. We don't have four lane highways or shopping malls and the area has limited cell phone coverage. What we do have are unique attractions that make the destination appeal to the potential visitor. These include the Green Bank Observatory, Cass Scenic Railroad State Park, Cranberry Glades and Snowshoe Mountain Resort to name a few. We also have an abundance of recreational opportunities including single track mountain biking, skiing and snowboarding, hiking and kayaking. Just one of these can attract a visitor with a specific interest but bundled together these attractions and activities create a destination. The Green Bank Observatory is a key component to the Pocahontas County destination. The tourism industry is the largest industry in the county contributing a minimum of \$100,000,000 to the economy and the GBO is a vital component of the tourism product. The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix and hosts annually approximately 50,000 visitors. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. GBO tourism facts and contributions to the tourism mix are many including:</p> <ul style="list-style-type: none"> • Educational enrichment: A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics. Tourism is the conduit to reaching the general population and sharing the science and story of radio astronomy with many. • Unique: The GBO is unique and is a point of pride for West Virginia • Field Trips: GBO is an exceptional educational facility for student engagement and the reason it is so positively impactful to students as a learning environment is that it is a working research facility. • The National Radio Quiet Zone creates a significant amount of publicity for the area as well which delivers visitors to the county who not only visit Green Bank but stay in lodging, eat in local restaurants and visit other attractions. Given the contribution the GBO makes to the tourism industry in Pocahontas County, the CVB can only support alternative actions #1 or #2: 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope <p>Any changes to the operation of GBO resulting from implementation of #3, #4 and #5 would carry consequential, damaging affects to the tourism industry - the visitor, the businesses that rely on tourism and the overall product mix that enhances the rural destination appeal. The specific resources that would be affected by changes to the GBO operations and also would impact tourism include the socioeconomic and the cultural resources. GBO contributes enormously to the economy through visitors which supports many businesses and jobs. The GBO is also a cultural phenomenon because so many visitors do not understand radio astronomy or how the area residents can survive without cell coverage. The site provides opportunity to learn and be in awe of the Green Bank Telescope and better understand cultural life in a rural environment and a National Radio Quiet Zone. In closing, the only clear actions that would have least impacts to the tourism industry are the alternatives #1 or #2. Alternatives #4 and #5 in particular would have radically negative effects on the tourism product and visitor experience in Pocahontas County. Although the primary purpose of the GBO is not tourism, the GBO does strongly impact the tourism industry. All of these benefits to tourism and the visitor will be lost if alternatives 4 & 5 are chosen. The best way to preserve these tourism benefits is for the NSF to choose alternative 1 or 2.</p>	Against Closure	Email - Scanned	11/11/2016	
572		Michael	Lucero	Masters Candidate in Biology Angelo State University	<p>I would like to start by saying was born and raised in West Virginia and I appreciate the years of support and service that the NSF has provided to the Green Bank Observatory and various other research initiatives across my home state. I understand the the Green Bank Observatory is expensive and difficult to maintain so I understand your reasons for contemplating the closure of the facility. I would just like to let you know that the effect that the Green Bank Observatory has on the state of West Virginia is immeasurable.</p> <p>In West Virginia we are bombarded by Pro- Coal propaganda from the time we are born. This propaganda, combined with the geographic isolation of the state, creates a culture that makes a young person think that the only good they can achieve in this world is to supply the energy the for the nation through coal mining. The Green Bank Observatory represents a pillar of hope for many young people in the state that they can have a purpose outside of the mines. It often times exposes people, like myself, to their first encounter with real science. The fact that this science is world changing and going on in our "backyard" shows us that being a scientist isn't just for the "smart, city people" (as many people in West Virginia see scientists) but that we too can make a positive impact. I was personally affected by the Green Bank Observatory when my parents took me to see it as a child and it has directly led to my current pursuit of a masters degree in Biology. Green Bank provided that reassurance that there was a world outside the mines and gave me the confidence to escape that pull. I know that if the observatory had that affect on me then it has had the same affect on countless other Appalachians within its proximity. I would just like for you to weigh all possibly overlooked consequences into your decision about the future of the facility. Thank you for your time and your overwhelming support of the science in West Virginia and our nation.</p>	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
573	a	Emily	Calandrelli		<p>My name is Emily Calandrelli, I grew up in Morgantown, went to West Virginia University and am writing in support of maintaining and fully funding the Green Bank Telescope. I published an article to TechCrunch's 14 million monthly readers on this topic that can be found here. I've also copied the contents of that article at the bottom of this email.</p> <p>On a more personal note, as a WVU engineering student, I remember listening to guest lectures from Duncan Lorimer, an astronomer who studied pulsars using the GBT, talk to us about the incredible capabilities of the Green Bank Telescope. As a West Virginian, the Green Bank Telescope was an icon that represented STEM leadership - an icon that tells young West Virginians that they too can participate in the act of discovery. This is no small message for the people in WV, a state often more well known for its poverty, obesity rates, opioid epidemic, and dying coal mining towns. Taking away this icon means stripping away the same hope that I was given as a West Virginian that I could grow up to be a leader in a STEM field.</p> <p>After WVU I went on to earn 2 Master's degrees at MIT and today I work with Bill Nye for his new science show on Netflix.</p> <p>As a science communicator and science literacy advocate, I implore you to keep the Green Bank Telescope in operation and fund it fully. Taking away such an excellent resource would be a blow that would strike too hard on a community already ridden with poverty and poor education.</p> <p>There's also a very important educational aspect to the GBT. Recently, to my dismay, the West Virginia board of education moved to include climate change denial and creationism in students' textbooks across the state. With this anti-science rhetoric seeping into mandated curriculum, these students need your help. They need to have outlets for science outside their classrooms.</p> <p>With all of this in mind, I hope that you'll read my article, especially the sections titled "Why are Astronomers Upset" and "Why are West Virginians Upset" and take them into consideration.</p>	Against Closure	Email - Scanned	11/11/2016	
573	b	Emily	Calandrelli		<p>There are many scientific reasons for maintaining the GBT, but I want to make sure you're aware of the economic and educational damage removing the GBT would do to, not just the town of Green Bank, but all of West Virginia. As I mention in the article below, West Virginia is one of the 5 poorest states in the country with 1 in 5 of its constituents living on food stamps. The GBT brings 100 jobs (140 in the summer) and an estimated \$12 million in tourism revenue to the surrounding community. This community, already on hard times, relies on those jobs and that money.</p>	Against Closure	Email - Scanned	11/11/2016	
574		Sara	Harper		<p>I am a WVU graduate and resident of Morgantown, WV. When I was young, I visited the Green Bank Telescope not long after it was opened. later, when I had the opportunity at Morgantown High School, I joined the science club to stay after school and search through the invaluable data that has lead to the discovery of pulsars. This was such an eye-opening opportunity for me as a student. It was something that many students felt proud and excited to be a part of. The GBT offers a unique chance to WV students to be proud of the state's contribution to science. I believe that WVU also has a group of experienced and world-renown scientists that specialize in research that is related to the GBT.</p> <p>Removing the GBT would be a terrible loss to the state, students, and public knowledge at large. WV in general has limited resources for STEM involvement and our rural environment makes it an ideal home for the GBT. I believe that removing this special resource would have a large impact on the science community, university, and K-12 education throughout the state. Please reconsider.</p>	Against Closure	Email - Scanned	11/11/2016	
575		Adrienne	Cohen		<p>Please do not close the Green Bank Telescope in WV. WV needs STEM-related jobs and technologies, and to take this away, is detrimental to the region. This isn't just to benefit West Virginians because this Telescope has technologies that others do not and it cannot easily be replaced. Keep it open and fully funded. \$12 million tourist dollars and 140 jobs is significant for this region. Thank you for your time,</p>	Against Closure	Email - Scanned	11/11/2016	
576		Rachel	Neiman	Undergraduate Recruitment Specialist WVU College of Business & Economics	<p>I want the Green Bank Telescope to be kept open and fully funded. I am a native West Virginian and I feel like our state is dying. Education, science and technology are our only hope.</p> <p>Please do not shut down this telescope. It is in the best interest of the people of our state and their futures if it remains fully open.</p> <p>Thank you for your time. I hope you will do the right thing.</p>	Against Closure	Email - Scanned	11/11/2016	
577		Michael	Hughes	Sales & Marketing RE/MAX Snowshoe Resort	<p>As local Realtors, RE/MAX has seen firsthand the positive impact of the NRAO on the local economy. Property values remain steady, vacancy rates are low, local businesses frequented by employees and visitors thrive. The Green Bank school system is staffed with excellent personnel and the students are bright and enthusiastic. The area would be negatively effected, as is any area where a large employer leaves. If the facility is closed, the effect would be devastating; property values will drop as the market is flooded with inventory, the local businesses that rely on employees and visitors will close, and the school will likely close. The Green Bank Observatory is an important asset, not just for the scientific and educational contributions but also to a vibrant local economy.</p>	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
578		Brenda	Person		<p>Knowledge, education, and innovation are what makes America great. To take away something that intrigues the public, educates them and sparks curiosity in children, would diminish the capacity for future generations to seek to understand the universe. This telescope provides astronomers with capabilities that aren't available in other technologies. Its steer-ability allows it to cover 80% of the sky.</p> <p>Just a personal anecdote: In my senior year of high school, I was having a really tough time and I took Astronomy as one of my electives; it was the best decision I have ever made. I researched, studied, read, and watched anything related to our universe. Most of my time was centered on planets, stars, and galaxies. The curiosity, wonder, and awe that I had for this great big place kept my mind off of the things that were out of my control. I had finally found something constructive and educational that gave me immense satisfaction. To take away something that might one day contribute to the life of someone who needs a positive escape would be doing a disservice to the public. I am still fascinated by our world beyond earth and would be tremendously disheartened to see this telescope shut down.</p>	Against Closure	Email - Scanned	11/11/2016	
579		Julia	Chincheck		<p>I am a West Virginia resident and a recent visitor to the Green Bank Observatory. Please fund or at least partially fund the Green Bank Telescope ("GBT"). The GBT is the most capable telescope of its kind and losing it could result in negative consequences to the State of West Virginia, for which it serves as a STEM beacon to its residents, and the field of astronomy. The GBT is the only telescope of its size that has its steerable range. It is an irreplaceable research and educational tool in West Virginia, an area in need of more STEM resources. It also provides jobs to those in the community surrounding the Observatory.</p> <p>Thank you for your consideration.</p>	Against Closure	Email - Scanned	11/11/2016	
580	a	Ashley	Noland		<p>Please do not dismantle the GBT. The GBT is both large and fully steerable and provides incredibly unique capabilities that aren't available at other observatories. It can cover 80% of the sky.</p> <p>I am from West Virginia, and the GBT is a symbol of innovation for our state. If you know anything of West Virginia, you know that we suffer from negative press often. Removing the GBT would cause incredible damage to our state -- we're already struggling for resources including STEM ones. The GBT offers a close place to let our children visit and see just how important STEM is to our community.</p>	Against Closure	Email - Scanned	11/11/2016	
580	b	Ashley	Noland		<p>Removing the GBT will cause a significant economic blow to West Virginia and could result in the loss of up to 140 local jobs. The GBT also brings in 50,000 visitors each year which equates to roughly \$12 million in tourism dollars to this region annually.</p> <p>Please, please do not get rid of the GBT.</p>	Against Closure	Email - Scanned	11/11/2016	
581		Allison	Evans	NASA Aerospace Engineer Former West Virginia Resident	<p>I'm writing to convey my appreciation for the Green Bank Observatory, and to request that it remain fully funded.</p> <p>The Green Bank Observatory is a unique asset to the radio astronomy community worldwide, as well as being a fantastic opportunity for STEM outreach in the state of West Virginia. Astronomers from all over the world take advantage of the Green Bank Telescope's ability to map approximately 80% of the sky with its steerable dish and great sensitivity. This ability is unparalleled and should be preserved in order to gain more information on how stars are formed, the chemical make-up of various galaxies and nebulae, the distribution of molecular gas clouds, pulsars, and the broadening research area of gravitational waves. With the discovery of gravitational waves new measurements in radio astronomy will be needed, and the Green Bank Telescope, as a large, steerable telescope, has capabilities that no other radio telescope can replicate.</p> <p>The observatory plays a large role in public outreach in addition to being an asset to the scientific community. As a middle school student my sister attended the Science and Math Governor's Honor's Academy at the Green Bank Observatory. It was a chance that she would not have received in any other state. Thousands of tourists from astronomy clubs to school groups learn about science and our amazing universe by visiting Green Bank. West Virginia University students conduct research there, and people who might not otherwise have an interest in or knowledge of astronomy research can visit and learn. It is an opportunity that many of us who live or have lived in West Virginia are very grateful for.</p> <p>I hope that the Green Bank Observatory will remain fully funded and that it will continue contributing to scientific discoveries, our knowledge of the universe, and STEM education. Please take this letter into consideration in your decision.</p> <p>(Disclaimer: My views expressed in this letter are my own and in no way represent the views of NASA. This letter was not written on government-funded time.)</p>	Against Closure	Email - Scanned	11/11/2016	
582		Andrea	Mucino-Sanchez	Marketing Assistant The Campaign Workshop	<p>As a native West Virginian, I urge you to keep the Green Bank Observatory fully funded and open. In this time and era where facts & science seem to take a back seat, it is imperative to keep a strong symbol for science and innovation in the state. Further, West Virginia should be a priority state to invest resources in, as it is a state in dire need of STEM educational resources.</p> <p>Please keep the Green Bank Observatory open!</p>	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
583	a	Drew	Calandrelli		<p>It has come to my attention that the Green Bank Telescope located in West Virginia has come under some uncertainty regarding its future. I would like to start this by saying I am a teacher in West Virginia involved in teaching STEM topics. The Green Bank telescope is an enormous tool that has been discussed as a STEM topic close to home and we hope to continue to use this tool for years to come.</p> <p>West Virginia is falling further and further behind in topics such as math and science and we hold on to what resources we have at home to show our students not only the importance of these topics, but the importance of them here in our own backyard. Shutting down the telescope would only further many children's misguided beliefs in the state that STEM may not be all that important to them, or at the very least not important enough for our state. That we as West Virginians can survive without it or it is a job for someone else, not us. I think it is wonderful to have such an amazing piece of technology so close to us that we can show off to our students to inspire them to believe in STEM. There are not many examples of scientific advances in many parts of West Virginia, and we cannot afford to lose the ones we have.</p> <p>The Observatory is something West Virginians are incredibly proud of to have in our state. It is a beacon of hope and prosperity to many young aspiring scientists and other children with STEM related dreams that come from small town West Virginia. It shows them that even in the smallest of places like where they live that science has not left them behind and is part of who they are and where they come from. We need to Observatory in our state to stay home not only for financial reasons to the state, but educationally as well for those children that come from the state that dare to dream big and can look at the Observatory from a young age and say to themselves "I can be part of that, I can do that."</p>	Against Closure	Email - Scanned	11/11/2016	
583	b	Drew	Calandrelli		<p>Outside of just educational purposes West Virginia as a state is in dire need of this. Just last year the state had to tap into its own "Rainy Day" reserve funds significantly just to balance the budget (around \$245 million was used). That accounted for over 6% of our budget that our state couldn't cover on its own. The Observatory brings in millions in tourism to the state which would be lost if it were to close further raising that 6% difference. The state is also losing jobs at an alarming rate and the Observatory employs up to 140 citizens. These aren't just typical jobs we would lose, but higher education jobs which are lacking incredibly in the state as we have one of the lowest rates of them in the country. It would be a hit on all parts of a struggling state.</p>	Against Closure	Email - Scanned	11/11/2016	
584		Chris	Haller		<p>I want to quickly follow up on my last email, we came across your public comment period and it seems like you're collecting unstructured feedback from a broad variety of channels. Since you didn't respond to my initial email, I'm curious if you have an efficient system to capture and track comments that way? If you do, would you mind letting us know what you're using?</p> <p>If not, maybe you're open to trying an alternative to make life easier? Since launching CiviComment, we've helped many clients like the Thurston Regional Planning Council and the Department of Energy significantly reduce the time it takes them to manage public comments. We are offering a free trial version of CiviComment that will allow you to evaluate the system in your current or next public comment project at no cost. Take a look and enroll, we can get you set up quickly!</p> <p>Feel free to reach out with any questions you may have.</p>	General	Email - Scanned	11/11/2016	
585		Raymond	Godwin		<p>The Greenbank Observatory is a amazing operation, and a critical piece of the economic health of Pocahontas County. In addition to the valuable research that has been gleaned over the past many decades, and that has been beneficial to our study of our vast universe, it has been a serious player in the tourist industry. To lose the Observatory would be a punch in the stomach to the economy of that part of Pocahontas County in particular and a hard hit to the local economy of both the rest of Pocahontas County, and Randolph County, as well. The area would lose a major population of those men and women who work there and would go elsewhere to find similar work. Please do all in your power to keep this important operation working for the immediate future and beyond.</p> <p>Thank you for what you are doing to help save the Greenbank Observatory.</p>	Against Closure	Email - Scanned	11/11/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
586		Janet	Ghigo	N/A	<p>The history of the development of Emergency Medical Services (EMS) in Pocahontas Co, WV, is closely tied to the presence of the National Radio Astronomy Observatory in Green Bank. In 1975, the state of West Virginia passed a law developing EMS as a profession in West Virginia. The Bartow-Frank-Durbin Fire Department (BFD) established a "rescue squad" as part of the department, with the first CPR and first aid training provided to these new medical providers by an NRAO spouse, "Bunny" Vance, who was a community native. Later, formal EMT training was provided by Theresa Weimer, another community resident, married to Ron Weimer, Jr., whose father worked at NRAO. Early EMTs included NRAO employees Harriet "Harry" Waddell and Zula Taylor as well as NRAO spouses Ann Coe, JoAnn Smith, and Kathy Norrod. Advanced Life Support by the BFD was expanded beyond the services of Medic Theresa Weimer when Ron Weimer, Jr., completed MICP training along with Dwayne Barker, NRAO employee, and Dwayne's wife Rose Mary Barker, who became a paramedic. Ron Weimer, Jr., was instrumental in working with the Observatory to help the BFD in the early days of EMS to run their own dispatch tower on Cheat Mountain before the county had 911. The Observatory had their own fire trucks and an ambulance, but only employees could serve as EMTs. In 1993, the BFD put up a state-approved satellite station across Rts 92/28 from the Observatory and all fire and EMS services on campus as well as for NRAO families were turned over to the BFD, saving NSF the cost of running these services. Theresa Weimer continued to teach EMT courses, with NRAO spouses Virginia Parker and Janet Ghigo becoming EMTs with BFD, and later paramedics after Theresa Weimer taught a paramedic class in Pocahontas County. This course in 1993-94 allowed squads other than the BFD to offer Advanced Life Services. In 1997, Theresa's last EMT class coincided with the training of NRAO spouse, Janet Ghigo, as an EMT instructor. Since 1998, Janet has taught 20 EMT classes, providing an additional 200-300 EMTs to the county. These ex-students now provide the backbone of all six EMS agencies in the county with students of previous instructors having retired. The county has a demonstration of the critical importance of large employers and the ability of volunteer services to thrive. In the 1990s, the little town of Hillsboro in the southern end of Pocahontas County had a vibrant EMS system, with many members being either employees of Denmar Hospital or their spouses. When that facility closed, there was no other place in the community for the employees and their families to work - and for the past 20 years the Hillsboro ambulance service has struggled with just a few members, fortunately being backed up by the Marlinton squad and recently by the Pocahontas Memorial Hospital Squad. Both of these squads are at least 15 miles from Hillsboro, and 30-40 miles from some of the more distant homes in the area. Obviously service suffered with the increased response time. In the early days of EMS in the BFD, a majority of EMTs, medics, and drivers worked at Howe's Leather Company in Frank. Howe's employees and spouses provided another large pool of people providing volunteer EMS service. The closure of Howe's in 1995 was devastating to the communities of Bartow, Frank, and Durbin; however, this closure was just a couple of years after the Green Bank satellite of the BFD Fire & Rescue was established, and increasing numbers of NRAO employees and spouses were able to take up the slack. There has been no loss of care to the community. All fire and EMS service has been provided by volunteers since the fire department was started in 1953. Only in the past year or two has the BFD had a single paid person, primarily taking care of paperwork, and more recently has begun to pay ambulance crews a minimal amount for each run, if they want to accept pay. Many of the most active drivers and medics still do not accept pay. The county EMS Authority was restarted in 1991 to promote emergency medical services in Pocahontas County. The Authority members include representatives from each of the county EMS squads. Tom Dunbrack, an NRAO employee, represented the Marlinton squad on the first Authority and was its Treasurer. The present representative for the Marlinton squad is Jennifer Barlow, one of Janet Ghigo's students. Ron Weimer, Jr., NRAO relative, represented the newly formed Ski-Medic serving the Snowshoe ski resort. In recent years, the squad at the resort has been represented by Mike O'Brien (now County 911 Director) and Seth Morgan, both students of Janet Ghigo. Theresa Weimer's paramedic graduates Marv Turner and later Christine Rebinski have represented the Cass ambulance service on the Authority. The present Secretary and Treasurer of the Authority is NRAO spouse, Janet Ghigo, representing the BFD. Although the present representative for Pocahontas Memorial Hospital is from out of county, many of the EMTs and medics employed at the hospital started with either Theresa or Janet. Ron Weimer, Jr, and Helen Clark, NRAO spouse, have served and presently serve as the county representative to the state regional EMS organization. In the past 25 years the county Authority has collaborated to bring e-911 to the county, to promote collaboration among the EMS services in the county, and to work to assure the best service possible to all county residents. This past year county squads responded to over 1600 calls, traveling close to 100,000 miles. Paid paramedic service is now available from four of the county's six squads, along with continued volunteer service. A majority of these squad leaders and active members can trace their training back to NRAO spouses and employees. At present the Assistant Fire Chief, Rescue Chief, and Assistant Rescue Chief for the BFD are all NRAO employees or spouses. It is not the main role of NSF to provide community services, but closing the Green Bank Observatory, with the necessary movement of these employees and spouses out of the county, would be a devastating blow to the network built over the past 40 years.</p>	Against Closure	Email - Scanned	11/11/2016	Green Bank Observatory and EMS in Pocahontas County.docx
587		Rusen	Lu	Max-Planck-Institut fuer Radioastronomie Auf dem Huegel 69 D-53121 Bonn / Germany	<p>I am a user of the 100-meter Green Bank Telescope and it has been and will continue to be a very critical telescope for my research on Active Galactic Nuclei (AGN) physics. It is a pity to learn that NSF will possibly divest the Green Bank Telescope from its portfolio.</p> <p>If the Green Bank Telescope were no longer available or the time available for science operations will be significantly cut, the progress of my research will be severely affected. We use the technique of very long baseline interferometry at short millimeter wavelengths to study detailed physics close to supermassive black holes in nearby AGN (on a few to a few tens of Schwarzschild radius scales). Although this technique utilizes an array of telescopes, Green Bank Telescope always serves as the high sensitivity and high resolution anchor for the whole array, as it is the most sensitive telescope. It is unacceptable to lose such an anchor!</p> <p>So, I strongly appeal to the NSF to continue the investment on the Green Bank Observatory for science-focused operations. Please save the 100-meter telescope!</p>	Against Closure	Email - Scanned	11/11/2016	
588		Brenda	Walters		I live in Pocahontas County and am proud to have this awesome facility in our county. It not only helps the economy but in a very special way contributing to humanity and viewing our universes	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
589		Bruce	Balik	University of Washington	<p>I have watched the EIS review processes being conducted at Arecibo Observatory and Green Bank Observatory with some interest. It appears that the **process** has been fair, open, and sensible. However, the **consequences** of closing both of these facilities are very broad and deep. That option merits extreme caution beyond environmental or senior panel reviews whose charge and scope are too narrow.</p> <p>In optical astronomy various national telescopes of broad and flexible usage at NOAO have been defunded or closed. However, other larger telescopes and similar telescopes operated by NOAO and others remain to absorb some of the impact on the community.</p> <p>Radio astronomy at the national level requires both frontier special-purpose arrays designed for spatial resolution (that are not particularly flexible in application) and very versatile telescopes with large collecting area to explore the spectral and time domains. These categories, both of which are essential, do not overlap. The EVIA and AIMA are examples of the first kinds of tools. Arecibo and the GBT fall into the second category. Of the latter two, the GBT has by far the largest spectral and sky coverage, whereas Arecibo has the largest aperture.</p> <p>Given the budgetary constraints at NSF/AST I can accept the closure of one of the two facilities. We can limp along with the other. However, the closure of both telescopes would be a serious - indeed, grievous - error since doing so removes not just one tool but an entire category of research.</p> <p>One telescope should be kept operational. Which one?</p> <p>The GBT is (by far) the premier and most flexible instrument of its kind in the world. It's role is and will always be a vital component in a spectacularly successful field of research whose future discovery space will only grow in time. Arecibo, while an especially valuable tool for classical HI and pulsar research, will soon be eclipsed by a larger facility of the same type in China called FAST (http://fast.bao.ac.cn/en/). Thus the traditional range of discovery space at Arecibo is unlikely to be expandable - - and possibly unsustainable once FAST comes into full-time operation.</p> <p>My recommendations:</p> <ol style="list-style-type: none"> 1. The GBT should continue to be operated by the US much as it has been as a shared resource for the world. At the very least it should be made available to Chinese astronomers in exchange for guaranteed time at FAST. (Other international agreements of this type may be worth pursuing.) Of course, I would never recommend this course of action without the demonstrated enthusiasm of the radio astronomical community. 2. Closing both the GBT and Arecibo is so consequential that any such decision should be an action that only the next decadal survey should be authorized to take. 	Against Closure	Email - Scanned	11/11/2016	
590		Barbara	Jackson		<p>Please keep our Greenbank Observatory open. It is essential for our community bring in money. The facility is also a benefit for all the children that visit.</p> <p>Keep it open.</p>	Against Closure	Email - Scanned	11/11/2016	
591		Ronald	Mudry		<p>I'm writing to support the continued funding of the green bank observatory. Aside from the valuable scientific knowledge we gain by its presence, I urge you to examine the implications of eliminating the large cellular "dark" zone that it provides so close to Washington DC.</p>	Against Closure	Email - Scanned	11/10/2016	
592		Delana	Vanover		<p>It should be preserved for future studies. Who knows, someday it may aid in national defense.</p>	Against Closure	Email - Scanned	11/10/2016	
593		Candy	Weiford		<p>We live in Huntington WV and have visited Green Banks many times.</p> <p>Please reconsider closing Green Bank's. We have taken our children, our grandchildren. It is interesting, educational. This is something for future generations.</p> <p>I believe this is important to World & National Security. Important to the scientific community.</p> <p>It feeds the economy in a financially depressed area. I believe it keeps the area beautiful due to the radio black out zone. I believe with all my being it would be a mistake to close this facility.</p>	Against Closure	Email - Scanned	11/10/2016	
594		Sally	Smith		<p>Please invest in the vital scientific resource known as the National Radio Astronomy Observatory at Green Bank in West Virginia.</p> <p>In addition to nearly \$30 million in annual investment contributed to our struggling economy by Green Bank, the research is vital to our country's future scientific and environmental communication and knowledge. The exposure to science education and exploration is also an extraordinary learning and vocational experience for our regional students and work force who become inspired to expand their knowledge and to reach for the stars!</p> <p>Thank you for your support.</p>	Against Closure	Email - Scanned	11/10/2016	
595		Karen	Peterson		<p>I write to implore that you continue to fund Green Bank observatory. There is no such facility available to the scientific community on the East Coast-- there is a telescope in New Mexico, and another in Puerto Rico. The potential opportunities available to the scientific community are amazing-- and bring people to Green Bank to utilize the incredible tool available to them. West Virginia needs to consider the opportunities that the telescope and the entire campus brings to Pocahontas County, and West Virginia--particularly now, with the exciting things that Space-X and Elan Musk and other entrepreneur scientists are doing. It would be short sighted and demonstrate an enormous lack of imagination to shutter such an opportunity.</p> <p>Please continue to fund this observatory, and then think outside the box- and start marketing these tool to folks who are going to pay to use it.</p>	Against Closure	Email - Scanned	11/10/2016	

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596	a	Martha	Williams	DHSc student, expected graduation December 2017	<p>My name is Martha Williams and I am a resident of Pendleton County, WV. I am originally a transplant to this state, but I have certainly fallen in love with this location. I left the area a few years ago only to return to raise my family to afford my daughter the same opportunities that I had.</p> <p>When I was in middle school we frequented the Green Bank Observatory which helped to solidify my love for science. And though I may not have entered the field of astrophysics, I can definitely say that my education path to helping people was lit by the influence of local scientists and educators at Green Bank. Even one of my high school classmates utilized Green Bank for his research while in physics at West Virginia University.</p>	Against Closure	Email - Scanned	11/10/2016	
596	b	Martha	Williams	DHSc student, expected graduation December 2017	<p>Recently Pendleton County lost one of our largest employers when the Department of Defense decommissioned the Naval Informations Operation Command at Sugar Grove. This has caused a significant impact not only to our economic base, but also to the morale of the residents that call this area home. With the National Science Foundation considering decommissioning the Green Bank Observatory in our neighboring county, the stability of this area I love will fall into question. And the very opportunities that I wish for my daughter may no longer be a valid option in this area.</p>	Against Closure	Email - Scanned	11/10/2016	
596	c	Martha	Williams	DHSc student, expected graduation December 2017	<p>Ideally, I would like to see the NSF complete the "No-Action Alternative," but I do understand that with the recent budget crunches the NSF faces that may not be a viable option. I would hope that the NSF would exhaust efforts to work with other organizations to maintain the research and educational opportunities at Green Bank as well as expanding the employment chances for the local community. This would be a hybrid of the two alternatives listed: "collaboration with interested parties for science- and education-foucused operations with a reduced NSF-funded scope" and "collaboration with interested parties for operation as a technology and education park."</p>	Alternatives Consideration	Email - Scanned	11/10/2016	
597		Albert	Justice		<p>My heart skipped a beat when I heard funding or the future somehow of the Green Bank Observatory(GBO) was in question. Jeez. And guess what? I have never been there.</p> <p>But my heart is there, and it is so on my bucket list. I think about it a lot, and when circumstances allow, want not only to go there but to take students there. I have had a life-long love affair with mountains, music and the night sky. That the GBO lives in my home state is actually a part of who I am, in some wonderfully woven ways.</p> <p>If there is a question concerning how to protect the observatory in West Virginia, it needs to be brought very clearly 'to the people.' A process that simply collects remarks and makes decisions, does not do this remarkable integral part of West Virginia justice at all! Basically, many many West Virginians are both dreamers and the night sky is part of us.</p> <p>I am not even sure exactly what is going on here, but I do know West Virginians want to know, and they want to be part of that process clearly. I firmly believe if this is brought before the breadth of West Virginians thoroughly, the GBO will survive for many many more generations--however that must be done.</p>	Decision Process	Email - Scanned	11/10/2016	
598		Marilyn	Meade		<p>Please keep funding for the Green Bank Observatory it is an important part of keeping eyes on the skies Thank you for reading my email</p>	Against Closure	Email - Scanned	11/10/2016	
599		Tennis	Parrish	WV citizen	<p>Please continue funding for the operation of this wonderful facility that contributes the economy and education of locals as well tourist who visit this beautiful part of WV. Please continue funding.</p>	Against Closure	Email - Scanned	11/10/2016	
600	a	Taylor	Hogge	Graduate Student, Boston University	<p>I am writing to you concerning the proposed changes to the Green Bank Observatory. As a frequent user of the Green Bank Telescope (GBT), I must speak up in support of future funding for the Green Bank Observatory. Many astronomers are currently using the GBT to perform important and groundbreaking science. To limit Green Bank's funding means limiting the time for crucial science that is performed each day. For many observers, the GBT is the only telescope in the world capable of helping accomplish their science goals. I personally use the telescope to survey the sky for high- mass star-forming regions. Recent upgrades to GBT hardware are crucial to observe a large portion of the Galactic plane with the necessary sensitivity and resolution. No other telescope in the world is better equipped for this task. My research and dissertation project will certainly be negatively affected by reducing the funding to this important observatory, and many other astronomers can say the same.</p>	Against Closure	Email - Scanned	11/10/2016	
600	b	Taylor	Hogge	Graduate Student, Boston University	<p>And the Green Bank Observatory is not only important to astronomers. The GBT stands as a monument to human ingenuity, and it is recognized as such by the many tour groups that visit the Green Bank observatory each year. Tours at the Green Bank Observatory allow the public to marvel at the impressive size of the GBT, as well as understand the important science that it performs. The public outreach performed at Green Bank is inspirational to students of all ages, and is exactly what the government should be funding to promote interest in STEM fields.</p> <p>The Green Bank Observatory houses a world-class telescope that performs groundbreaking science every day, while providing necessary public outreach that inspires the future generations of our country. To reduce or in any way limit the good and important things that comes out of this observatory would be an ill-advised travesty. I support the NSF fully funding the Green Bank Observatory for the benefit of citizens and scientists alike.</p>	Against Closure	Email - Scanned	11/10/2016	
601		Charles	Freeman		<p>Greenbank needs to continue in business, where else could you find a quite zone on the east coast.</p> <p>We spend billions on other countries but want to throw away opportunities in an area that would blow away without Greenbank being in business.</p>	Against Closure	Email - Scanned	11/10/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
602		Christopher	Wotta		<p>I am a PhD student in my sixth year and I am writing on behalf of the Green Bank Observatory (GBO). The GBO has been an important part of my research and training as a graduate student. It would be a significant loss would the GBO be closed or defunded.</p> <p>Furthermore, the availability of the GBO to All scientists is crucial. I have an interest in the future of the GBO and recommend it remain funded as-is.</p>	Against Closure	Email - Scanned	11/10/2016	
603		Michelle	Berg		<p>As a Ph.D. graduate student, being able to use the GBT to gain research experience has been invaluable. This telescope provides the easiest way to step into and learn about radio astronomy. The several projects I have used the GBT for are a significant part of my thesis. I think the only two options to consider moving forward would be either continued NSF funding (no-action alternative) or reduced NSF funding.</p>	Against Closure	Email - Scanned	11/10/2016	
604	a	Ann	Schmiedekamp	Professor, Physics Penn State Univ. Abington	<p>You are presently involved in evaluating the environmental impact of funding the Greenbank Observatory and I write because our institution will be affected. We have utilized the telescopes of the Greenbank Observatory for undergraduate research each year since 2009. Every fall, we train students in the background for radio astronomy and then the students travel to the observatory and take data. Every year the teams of students produce posters on their projects. The presence of the educational staff at Greenbank, along with the researchers on site, have provided much enrichment and assistance for our students in participating in scientific research. This has been a top rate opportunity for our students and we have seen many of them go on to internships and careers in STEM fields. Our campus, Penn State Abington, is located in the Philadelphia area and draws students from underrepresented groups in STEM fields. We are very fortunate to have had the facilities at Greenbank to offer to them.</p>	Against Closure	Email - Scanned	11/10/2016	
604	b	Ann	Schmiedekamp	Professor, Physics Penn State Univ. Abington	<p>I am concerned about the possibility of shuttering the lab and the GBT. This large Greenbnak telescope is one of very few large single dish telescopes in the world. I also understand that Arecibo is being evaluated also. Our students are also participating in the pulsar search collaborative and we are linking to high schools in the Philadelphia area. Shutting down the large U.S. radio telescopes will severely cripple radio astronomy in the U.S. leaving us to go outside of our country to obtain such data. Single dish radio astronomy is an ideal area for undergraduates to begin to participate in astronomical research. Our projects, in collaboration with the staff at Greenbank, have been engaging pedagogical experiences for our undergraduates.</p> <p>We ask you to list our undergraduate participation in the facilities at Greenbank among your considerations of the environmental impact of the observatory.</p>	Against Closure	Email - Scanned	11/10/2016	
605		Kaustuv	Basu	University of Bonn	<p>I wish to make an endorsement for the continuation of the scientific operations and NSF funding at the Green Bank Observatory through this email.</p> <p>I am a staff scientist and lecturer at the University of Bonn, Germany. My research is focused on galaxy clusters with the aim to improve our understanding of cosmology and various astrophysical processes. Through the collaboration with many of my US and European colleagues over the last several years, I have participated in multiple observational programs at the GBT. These observations were mostly focused on using the high-frequency (90 GHz) capabilities of the GBT using sensitive bolometer instruments (developed by the group of Mark Devlin at UPenn).</p> <p>For my field of research this high-frequency capabilities of the GBT is truly unique, setting it apart from a similar radio telescope in the Effelsberg (Germany), for example. The weather and the excellent accuracy of the telescope surface allows for a seamless operation with the bolometer receivers at this frequency, providing a collecting area (and hence sensitivity) that is unmatched by any other instrument at similar wavelengths. It will be a true loss for science if we cease the full scale NSF funded scientific operations at the GBT and close this unique window onto the universe. Even though powerful interferometers like AIMA is now in operation, for certain applications (like imaging a diffuse, extended signal) there is no replacement for a single-dish observatory, and also GBT's location in the Northern hemisphere makes it a unique compliment for AIMA.</p> <p>I hope my mail could be of some help in deciding for a continued NSF investment for the full-scale science operations at the GBT.</p>	Against Closure	Email - Scanned	11/10/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
606	a	Jose	Rodriguez-Velez	Wildlife Biologist	<p>I respectfully submit to you my personal opinion regarding the plan to divest, close, and/or downgrade the functions of the Green Bank Observatory (GBO).</p> <p>The GBO is the only such scientific tool directly accessible to the entire Eastern USA region, and surrounding Northern and Middle States. It's location, the National Radio Quiet Zone, not only ensures and guarantees suitable conditions for its operations, but makes it highly accessible to a substantial number of people from these surrounding States. The NSF intrinsic function is to protect our Nation's scientific endeavors, to promote continued social scientific interest and ensure access to the broader audience possible. It appears to me, the most likely sought out outcome for this scientific and educational facility, unique to the Eastern USA region, could contribute to a growing Nationwide disconnect between the common People, and Science/Mathematics exposure. Efforts by the NSF to divest will only contribute to more scientific isolation and disinterest amongst members of communities already disconnected with how R&D emerging technologies and visible Science work to better our lives. Communities, like Green Bank, have a voice when it comes to how Congress determines the size and manner by which tax dollars are spent. Neglecting to include or ignore the ones at the bottom could eventually render your future funding pursuits troublesome.</p> <p>Worth repeating, being the only facility with such an array of instruments in the entire East Coast, the GBO should be NSF public relations STAR, because it is a fantastic tool located within Federally protected land of immense biological value that can be used by NSF to bring back all aspects of Science to remote locations that border urban centers of the USA. Its location in West Virginia is crucial, for it is one of many States where Math and Science are increasingly being seen as "negative" qualities to have by the general public, because certain member of Science academia render the general public, who support with tax dollars, ignorant and below themselves. The ALMA venture will benefit the World for sure, but back here in the "woods" of the USA, those far foreign land findings will provoke very little impression, because people will not see, feel or physically have the chance to experience science at work, which would help establish a life lasting connection that will ultimately matter the most.</p>	Against Closure	Email - Scanned	11/10/2016	New PDF 2.pdf
606	b	Jose	Rodriguez-Velez	Wildlife Biologist	<p>The NSF is risking a great deal more down the line, by transferring tax dollars to sovereign foreign Nations at the expense of USA based scientific endeavors, which, always have the capability to give favorable impressions about how tax dollars are invested on R&D ventures. An large amount of dollars has gone to ALMA alone, while a small fraction is required to maintain and operate the GBO.</p> <p>To an increasingly Nationalistic voting block, here in the USA, the tax dollars trusted to the NSF will be seen as a wasted investiture on foreign affairs that benefit no USA taxpayer. A quick look at any social network comment section will illuminate my point, look at our Presidential results.</p> <p>Be very concerned, for social animosity and voter resentment can develop quickly, starting at the local levels to expand Nationally. As a wildlife Biologist who dedicated 15 years of my life to save the endangered Puerto Rican parrot from extinction, these dollar investments in ensuring local visibility that provides engagement and lasting connections for the people paying your bills count.</p> <p>If anything, you need to ramp up the importance of facilities like the GBO and Arecibo and make them working partners with public and private schools and universities. That visibility ensures funding continuity.</p> <p>ALMA R&D foreign investments are valid, but not at the expense of perfectly usable USA land based technologies which are accessible to all and bring a real life experience to a greater number of people. The thought of NSF suggesting the waste of millions of taxpayer dollars by dismantling of these instruments to transfer technologies, science and tax dollars to Chile is offensive and so I urge you to reconsider and opt for fully funded continuity (option1), but with enhanced participation from all branches of Natural Science, converging in these remaining magnificent and pristine lands.</p>	Against Closure	Email - Scanned	11/10/2016	New PDF 2.pdf
606	c	Jose	Rodriguez-Velez	Wildlife Biologist	<p>If support is maintained at previous levels, the GBO will get to continue to provide USA soil based, "hands on" access to large swaths of bright future scientists from low and middle class America, as well as International students. The GBO facility is A+ "cream of the crop" easily accessible, and equipped to experience Astrophysics. The GBO location, within the Monongahela National Forest, makes it an ideal location for the NSF to explore R&D possibilities in Earth Science, Environmental Research and Conservation, all within the scope of NSF pursuits in the National interest. This will allow college graduates to get hands on experience utilizing top of the line instrumentation and instruction, and also, will give NSF National presence that counts and gains followers and supporters. Don't lose sight of that which can secure your financial security as an institution that must serve the interest of the public and the Nation.</p>	Against Closure	Email - Scanned	11/10/2016	New PDF 2.pdf
606	d	Mary	Willis	Elk River Touring Center, Inn and Restaurant	<p>I am writing in support of keeping the Radio Astronomy Observatory in Greenback, WV open through funding from the National Science Foundation. I understand that the facility is not actually a part of NRAO anymore, but there are many ways this facility can be used to promote astrophysics, the study of space and other scientific research.</p> <p>As a resident of Pocahontas County I regard the influence of NRAO on the county and it's residents was immeasurable. My two sons graduated from the county high school. Having NRAO close by for field trips, special programs and camps helped to 'up the bar' for our county's science program in all the schools. As everyone knows, students need to be influenced to enter the STEM programs in universities for our country to be relevant. Facilities such as GBO are excellent places to spark the interest of students and launch careers in all areas of science. Programs such as the Summer Research Program for Undergraduates or the Pulsar Research Collaborative with West Virginia University and SkyNet Junior Scholars program must be preserved for future of scientific research.</p> <p>I hope that the National Science Foundation will find funding to support all or at least a large portion of the budget to keep this important facility and the research and educational opportunities that it supports open and thriving for many years to come.</p>	Against Closure	Email - Scanned	11/10/2016	
606	e	Mary	Willis	Elk River Touring Center, Inn and Restaurant	<p>GBO is a major tourism attraction for the county. It employs over 60 people, all excellent community minded folks who are great contributors to the county. These are good paying clean jobs in addition to the associated tourism economy which will be sorely missed in the community. I have a small business in the tourism industry which is becoming the major economic driver of our area. Many of my guests visit the GBO and find it a most interesting and unique experience.</p>	Against Closure	Email - Scanned	11/10/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
607		Suzanne	Simmons		I am writing in support of continued funding for Green Bank Observatory. The contribution the Observatory has made for over 50 years is without question, but continued funding must result in continued benefits and accomplishments. The science and technology and research opportunities in this location are not possible in other locations around the country. In today's world, wireless and cellular data and communications are nearly essential to everyone, and the ability to conduct research in a silent, radio-free environment is essentially impossible in other locations. Science and technology are essential to the future of our state and our country. Monies spent to continue and expand the work done at this facility will be money well spent. The payback comes in terms of the future contributions of the work done there, future discoveries, and future communication methods to and from space. Development of new technology and new research must be supported financially for the good of our country, and the Observatory at Green Bank is worth continued investment.	Against Closure	Email - Scanned	11/10/2016	
608		Suzanne	Simmons		Additionally, the educational contribution of Green Bank reaches far beyond the local or state level. Contact the scores of students from around the country and around the world who have attended the annual National Youth Science Camp and ask how their experiences at Green Bank influenced them in their ultimate endeavors.	Against Closure	Email - Scanned	11/10/2016	
609		Sean	Harwell	M.Ed. Geoscience Grant Manager	A few years ago I was introduced to the Green Bank Observatory and realized what an important role it played it played. Not only is this a place that the people of West Virginia are proud of, but a place that it sought after by other countries. The Green Bank Observatory does amazing work in the field of Astronomy and plays a huge role in getting students into the science field. The outreach program at Green Bank is on par or better than that of NASA when it comes to exposing students to science. Introducing students to this type of research at a young age fosters an interest in these fields, leading to future scientist. The Green Bank Observatory outreach program is growing larger every year, exposing more and more students to this world of science. This place is truly one of the best places for science in the United States.	Against Closure	Email - Scanned	11/10/2016	
610		Karen and Richard	Watson		We are writing to urge that federal funds be continued through the National Science Foundation to support and maintain the work of the Greenbank Observatory at its present location in WV. As life-long residents of WV, we have had occasion to visit the Observatory several times and are always amazed by the work being conducted there. We also feel privileged (and have for all these years) that such a significant scientific endeavor is being carried out right here in the mountains of WV. It is an iconic institution and has become a significant tourist attraction in WV, very important as we try to diversify our economy during these stressed times. More importantly, the work done at the Observatory contributes greatly to our scientific knowledge of the universe and should be continued for future generations. We urge you to continue funding this marvelous facility. Thank you for your consideration,	Against Closure	Email - Scanned	11/10/2016	
611	a	Mike	Hedrick		My thoughts about the impact are: 1. The loss of a facility were young collage engineers, designers, and technicians can work with, "hands on" and learn just what it takes to build the receivers and instruments that we use on the GBT telescope, and that they will use in their future career. 2. The ability to show local students a facility that houses a variety of career opportunity, and to expose them to manufacturing and the career paths that are available, along with seeing real math and science being used, and leaving with a better understanding of why they need to learn and put to use their education, in a rural area that is not afforded many opportunity's to see a machine shop, or a technicians lab and the education that goes along with it.	Against Closure	Email - Scanned	11/10/2016	
611	b	Mike	Hedrick		3. A facility for the scientific community, in this rural area, on the east coast, and so close to so many collages, in the "National Quite Zone, that if it is ever lost, will not ever be regained " a place that can be used to prototype, try new ideas, new one of the kind receivers, or a whole new line of thought, with the infrastructure already here, the lab, the Machine shop, the Electrical shop, Carpenter shop, Plumbers shop, Mechanic shop, and with people with the ability to help and show how to learn, build and complete any project.	Against Closure	Email - Scanned	11/10/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
612		Diane	Schou		<p>Below are comments for the NSF for support of the Green Bank Observatory from another perspective of people harmed by electromagnetic radiation (EMR) and their exposure to environments with higher levels of EMR:</p> <ul style="list-style-type: none"> • Air quality considerations: Studies to detect changes of EMR in the radio quiet zone are valuable. o Why do several people detect unusual EMR at the same time, yet they live a distance apart? What are the emissions that injure some people? o Funding is requested to measure, log, and document emissions, and correlate resulting effects. o To help the observatory, 1) some persons are better than meters. 2) these people choose to live without EMR and hence are good neighbors in the environment near the Green Bank Observatory. • Safety, health, and long-term biological effects are important to study in this unique environment here. o EMR levels are increasing, injure biological systems, and there may be nowhere else that is as protected as the unique environment around Green Bank, West Virginia. o Before coming to this extra protected area many of us became injured from EMR emissions and escaped to live elsewhere in a car, tent, shed or cave. We lived without easy access to food, water, and without protection from weather. We also lived without contact to other people because of the wireless communication devices they carried (not commonly done in Green Bank). • Cities have many, many emissions, and rural areas often have stronger emissions (likely because EMR have to travel farther for communication systems). Then we found Green Bank, in the National Radio Quiet Zone and our health has improved here. • We feel we are an endangered species, harmed by EMR as well as are animals, plants, and other systems on earth. It would be of value to use this area as a control in tests. o Needs for EMR people include a life without injury and pain from unnatural EMR exposures. • Social economics o Before discovering Green Bank, many of us left family, friends, careers, and homes (at great financial loss) and escaped to and lived in almost primitive environments such as in cars, tents, sheds, and caves. Many of us are college educated and could contribute, but at this stage the first focus is on survival. The urgent question is will this happen to many more people soon? o Without the Green Bank Observatory, there would not be security or a support system for us to contribute to in a manner to better prepare for others to understand coping with EMR. • National Historical Preservation: Green Bank's radio observatory's protected National Radio Quiet Zone is rare both in the United States of America and in the world. o People move to Green Bank for 1) safety (much electromagnetic radiation is unnatural and man-made), 2) security because people injured by EMR find no other protected quiet zone and 3) social connections with people as this is a humane place to live (versus in a remote cave or in a car). • Recommend expanding research at the Green Bank Observatory with goals to study physical needs. o Why do many people detect EMR? Additional funding is needed to measure, log and report EMR, especially the EMR that is artificial. Perhaps the NSF would fund this as a different entity, (i.e. in addition to or other than astronomy)? o There is also a facility for sale that could become a humane refuge at Sugar Grove, WV. Could the NSF purchase this facility, and/or work with other government groups there? <p>People harmed by EMR would be good neighbors, not needing cell phones, wi-fi, or other wireless devices. And vice versa, we need the Green Bank Observatory National Radio Quiet Zone's survival and protection.</p>	Against Closure	Email - Scanned	11/10/2016	Schou comment to NSF.pdf
613		Jeffrey	Mears	Environmental Area Manager Oneida Nation Environmental Health & Safety Division	<p>The Oneida Nation, located in Wisconsin, is not interested in participating as a consulting party at this time.</p> <p>I can serve as the Point of Contact for any questions. Please see my contact information listed below.</p>	Resource Considerations	Email	11/9/2016	
614		Victoria	Kovalchuk		<p>My name is Victoria, and I am a member of the Astronomy Club at the University of Virginia. Every year, our biggest event is a trip to the Green Bank Observatory, and it's always thrilling to visit a place that contributes so much to the astronomy and astrophysics community. The GBT plays a big role in inspiring the children of its community to pursue scientific inquiry. It also plays a big role in the astronomy clubs across the country including the University of Virginia Astronomy Club. On our trip to Green Bank, we get to explore the universe and learn about radio astronomy, even when it's cloudy! Not only that, the GBT conducts a lot of valuable research. However, I have heard that the government is planning on cutting all funding to the Green Bank Observatory. I know that this would hurt the GBT greatly and I would strongly urge you not to cut the funding to the GBT.</p>	Against Closure	Email - Scanned	11/8/2016	
615		Joe	Mitchell	President, Mitchell Chevrolet	<p>I am writing to express my support of continued funding for the continued operation of the Green Bank Observatory by the National Science Foundation.</p> <p>The Green Bank Observatory has been part of the fabric of the Pocahontas county community for many years. Community impacts include:</p> <ul style="list-style-type: none"> - Exposure of students to the application of math, science and engineering that helps them discern career paths through mentorships and other activities. - Exposure of thousands of tourists annually to, scientific research activity of which many had no previous appreciation. - Enhancement of local workforce especially in education by family members of GBO employees. While most of us don't fully understand the research being conducted at the GBO we do understand the importance of the continued exploration of the universe. 	Against Closure	Email - Scanned	11/8/2016	
616		Connie	Mole		<p>I am in full support of Green Bank Observatory remaining open. I grew up less than 20 miles from the observatory and from personal experience am very well aware that the observatory is the only major STEM job opportunity to encourage children to get involved in science in the Pocahontas/Randolph area. Losing the observatory would economically damage this area beyond repair. I remember our class visiting the observatory a number of times as a child and the science I learned from those visits. It is a teaching facility as much as it is a research facility. My husband and I recently took our son to the facility for a day of science and learning about launching rockets as well as the telescopes. Please don't close this valuable resource.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
617		Chelen	Johnson	Science Teacher and Yearbook Advisor Breck School	<p>For the past 14 years, I have had the distinct privilege to work with astronomers and EPO staff at the Green Bank Observatory. These experiences have transformed my 32-year teaching career. When I first set foot in Green Bank in June 2002, I was not conversant with the intricacies of radio astronomy. Having been awarded a Research Experience for Teachers grant, I worked with Dr. Ron Maddalena on an eight-week calibration project. This experience allowed me to expand my high school astronomy classes to included long wavelength research, for different from the usual optical observations. The next two years, I spent my spring breaks continuing to refine calibration values for the Green Bank Telescope (GBT).</p> <p>Having won a sabbatical from my school, I spent the 2004-2005 academic year in Green Bank. New algorithms were developed to refine cal values to greater precision. I also worked with Sue Ann Heatherly to develop lessons for dissemination both in the state of West Virginia and across the nation. My Green Bank adventures have continued. For eight consecutive summers, 60 rising West Virginia ninth-graders were selected to gather in Green Bank for the two-week long West Virginia Governor's School for Math and Science (GSMS). The GSMS students ("govies") were challenged to delve into stream ecology, astronomer, electronics, engineering and technology much, much more deeply than offered in their schools. In addition to using the 40-foot telescope, each govie worked with an NRAO astronomer on an authentic research project, oftentimes adding their own GBT observations to enhance their research. What a thrill to watch 14-year-olds control the world's largest fully steerable object!</p> <p>When the ninth-grade curriculum in West Virginia changed to Earth and space science for the current school year, the observatory took on a leadership role in helping teachers master the new curriculum. Along with Fairmont State, the EPO staff at the observatory offered the Earth and Space Science (ESS) Passport to teachers across the state. I was fortunate to be a part of the astronomy education team. At the West Virginia Science Teachers Associated conference held just last week in Morgantown, it was thrilling to hear ESS Passport teachers brag about passing their PRAXIS exam after our two-week intensive workshop.</p> <p>Having the opportunity to with Sue Ann Heatherly through Skynet Junior Scholars, Governor's School, Pulsar Search Collaboratory and many other programs has been instrumental in my teaching success. She has positively impacted well over 10,000 lives through her astronomy education programs offered at the Green Bank Observatory for the past three decades. Heatherly is nationally recognized for her vast contributions to astronomy education. It is impossible to walk with astronomy teachers or to walk through an American Astronomical Society conference without bumping into a person (or five) who doesn't have a "SA has taught me so much" story.</p> <p>There is no equal to what the Green Bank Observatory has contributed to astronomy education. The cutting-edge Pulsar Search Collaboratory is a unique way for students to analyze actual data in hopes of discovering a pulsar! T is critical that these opportunities continue to be offered to our students and teachers. If our nation is to regain supremacy in STEM education, it is imperative that facilities like the Green Bank Observatory have the funding to function properly.</p>	Against Closure	Email - Scanned	11/8/2016	
618	a	Bernadette	Lynch		<p>The STEM subjects were never presented to me in my elementary and secondary education as a viable career option. I was encouraged to be a teacher, or an office assistant, never hearing that 'you can be a scientist, an engineer, a researcher'. Yes, I am an over 50's female, and what I have experienced by following my children's careers in science and math has led me to a new found discovery that maybe science and I would have made a great partnership. The biggest influence in my new appreciation of scientific research and outreach lies within the miles of the Green Bank Observatory.</p> <p>...We cannot treat this structure as a disposable science project which some may think has met its usefulness because it has not! The GBT is one of NSF newest, large telescopes and remains at the cutting edge of astronomy. The observatory shares a balanced goal of science and outreach that has made useful discoveries and encouraged the public to understand what man's mind can accomplish and find in our universe. The influence upon young minds of a stately structure that conducts outstanding research and innovations, motivating them to find their niche in a STEM career, cannot be understated. Over 50,000 visitors and 3,500 students visit Green Bank every year to learn and be inspired by science and technology. In the past 12 months, 54 different groups spent the night in Green Bank and used the 40 foot radio telescope as part of their hands-on educational experience. These are numbers that cannot be ignored!</p>	Against Closure	Email - Scanned	11/8/2016	
618	b	Bernadette	Lynch		<p>The pride of a rural community to have such a place in their community and the economic benefits that it has realized cannot be pushed aside and slated as not necessary any longer. We are talking about human lives, human minds, that continue to contribute a significant impact in the field of astronomy. Ceasing science operations at the GBT will negatively affect the careers of over 900 astronomers, many of whom are just entering the field, and could wipe out up to \$30 million in economic benefits for the state of West Virginia.</p> <p>I am also feeling the impact of countries like China who have recently built the FAST project to promote their country in the astronomy field. Cuts to the GBT funding comes at a time when other countries are investing in radio astronomy. This threatens US leadership in this cutting edge field while on the doorstep of many new breakthroughs in science and technology. All four of my grandparents immigrated to the the USA because they believed a better life could be found in this great country. They left their roots, their family, their culture to make their new home in a country that led the world in prosperity, intellect, creativity and most importantly, freedom. Is this yet another example of how we allow our world leadership to fade? Furthermore, the GBT has historically been open to any scientist in the world. Time was awarded based solely on intellectual merit, not affiliation or citizenship.</p> <p>I encourage the National Science Foundation to look at the facts of what the Green Bank Observatory has and will continue to do to influence the advancement of mankind. Do not turn away from your monetary and labor investments that have produced so much. GBT operations account for only 3% of the astronomy budget at NSF. The GBT is an incredibly flexible telescope that has made ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond Earth. A decrease in NSF funding for the GBT will limit the amount of time available for the open science that has been the engine of discovery thus far. Please, deeply consider this heartfelt plea to retain all GBT functions.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
619		Helen and James	Fleming		<p>We have just read information on the funding of the Observatory which Sen. Joe Manchin emailed to us. Although we live in Greenbrier County now, we have lived previously for forty five years in Pocahontas County.</p> <p>My husband taught school right beside the Observatory property. It is always a beautiful sight to see the large dish telescopes there in that lovely rural landscape. The staff of the Observatory and their families were very good community members. The Observatory provides unique educational experiences for local students of all ages as well as giving older students and adults valuable experience and knowledge about this aspect of science.</p> <p>It also helps the community by bringing in tourists and professional people to visit the site and take advantage of the experience it offers. West Virginia depends on tourism as there few opportunities for employment here.</p> <p>Residents of this region always bring their visiting company to have this scientific experience. These guests, of course, are absolutely delighted with their visit to Green Bank.</p> <p>It is our hope that the Observatory will continue to be funded and to be an excellent showpiece, a pride of we West Virginians. Please present this plea to whoever can help with the cause of funding this special place that means so much to our state.</p>	Against Closure	Email - Scanned	11/8/2016	
620		Johannes	Hubmayr	Long-wavelength Project lead, Quantum Sensors National Institute of Standards and Technology	<p>This letter is in strong support of continued National Science Foundation (NSF) operations at the Green Bank Telescope (GBT). The scientific impact enabled by the GBT is important to me. Additionally, the resource has been an invaluable test bed for new technologies. Because of the GBT, we have been able to advance cryogenic sensors and readout for mm-wave observation, which have found broad application. lastly, my group and others in the mm-wave community have benefitted directly from students trained at the GBT. Graduate students whose thesis projects rely on the GBT have become valuable postdocs in my group. The GBT is a unique resource that we should continue to capitalize on.</p>	Against Closure	Email - Scanned	11/8/2016	
621		Trisha	Ashley	NASA Postdoctoral Program (NPP) Fellow NASA Ames	<p>I have been informed that the NSF is soliciting comments on the environmental impact statement and proposed changes to the Green Bank Observatory. I would like to submit my personal thoughts on this matter and attempt to convince NSF to continue to invest in the Green Bank Observatory for science-focused operations (i.e. the No-Action Alternative).</p> <p>The Green Bank Observatory has had a great impact on my career as a female astronomer. I began using the GBT as a graduate student. In graduate school I collected amazing data from the GBT and made new discoveries about the galaxy, IC 10, putting me on the map a scientist in my field. The Green Bank Observatory staff was particularly welcoming; they encouraged of diversity in the field and personally, they encouraged me to learn as much as possible about radio astronomy and the capabilities of the Green Bank Observatory facilities.</p> <p>Facilities that are open to students are increasingly rare; therefore this was a unique opportunity for me. Using the GBT as a graduate student allowed me to not only obtain amazing data for my dissertation, but it also taught me proposal writing skills, data collection skills, data analysis skills, and it encouraged me to continue in my field after graduation. As a graduate student, being given the opportunity to use a telescope like the GBT is a great honor and it motivated me to be a better scientist, work harder in my field, and continue in research related work after graduation. If graduate students are no longer able to experience observing at a facility like the GBT, then they may not be able to build the confidence to work with instruments like this in the future and they could end up feeling disconnected from the field itself. Adventures like going to the GBT, being in the operator's room, and controlling the telescope to study astronomy are the motivation that graduate students need to feel like they are achieving something and are connected to the astronomy community. NSF provides these opportunities by providing funding to operate the Green Bank Observatory.</p> <p>I have continued to collect data from the Green Bank Observatory as I begin the early stages of my career. The staff at the Green Bank Observatory has continued to help me understand the data that I have collected and continued to help me in my research endeavors. The data I have collected from the GBT and the amount that I have learned from working with the GBT are invaluable. The Green Bank Observatory is not just an observatory for seasoned researchers; it is a place where young astronomers learn new skills, gain confidence in data collection analysis, and are encouraged to be part of the scientific community. Please don't take that away from future young astronomers by taking away any of the funding that is so desperately needed by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/8/2016	
622		Sarah	Stanchfield	PhD Candidate Department of Physics and Astronomy University of Pennsylvania	<p>As a graduate student at the University of Pennsylvania, I have spent the last three years building MUSTANG-2, a 90 GHz continuum instrument for the GBT. The importance of the GBT to me and other graduate students and young postdocs cannot be understated. First and foremost, clearly science capabilities of the GBT in the 3mm band do not exist on any other instrument. I will be writing my PhD on MUSTANG-2 observations of galaxy clusters, studying both the astrophysical phenomena occurring in these clusters and also using the clusters I observe as a tool to better understand cosmology. For this science to be impactful, I need to observe such a large number of clusters in a reasonable amount of time with high angular resolution, there is no other telescope on which MUSTANG-2 would be as effective as it is other the GBT. Of course, there are many more people much more qualified than I to tell you how imperative the GBT is to the scientific community. I would like to tell you why I think the GBT is so important for more junior scientists like myself, specifically those of us in the US.</p> <p>The other unique capability of the GBT which I think is even more important to younger people is the hands on experience afforded to scientists in training. The time I have spent at learning at the GBT is some of the most important of my program. There are very few other instruments of GBT caliber where students can have such ownership in their observations and science. Another important aspect of the GBT is that this is an American facilities. If scientists are forced to take their projects to other observatories (for example, the IMT) the people this will hit the hardest is students. Students often have limited funds available for travel and travel to foreign countries is often unfeasible.</p> <p>Please don't punish US graduate students and young postdocs by limiting the science capabilities of the GBT.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
623		Kathryn	Williamson	Teaching Assistant Professor Department of Physics & Astronomy West Virginia University	Email: In a separate email I sent a support letter from just me, but I would also like to send a compilation of letters from students in West Virginia University's Fall 2016 Astronomy 106 course. This compilation is attached here. Thank you for your consideration in keeping this iconic scientific beacon for our state open and operational. Letters: Inserted as separate comments, listed by individual (WVU Astronomy 106 Students).	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
624		Tony	Beasley		The state of West Virginia (WV) has an environmental review process – WV Division of Natural Resources. To what extent has the scope of this EIS review meet any relevant WV DNR requirements, if applicable? Issues that potentially impact Pocahontas County such as site road maintenance being returned to the state, and mitigation of the airplane runway, should be reviewed. State Road 2 runs through the site – who will maintain that in future? What consultation has the NSF performed with relevant local, county and state agencies to understand the impacts of the action alternatives identified?	Resource Considerations	Email - Scanned	11/21/2016	
625	a	Danielle	Cain	WVU Astronomy 106 Student	My name is Danielle Cain, and I am enrolled in an astronomy course at West Virginia University. Throughout this class, we have used the 20-meter telescope in Green Bank, West Virginia to further our learning and knowledge of the universe. The Green Bank Observatory is truly an asset to schools and scientists worldwide. There are new discoveries and research being done every day right in our backyard. Being from Pocahontas County, WV I see the effects that the NRAO has had in my county. The Green Bank Science Center is such an extraordinary experience for the kids in our schools every year. Going on field trips there gave us many educational opportunities that we only got because something so crucial to science was so near to us. Even if students are not as close as I was to Green Bank, they can still utilize the 20-meter radio telescope online through Skynet, gaining experience with multi-wavelength astronomy. The learning possibilities are endless for science learners worldwide with access to such a critical tool.	Against Closure	Email - Scanned	11/8/2016	
625	b	Danielle	Cain	WVU Astronomy 106 Student	Not only is education a primary impact of the Green Bank facility, but they also employ a large portion of people living in Pocahontas County. The number of families that would be affected if the facility were to close is tremendous. Many people in our county would lose their jobs and may have to move away because of this. Pocahontas County is such a small, but beautiful county and we can't afford to lose more of what we have to offer. Tourism is a significant factor for the county and if the Green Bank Observatory closes this could severely damage our tourist industry and economy. I hope you take this letter into consideration and reflect on how the Green Bank Observatory affects more than what others may realize. An educational research facility of this power should be highly valued.	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
626		Ryan	Brown	WVU Astronomy 106 Student	Hello, my name is Ryan Brown and I am a current astronomy student at West Virginia University. I have recently heard of the disappointing news that the Green Bank Observatory may be closing soon. Although I am not an astronomy or science major, I am still saddened by this recent development. I have not yet been to Green Bank, but was looking forward to a trip planned later this month. I had first heard of Green Bank by my astronomy professor, Kathryn Williamson back in August when the class had just begun. She mentioned a few things about it, like what an experience it is to go. At the time, I did not read much into it other than the part of extra credit offered for going. I planned on making a solo trip and to get nothing out of it other than extra credit points. However, as the semester went on my mindset began to change and is certainly different today. I have realized more and more throughout the semester that I have a large interest in astronomy. I have found this out not only through my class, but watching science fiction movies such as Interstellar and Gravity, along with shows such as the Cosmos and Through the Wormhole. Science, specifically space, stars, and the unknown has really piqued my interest recently. Also, we have worked with telescopes like the 20-meter telescope at Green Bank on this online robotic telescope program called Skynet. Skynet has been so much fun for me, as we have taken pictures of stars and asteroids in class. I find it fascinating at the wealth of knowledge and resources I have in this class, including Green Bank. Despite struggling with the material, I have gotten a great deal of value I have gotten from this class, as I have recommended to many peers and friends. All of a sudden as this semester has moved along, my solo trip planned to Green Bank has turned into a trip where my friends, who are not astronomy students, and I are going with an SUV full of people, excited to see what Green Bank has to offer in person. We are not only planning our trip this semester, but also are looking forward to future adventures there next semester, as well. I am truly interested and enthralled with this new found interest of mine of astronomy, as my friends are too. I am certain that my friend group is a small representation of a larger group that has this exact same curiosity with astronomy and space. I am writing to you today as one of many students, teachers, and other interested parties in the hopes that Green Bank will permanently remain open. I find myself thinking about astronomy more and more in everyday life and find it very interesting and very exciting that within this great state I attend college in there is a 100 meter telescope that I can go explore at any time I get bored, fascinated, or just plan to see. Thank you for your time.	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
627		Shannon	Cawley	WVU Astronomy 106 Student	<p>The Green Bank Observatory offers one of the most unique experiences one can have here in West Virginia. For years now, children, teens, and adults have come to the observatory for a firsthand look at the amazingness that's out in the universe. The Green Bank Observatory everyday inspires many of the children that come to visit either through school or with their families, teaching them a perspective about the universe that a textbook couldn't teach. That is why I'm writing this letter. Shutting down the Green Bank Observatory would be a great mistake and tragedy to our community.</p> <p>So many programs and people rely on the information and data that these telescopes offer. The "Pulsar Search Collaboratory," is just one that utilizes the GBT to discover amazing stars called pulsars. Without this observatory, great scientists like Dr. McLaughlin and her team from WVU wouldn't have a place to conduct their gravitational wave research. Along with furthering the field of science, Green Bank allows for many outreach programs aimed toward kids. The "PING" summer camp for rising 9th graders is a great opportunity to interact with the telescopes and technology offered. I remember looking through a telescope for the first time in about 8th grade; we looked at the Andromeda Galaxy. It was such a surreal experience, almost kind of scary to realize just how minute Earth actually is and how great/vast the galaxy is. It truly gives a person perspective and humbles you in a way. This type of experience is something that every kid should have if possible, and closing this observatory would deprive many youth of such experience. The PING summer camp, along with the many other programs offered at Green Bank, is so important to the community and so I'm writing this letter to ask you all to understand the full weight of your decision. Closing this observatory down would be a great disservice to our community and youth.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
628		Emilee	Austin	WVU Astronomy 106 Student	<p>I am a student at West Virginia University and am currently in an introductory astronomy class. Within this class we have had access to the 20 meter telescope at Green Bank remotely online through Skynet. This opportunity was eye opening for me because it was not only the first time I had used any telescope, but I was able to see things that I was not positive would actually be visible. Green Bank has helped me to understand certain aspects of astronomy that without access I cannot say I would have grasped. It was exciting to know that I was using a relatively local telescope because I felt like I was contributing to the West Virginia community in a way. I grew up in Northern Virginia, and the Air and Space Museum was really one of the only things that allowed for any sort of space experience. As great as the museum is and was it limited the experience to what was there. The Green Bank telescopes allow for exploration and expansion of knowledge, but it supports and encourages it as well. Having such a resource available to researchers, students, professors, and so many more people creates an environment that will promote discoveries and a desire to gain more understanding of what is actually out there. There is so much more to learn about space in general that to shut down a telescope anywhere is slowing down any progress.</p> <p>If the telescope was shut down permanently there would not only be people out of jobs, but a society out of the opportunity to explore and understand as I did and continue to. This is a rare opportunity, being able to use a scientific grade telescope was shocking when I found out; to take away opportunity is to take away knowledge in this case. If this telescope is shut down the advancements within the astronomy field could be at risk. This telescope is important to many people, and many of those people rely on it for research, education, employment, and inspiration. The Green Bank telescopes are an essential opportunity for anybody.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
629		Adam	Haddix	WVU Astronomy 106 Student	<p>My earliest memory of the Green Bank Telescope (GBT) is from playing on a nearby soccer field and looking up during the game and seeing this massive telescope and actually getting to see it move. My next memory is going to the observatory on a school field trip. I remember how amazed I was at everything our tour guide was telling us about the GBT and how it was one of the biggest radio telescopes in the world. That was just amazing to me -- that one of the biggest telescopes in the world is in my state. That stuck with me as I grew up and I still look at the GBT with the same amazement. Until this year I viewed the GBT as a huge tourist attraction for West Virginia, but now I actually know more about the work that goes on there (as the result of taking astronomy at WVU?), it's more than just a tourist attraction. Learning about how astronomers are using the GBT to monitor pulsars to detect changes from gravitational waves in spacetime has made me even more proud that this is all happening in my state just three hours away from where I'm from (Randolph County). I love West Virginia, I've been born and raised here and there's nowhere else I'd rather be and I'd do anything to help this great state. Taking down the GBT would just lower this states "morale", it'd put people out of work, tourism would drop, and West Virginia and the people working at and using the GBT would never get the credit for a breakthrough in space that could be just around the corner if it stays. As a very proud West Virginian I ask for you to keep the GBT up and running. It may not seem like it all the time but the people in this state really do appreciate the GBT and having it in this state. Please do not shut down the GBT.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
630		Noah	Wilds	WVU Astronomy 106 Student	<p>Growing up in West Virginia, I learned early in life we take pride in every part of our beloved state. When we hear someone talking about Barney Fife (Don Knotts), Jerry West, Randy Moss, or Brad Paisley, we make sure that everyone knows exactly where they are from. Anytime a movie films in the state, such as We Are Marshall and Super 8, everyone goes to see the movie whether it is something they'd normally see or not. Even if someone mentions West Virginia on TV, the radio, or in a news article, we make a big deal about it. This is just who we are and this feeling of pride and love for our state extends into the science world because we are the home to the Green Bank Telescope.</p> <p>There are two ways to look at just how important the observatory is to the state. First, as a state that isn't used to being the best at anything, we see it as an honor to be the home to one of the best telescopes in the world in addition to being the largest fully-steerable telescope. Knowing that this leads to new discoveries every year, ones that improve our future, it would be a poor decision to close the observatory.</p> <p>Another purpose of Green Bank is that it provides the future generations with a place to expand their knowledge. There are many opportunities such as a summer camp, a junior scholar program, and even an internship program that benefit our youth. When you take this away, this becomes yet another example of damaging the future of this country and taking away even more opportunities for new minds to succeed.</p> <p>There are many things that need defunded, but this is not one. Unlike most of our spending, the Green Bank Observatory has a purpose and the potential to constantly improve our world in addition to being a source of pride for the state of West Virginia, a state that needs as much hope as possible.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
631		Kelsea	Hower	WVU Astronomy 106 Student	<p>My name is Kelsea Hower, and I am an astronomy student at West Virginia University. I grew up in Greenbrier County, West Virginia, a stone's throw from the Green Bank Radio Observatory. The observatory has become part of my heritage as I have been there countless times in my twenty short years. My grandmother was, and still is, fascinated with the skies above us, extraterrestrial life, and what else might be in the dark beyond. She instilled this fascination in myself by taking me to the observatory as often as possible. One of my visits to Green Bank was brought about by the regional math field day, where they let us tour the facility after all the exams had been taken and we were waiting for the results. Out of all the science museums and exhibits I have been to, the interactive exhibit inside Green Bank was the most educational I have ever experienced.</p> <p>The Green Bank Radio Observatory has become part of the culture in my beloved West Virginia, something for my state to be proud of and boast to the country. It is an amazing tool for students and researchers across the globe to be able to use. The telescope is an essential part of Pocahontas County and defines the town as a "quiet zone." The closing of the observatory would destroy any tourism that the small town of Green Bank receives along with extinguishing the massive outreach through science from the state. West Virginians are often misunderstood as backwards, uneducated "hillbillies" and the Green Bank Radio Observatory shatters this disillusionment. I hope that you will take this letter and the letters of my classmates while deliberating on the fate of our telescope.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
632		Rachel	Jenkins	WVU Astronomy 106 Student	<p>I, as a college student at West Virginia University, have used the Green Bank 20-meter telescope for my astronomy class and it helped me learn a lot more about space such as how to use a radio telescope to discover how to emission from hydrogen clouds in the Milky Way. Also, it allows people such as students or adults to be able to discover the invisible universe, including pulsars that these people haven't found for before. Finding pulsars or objects far away in space can allow students to visual how big space is. It allows students to experience what they are learning in science classes and see what they are learning in life not just in a textbook. Also, they can use very important scientific instruments that they have talked about and use it themselves. It also allows astronomers to learn more about pulsars, gravitational waves and black holes in space. It gives West Virginia a tourist attraction that allows people to learn about telescopes and how they work. Finally, it allows students and astronomers all over the world to see what is happening in space from radio telescopes with a variety of capabilities. This gives people the ability to appreciate astronomy and the science in general. The potential NANOGrav to discover gravitational waves using the Green Bank Telescope can revolutionize how we study space easier. I feel that it is important for all people to have the experiences the Green Bank Observatory provides. Gives huge contributions to science and I don't think that these experiences should be taken away from all scientists and people who just enjoy learning more about space. The Green Bank Observatory should stay open so everyone all over the world can enjoy the telescopes and engage in science.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
633		Adelaide	Estep	WVU Astronomy 106 Student	<p>Having lived in West Virginia my entire life, I've always considered this state incredibly fortunate to be the home of such an impactful scientific site. For years, The Green Bank Observatory has been a place where astronomers work to discover the many mysteries of space. Education is another reason why this site is so crucial to the world we live in. This is one of the few locations where schools can take their students, and future astronomers, to educate them on the subject. Not only does this site hold summer programs for astronomy, but it also includes engineering and computer science education, which is remarkably important for the future generation.</p> <p>The research performed at Green Bank is truly groundbreaking. From listening to the closest 100 galaxies outside of the Milky Way to the study of pulsars and gravitational waves, the observatory has composed many important studies over the years. There is an immeasurable amount of information about space we have yet to find; therefore, the continuation of funding for the Green Bank Observatory would be by no means a mistake. I've taken the time to write this letter because I am concerned for the education of astronomy, and this is an extremely important asset to the future studies of astronomy, technology, engineering, and computer sciences. Please reconsider the thought of taking away the observatory's funding. The loss of this technology would be a shame.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
634		Judy	Hipelius	WVU Astronomy 106 Student	<p>The Green Bank Observatory serves many purposes. First, it supports research and discovery in West Virginia. The United States needs more research facilities and opportunities for students, college graduates, professionals, and the public to explore and learn about our extensive universe. Close the Green Bank Observatory down, and it will prohibit those chances for young learners and professional alike.</p> <p>Second, the Green Bank Observatory is the world's largest fully steerable radio telescope. That is an impressive feat, and even more of a reason to continue funding for this national landmark. West Virginians take pride in what this wonderful state has to offer, and taking away such an immense telescope would definitely impact West Virginia. I did not grow up in West Virginia, but I do know many young students travel to this facility for field trips and learning opportunities. Science and math are severely lacking in the United States; exposing young learners to museums, research facilities, and places like the Green Bank Telescope begins that thirst for knowledge and self-improvement. Many children dream of becoming astronauts in the future; seeing the Green Bank Telescope during this young age just may inspire them to do exactly that. Cutting the budget for science and math is the exact opposite of what the National Science Foundation should do. If funding for this facility is ceased, West Virginia and the United States will have yet another reason to continually fall short in science and math when compared to other countries.</p> <p>Third, real students across West Virginia have aided in new discoveries with the use of the Green Bank Telescope. A group of students discovered a pulsar back in 2012. "When you discover a pulsar, you feel like you're walking on air! It is the best experience you can ever have." --- Jessica Pal of Rowan County High School in Kentucky stated as she was interviewed. This type of student involvement is what sparks that interest in learners across the country.</p> <p>Anne Agee of Roanoke Valley Governor's School in Virginia stated she is "considering pursuing astronomy as a career choice," and "The Pulsar Search Collaboratory has opened my eyes to how fun astronomy can be!"</p> <p>Many positives stem from continuing to fund the Green Bank Telescope in West Virginia. Being the world's largest fully steerable radio telescope, Green Bank Observatory is a national landmark that West Virginians take pride in. It serves as memorable location where many residents toured at a young age. It inspires students to become future astronomers, scientists, and astronauts. It gives professional research opportunities to aspiring young learners. These are just a few of the reasons the National Science Foundation should decide to support funding for the Green Bank Telescope. I hope you find this letter explains why it is important to keep the Green Bank Telescope operational for generations to come.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
635		Brian	Driscoll	WVU Astronomy 106 Student	<p>It has been brought to my attention that you are considering closing down the Green Bank Observatory. I believe this would be a huge mistake. When I think of what the state of West Virginia is proud of, the Green Bank facility comes to my mind. I was lucky enough to attend Governor's School for Math and Science the summer before my freshman year of high school; the program was held at Green Bank. During my time there, I learned more about astronomy, the facility, what it has to offer, and about how the facility and astronomy go hand in hand with each other. I was fortunate enough to use the 40-foot telescope during my time there, and I used the 20 meter telescope through Skynet in an astronomy course I am taking now at WVU. I would hate for the facility to be shut down and to see kids miss out on the experiences that I will carry through my lifetime. I understand changes may need to occur in regards to this facility, but I believe it would be detrimental to not only me, but West Virginia to shut down the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
636	a	John	Carnell	WVU Astronomy 106 Student	<p>After recently finding out that you are considering shutting down or changing the NRAO, located in Green Bank, West Virginia, I was completely shocked. I honestly did not believe it.</p> <p>The observatory there is one of the largest radio observatories in the world; I do not understand how you could shut such an important research facility down.</p> <p>Back in 2012, I was selected to be a part of the West Virginia Governor's School for Mathematics and Science which was a two-week long academy located at Green Bank. We were divided into groups and all given projects. Each group's project had to be completed during night labs while using the 40-meter telescope. It was so awesome to be able to use actual telescopes to receive raw data to manipulate into useful situations. My group was then selected to use the Robert C. Byrd Green Bank Telescope for data recording. It was truly an unforgettable experience. I also attended seminars on the campus of the NRAO in Green Bank. They were two weeks I will never forget.</p>	Against Closure	Email - Scanned	11/8/2016	
636	b	John	Carnell	WVU Astronomy 106 Student	<p>The Green Bank telescopes have also been creating breakthroughs for science. I remember when I was there that they were being primarily used to find and study pulsars, which was a relatively new topic at the time. There are countless other things that they could study, too. Not to mention, the GBT brings a lot of pride to the state of West Virginia which is in a downturn right now. It is an honor to the citizens of West Virginia (I am one of them) to have such a prestigious science research facility in our state.</p> <p>As you can see, shutting down Green Bank will be a disaster for me, my state, and for science, especially astronomy. I recommend you reconsider this.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
637		Natasha	Yousef	WVU Astronomy 106 Student	<p>As a West Virginia native, the Green Bank telescope has always been a source of pride for me. I was born and raised in Charleston, WV and one of my fondest childhood memories is taking an elementary school field trip to the Robert C. Byrd Green Bank Telescope. At that age, I understood very little about how that large white piece of equipment could see things in the sky that I could not see with my own eyes.</p> <p>That experience sparked in me an interest of the universe beyond the clearly visible. My education since then has been focused on the sciences and performing research on things too small to be seen with the naked eye. Remembering back to my elementary school years, I was prompted to take an astronomy class at West Virginia University, where I am learning about all the stars and planets too distant to be seen easily. I was finally able to learn how the previously enigmatic Green Bank Telescope worked.</p> <p>Unfortunately, it was also in this class that I found out the Green Bank Telescope was losing funding and could potentially be dismantled. I urge you to reconsider. It would be a shame to lose the largest steerable telescope in the world. Not only does this impact the astronomers who use the radio telescope to study distant gas clouds and stars of other galaxies, but it also hurts the curiosity of children like me who were astounded by the telescope. As more and more young people continue to leave West Virginia due to the lack of job opportunities, it is imperative that the youth of this state know what great opportunities still lie here in West Virginia. Losing the Green Bank Telescope would cause West Virginia to lose thousands of jobs and an important source of revenue. The people who live in the National Radio Quiet Zone have given up the use of anything that emits electromagnetic radiation for the sake of scientific research, but there are no complaints from the residents. Visiting the Green Bank Telescope brings inspiration to those who visit and should be appreciated for its part in scientific discovery.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
638		Jacob	Hughes	WVU Astronomy 106 Student	<p>What a fabulous STEM opportunity we have in the great state of West Virginia! The Green Bank Observatory located in Pocahontas county offers tons of learning and research opportunities for students of all ages. From field trips for elementary students to summer camps to undergraduate internships, this science center inspires students on a daily basis. This Observatory was a trailblazer in the field of Radio Astronomy.</p> <p>The PSC (Pulsar Search Collaborative) collaboration between WVU and the Green Bank Observatory allows high school students and their teachers to do real research which builds confidence and experience that can lead to a successful future in a STEM career. Now, over 10 colleges and universities have joined the work. Over 2 and a half million pieces of data has been analyzed and many discoveries made due to these programs. Also, the impressive My Brother's Keeper program targets young men of color and females to promote interest in science!</p> <p>All of that leads me to focus on the sad losses that would happen if this observatory would close. Just think of all of the lives impacted by the loss of the opportunities that would occur. When I was in 3rd grade, I was selected to visit Green Bank Observatory with a small group of students from Raleigh County. This trip was funded through a STEM grant. I will never forget being able to observe science in action!! I enjoyed using the telescope and learning about the cool things researchers had found.</p> <p>Please don't close this amazing science center and allow the over 40,000 visitors each year to lose this experience! There is still much to be learned about science right in the backyard of West Virginia! Also, just think of the economic impact that this closure would have on our great state. This is a facility that is necessary and beneficial to budding and established scientists everywhere!</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
639		John	Kerr	WVU Astronomy 106 Student	<p>The importance of the Green Bank Facility and its program is much more than just a telescope. It is a monument to how far we have come in the recent decades when it comes to space exploration and trying to understand our neighboring stars and galaxies, including our own. To me, the most important thing is discovering what is out there for man kind and even though it will not be in my life time, we need to keep advancing towards a greater goal in the case that Earth is not habitable anymore, or if we choose to colonize other worlds! Shutting down Green Bank would be a large blow to the astronomical society as a whole. Personally, I know it is used to find out information about black holes, which I find absolutely fascinating. The possibilities are endless when looking at the massive number of galaxies, stars and planets that neighbor our great planet. In conclusion, shutting down Green Bank would be a terrible thing. It has so many great tools that help move our entire species forward. It is beneficial to everyone on earth that we keep learning and keep exploring what is out there.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
640		Taylor	Miller	WVU Astronomy 106 Student	<p>The Green Bank Observatory is an invaluable asset to astronomy as we know it. The remoteness of its location allows for superior detection of objects such as pulsars and black holes. Particularly, it is vital to detecting millisecond pulsars, which make detecting gravitational waves much easier. Losing the Green Bank Telescope would mean the loss of way to observe at wavelengths high enough to detect these millisecond pulsars. In fact, it was responsible for the discovery of the most massive pulsar ever discovered, which equaled two solar masses. Because of its location in the National Radio Quiet Zone, it is the only instrument capable of researching Baryon Acoustic Oscillations, which can be studied to determine the rate of the universe's accelerating expansion. Loss of the Green Bank Telescope would also mean the inability to determine the distances between galaxies at high angular resolution. The Green Bank Telescope has proved to be capable of major scientific advances, and therefore, it should not be shut down.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

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641		Jacob	Baker	WVU Astronomy 106 Student	<p>The Green bank Observatory is one of the most substantial observation facilities in West Virginia for multiple reasons. The first and most important of these reasons should be to help to provide information regarding astronomy for both the educating of new generations and facilitating ground breaking research for the new pioneering frontier of astronomy. I have been to the Green Bank Observatory for a field trip. I learned about how the concept of radio frequencies operated with the massive 100 meter collecting disc.</p> <p>The importance of the Green Bank Telescope (GBT) is that it is a vital part of the research projects, it has the capabilities to spin and turn in the exact direction of interest. Allowing for a 85% accessibility to the celestial sphere which is a critical feature for researchers when they are attempting to record star movements over a long period of time. Another key reason why the GBT should not be shut down is due to its very adaptive reconfiguration that can work with new and experimental hardware that is continually improving. This will consequentially be able to continually improve the functional capabilities of the GBT and to adapt as the improving hardware evolves, allowing to prevent the GBT to become obsolete.</p> <p>The GBT shows no sign of decline due to the vast amount of new discoveries that are continually being announced on their website. Therefore, it makes no sense to discontinue the funding of an important piece of the astronomical astronomy world. The most recent of these discoveries have been a surprisingly quiet black hole that was previously thought to be a galaxy developing. The discovery was made just less than 4 months ago, and will continue to make interesting and potentially universal changing discoveries in the future. Again, the closing of such a unique and limitless source of information seems very underwhelming not only to the astronomy world, but also to the people of the surrounding area who have the most invested in the telescope and the facility. The great people of the small town are willing to make many sacrifices of amenities such as not having wireless internet and cell phones to better the functional ability of the telescope. If these people are willing to sacrifice so much to make something that does even belong to or benefit them, how can someone who is benefiting from it want to shut it down. I am pleading to not shut down shut an iconic part of my great state of West by God Virginia.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
642		Kyle	Bird	WVU Astronomy 106 Student	<p>I have long lived in West Virginia and enjoyed the endless views of rolling mountains; however, the single most incredible feature I have seen in this state is the Green Bank Telescope. I visited the site once in elementary school and left with a sense of awe at the magnitude of technological construction. How can you not while looking at the largest movable telescope on the planet? Removing the telescope from the area will not only affect those nearby, but it is used by students and scientist far and wide around the globe to study radio and gravitational waves, capabilities that are very rare and in our own backyard in this state. Just the other day a leading researcher on gravitational waves talked to my college astronomy class about the amazing work with pulsars and gravitational waves that she has been doing in coordination with the Green Bank Telescope. Scientists are making incredible discoveries on a yearly basis and recent progress is increasing with more results being either nullified or confirming theories, so now is not the time to stop these peoples' research and life work that is helping shape our understanding of the universe.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
643		Nicholas	Paitsel	WVU Astronomy 106 Student	<p>My name is Nicholas Paitsel. I am a student at West Virginia University. I am writing to you because I am concerned about the future operations of the Green Bank Observatory. I feel the best way to proceed is to share my experience at the observatory and how it impacted me. I was in seventh grade at Madison Middle School in Boone County when my class took a weekend trip to the Green Bank Observatory. My county school system, like too many others in West Virginia, was highly deprived of funds, resources, and quality teachers. This trip was truly an amazing opportunity for us. I remember being amazed by the sheer size of the telescope as we approached the observatory. Then, we had an in--depth tour of the facility, and a chance to visit a night lab as part of their Radio Astronomer for a Day program. We were given the chance to search for hydrogen in space using the 40--foot telescope and many people found results. The data just looked like squiggles on paper, but the researchers assured us that we could have found something amazing and informed us of all the possibilities of what it could have been.</p> <p>Our little faces lit up and our minds wondered. This was so exciting and educational for a bunch of small town boys and girls, many of who would never get a similar opportunity again. I am sure this experience has had a lasting impact on many of my classmates as it has on me. This visit to the observatory initially sparked my interest in astronomy, and now I am enrolled in an introductory astronomy course at WVU where I get to use the Green Bank 20---meter telescope online through the Skynet interface. The educational opportunity the Green Bank Observatory provides to the residents of West Virginia as well as people all over the world is colossal. It would be a huge mistake to alter the operations of this facility, and I urge you to strongly consider the negative educational impact this would have on the state of West Virginia.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
644		Zoe	Kahle	WVU Astronomy 106 Student	<p>The Green Bank Observatory is very important in the world of astronomy. For one, the 20--meter telescope has personally helped my astronomy class at West Virginia University in our learning process. We used the telescope to find actual data and extend our learning into actual information about hydrogen gas. And secondly, just within my first semester of college, I've personally heard from another astronomer of how important this place is and all it does. Her project on pulsars and gravitational waves could be ground breaking into the knowledge of our universe. Her project will no longer exist without this place and that will simply be a disgrace. I imagine that her project is not the only one that needs this place to continue research. I imagine there are so many other people who not only care about this place but need it for their career. I may not know the full extent of this place or much knowledge on astronomy, but I know that the Green Bank Observatory is extremely important in all that it does. So finally, take time and consider, listen to the words of all the people calling out to you, and think about it.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
645	a	Laura	Harper	WVU Astronomy 106 Student	<p>I understand that sometimes what is being funded needs to be reviewed, but I sincerely hope that the Green Bank Observatory remains in service. Looking at the current proposals for the observatory, there are options to keep it open as is or with some changes to funding or function, and then there are options to temporarily or permanently close the observatory.</p> <p>It would be a disservice to West Virginia and to science to dismantle the observatory. Even shutting it down temporarily seems unnecessary unless it is purely a funding issue; but if it's shut down, is there a guarantee that it will be opened again? So I am considering both the temporary and permanent shut downs together for the moment, even though there is a very real difference in the observatory itself being left intact or being dismantled.</p> <p>If dismantled for environmental reclamation, of course, the site can't simply be restarted. The environment is important, but there are other places in West Virginia that can be redeveloped, even if they are outside of the NSF's scope. Where else do we have a radio telescope of the level and capacity of the GBT? Why use land elsewhere and additional funds to build something comparable when this is already in use? Reclaiming land for environmental purposes is good and helps to counter some of the tree cutting and land clearing that seems to continually happen for ever more businesses and parking lots. However, environmental reclamation would be better done at places like dilapidated buildings and old strip mines. Again, I realize that other sites may be outside of the NSF's influence, but that doesn't negate the importance of the observatory remaining because of what it does accomplish.</p> <p>There are proposals to adjust the funding of the Greenbank Observatory, which already is funded in part by NSF and in part by other entities. Of course, it needs funding to continue operating; figuring out exactly who funds what amount is beyond my scope of information or knowledge. The idea of operating it as a technology and education park could help expand its impact on the state, especially on people who aren't already scientists working with the telescope, and seems to be acceptable as long as it doesn't stop the telescopes themselves from operating. Adjusting details (funding, operation, additional function, etc.) is fine to discuss. Just please do not shut down the site. Temporarily, it would halt or slow people's education in astronomy and physics, and it will halt or slow down the research being done there (like the NANOGrav program). Shut down permanently, it will take away a site that is encouraging science for the residents of a state that needs to support science education and development, and it would affect people outside of West Virginia as well.</p>	Alternatives Consideration	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
645	b	Laura	Harper	WVU Astronomy 106 Student	<p>The Green Bank Observatory allows multiple people, from amateur scientists and elementary students to professionals and college students, to learn about astronomy and physics and to help expand our knowledge of the universe and how it works. It has outreach programs and internships, and it allows people off site to access the telescopes for their learning and research. West Virginia already has trouble, ranked as low in education, losing its younger generations as they leave to find better work elsewhere, and with economic difficulties such as the coal industry closing mines. We need to continue encouraging scientific endeavors for people of all ages and stages of learning.</p> <p>Some people might argue that the work itself is unnecessary, and perhaps it seems disconnected from immediate, day-to-day concerns in our lives. However, it does teach us about the universe, which we are part of, and aside from expanding our understanding of the universe, who knows what knowledge it will give us that can be applied here on Earth? The pursuit of knowledge itself is admirable, and there is always the possibility of it paying off in ways we can not foresee now. And the telescopes are used by people who aren't directly in Green Bank, including my own astronomy class at WVU (which is, I realize, already a collaborator with Green Bank Observatory).</p>	Against Closure	Email - Scanned	11/8/2016	
646		Sarah	Anderson	WVU Astronomy 106 Student	<p>It has been brought to my attention through my astronomy class at WVU that funds for the Green Bank Observatory are being threatened. The Observatory has always been something special that made West Virginia constructive in the scientific field. Green Bank has given students across the country an amazing opportunity to learn and observe our vast universe. I have personally used it several times in my astronomy course by using the 20-meter telescope through Skynet to help apply what we are taught in class to real invisible situations. Green Bank also offers a program called the Pulsar Search Collaboratory each year where students learn to analyze GBT data and are able to discover pulsars. The GBT is at the forefront of pulsar research and gravitational astronomy, as I learned from a guest speaker in class, Dr. Maura McLaughlin. Thanks to Green Bank we have now discovered the a variety of interesting neutron star systems. The hydrogen clouds surrounding galaxies and complex molecules in space are also notable discoveries. With this telescope, there is no telling what we will be able to observe in the near future. Defunding to Green Bank will lead in a halt to astronomy and a halt in humankind understanding something greater than ourselves.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
647		Courtney	Stanley	WVU Astronomy 106 Student	<p>I am currently enrolled in Astronomy 106 at West Virginia University. I'll be the first one to tell you that this astronomy is hard, it isn't about aliens and UFO's; it's about discovering parts of outer space that we've never even thought of before. This class has taught me that there is a lot more to outer space than simply just stars and the moon. The Green Bank Observatory was a major help to our class on our learning journey to discover more about the universe. Our teacher, Kathryn Williamson, even allowed our class to use the Green Bank telescope in our class discussions and homework, so we were able to see first hand what this telescope is able to do and to what it is able to teach us.</p> <p>Not only is then Green Bank Observatory a great educational resource for my college class, it is also helpful to other education levels. Green Bank Observatory has many fun and educational things to offer, like class field trips, student science fairs and many research opportunities. Some of the research opportunities it offers are things like Skynet and Skynet Junior Scholars, an online program that allows a student to have access to what the Green Bank 20-meter telescope sees right at their fingertips! One other program they offer is Radio Astronomer for a Day, allowing students who are in the fifth grade and up to stay the night in the observatory and get some real astronomy action hands on!</p> <p>The Green Bank Observatory is a location that needs to stay around to further younger and older generations on what the universe actually holds. Education is very important -- we could have some future NASA astronauts visiting! The observatory also means something special to my Astronomy class and I as it helps us visually see what our teacher is trying to get us to understand! These are reasons that it is important that Green Bank Observatory continues to be funded. Education is so important!</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
648		Emily	Hughes	WVU Astronomy 106 Student	<p>First of all, thank you so much for the wonderful STEM opportunity we have in beautiful Pocohontas County, West Virginia! The Green Bank Observatory gives students of all ages, from elementary to college, hands-on opportunities to learn and research in many STEM fields. The great field trip opportunities along with summer camps and college collaboration affords many students opportunities that are rare. This science center is an inspiration to visitors and students 362 days a year.</p> <p>High school students and their teachers can research and study science topics. These studies build confidence and experience that inspire students to persevere and earn a college degree with a prosperous future in a STEM career. The PSC, which began as a pulsar search partnership with WVU, now has over 10 colleges and universities that have joined the effort. Millions of pieces of data have been analyzed, as well as many discoveries made due to the availability of these programs.</p> <p>What a loss for West Virginia and scientists from all over the world if this amazing center would close. The great work of initiatives such as My Brother's Keeper would set science back hundreds of years. This initiative targets young men of color and females to promote interest in science. There are many future discoveries to be made and these young scientists are just waiting for the right opportunity to research and compile data that would lead to more knowledge about our world.</p> <p>I urge you to keep the Green Bank Observatory open. Not only would the lives of scientists and future scientists be impacted, but this loss would have a huge economic impact on Pocohontas County and West Virginia! As a future elementary school teacher with a passion for science, I ask you to please continue to provide these great opportunities for students everywhere. Just think of the loss that would occur as over 40,000 visitors are denied access to these amazing learning opportunities!</p> <p>STEM opportunities are growing by leaps and bounds. Please keep West Virginia's Green Bank Observatory in the forefront of this endeavor.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
649		Jacob	Klatt	WVU Astronomy 106 Student	<p>The Green Bank Observatory provides West Virginia students an incredible learning experience and if it were to be closed, I think it would be doing the state of West Virginia and the science community a huge disservice. As a student of astronomy at WVU and someone with a great interest in the recent discoveries regarding pulsars and gravitational waves, I would be disappointed if a facility on the forefront of these discoveries in my own state was shut down. I understand an economic analysis has to be done and the benefits and costs must be calculated, but I believe the benefits clearly outweigh the costs. West Virginia is a state with a dwindling economy and various issues on the rise, but our education has steadily improved with the help of the Green Bank Observatory. The world-class telescope at Green Bank has brought in many scientists and other professionals into West Virginia, benefiting the education system here. If Green Bank were to be shut down, the quality of astrophysics research in America would decline.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
650	a	Jose	Rodriguez-Velez	Wildlife Biologist Green Bank, WV	<p>I respectfully submit to you my personal opinions regarding the plan to divest, close, and/or downgrade the functions of the Green Bank Radio Astronomy Observatory (GBRAO).</p> <p>The Social Environmental impact concerns regarding the most likely sought out outcome for this scientific and educational facility, unique to the Eastern USA region, could contribute to a growing Nationwide disconnect between the common People, and Science and Mathematics. Efforts by the NSF will only contribute to more scientific isolation of communities already disconnected with how R&D emerging technologies and visible Science work to better our lives. These communities have a voice when it comes to how Congress determines the size of the operational funding pie. Neglecting to include the ones at the bottom could eventually render your future funding pursuits troublesome.</p> <p>If support is maintained at previous levels, GBRAO will get to continue to provide scientists with a USA soil based, easily accessible facility to continue to conduct research. This will allow college graduates to get hands on experience utilizing top of the line instrumentation and instruction, and also, provide the most important aspects to the national interest, which are accessibility and presence for people of all walks of their life.</p> <p>Being the only facility with such an array of instruments in the entire East Coast, it serves as a fantastic tool that can be used to bring back science to a broader level of the USA population. Its location in West Virginia is crucial, for it is one of many States where Math and Science are increasingly being seen as "negative" qualities to have by the general public.</p> <p>The NSF is risking a great deal more down the line, by transferring tax dollars to sovereign foreign Nations at the expense of USA based scientific endeavors which always have the capability to give favorable impressions about how tax dollars are invested on R&D ventures. An large amount of dollars has gone to AIMA alone, while a small fraction is required to maintain and operate GBRAO.</p> <p>The AIMA venture will benefit the World for sure, but back here in the woods of the USA, those findings will provoke very little impression, because people will not see, or physically have the chance to experience science at work.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
650	b	Jose	Rodriguez-Velez	Wildlife Biologist Green Bank, WV	<p>The NSF is risking a great deal more down the line, by transferring tax dollars to sovereign foreign Nations at the expense of USA based scientific endeavors which always have the capability to give favorable impressions about how tax dollars are invested on R&D ventures. An large amount of dollars has gone to AIMA alone, while a small fraction is required to maintain and operate GBRAO.</p> <p>The AIMA venture will benefit the World for sure, but back here in the woods of the USA, those findings will provoke very little impression, because people will not see, or physically have the chance to experience science at work.</p> <p>To an increasingly Nationalistic voting block, here in the USA, the tax dollars trusted to the NSF will be seen as a wasted investiture on foreign affairs that benefit no USA taxpayer. A quick look at any social network comment section will illuminate my point.</p> <p>Be very concerned, for social animosity and voter resentment can develop quickly, starting at the local levels to expand Nationally. As a wildlife Biologist who dedicated 15 years of my life to save the endangered Puerto Rican parrot from extinction, these dollar investments in ensuring local visibility that provides engagement for the people paying your bills count.</p> <p>If anything, you need to ramp up the importance of facilities like this and make them working partners with public and private schools and universities. That visibility ensures funding continuity.</p> <p>AIMA R&D foreign investments are valid, but not at the expense of perfectly usable USA based technologies which are accessible to all and bring a real life experience to a greater number of people. The thought of NSF suggesting the dismantling of these instruments to transfer technologies, science and tax dollars to Chile is offensive and so I urge you to reconsider.</p>	Against Closure	Email - Scanned	11/8/2016	
651		Kathryn	Williamson	Teaching Assistant Professor Department of Physics and Astronomy West Virginia University	<p>As a Teaching Assistant Professor at West Virginia University and the former Public Education Specialist at NRAO in Green Bank, I am writing to express my strongest support for the Observatory to remain open and operational at its current status. Both professionally and personally, I have never been more inspired than when in Green Bank. For the first time in my life, I felt part of something truly, cosmically, larger than myself. I felt part of humanity's endeavor to understand our universe. I can hardly put the magnitude of what Green Bank means to me into words. The cutting edge science of pulsars, gravitational waves, astrochemistry, star formation, radar mapping, and now SETI. The amazing history of the struggles and triumphs of radio astronomers over the last seventy years to build new instruments, break new ground, and propel humanity's curiosity forward. The staff, the scientists, telescope operators, tour guides, machinists, engineers, and even the janitors take pride in what they do, giving the observatory their all. And perhaps most importantly, the students, teachers, and tourists who visit for educational camps, programs, and exhibits, get a chance to feel part of something bigger, receiving the message that, "you can do real science, right here, right now." The Green Bank Observatory brings people together for science, for learning, and for community.</p>	Against Closure	Email - Scanned	11/8/2016	GBO letter of Support3.pdf
652		Kathryn	Williamson	Teaching Assistant Professor Department of Physics and Astronomy West Virginia University	<p>During my time working in Green Bank, I engaged thousands of students in authentic radio astronomy experiences with the 40-foot educational telescope. Being able to use an old-fashioned chart recorder to collect my very own hydrogen emission line is what captivated me during my interview in the first place. With just a single night of such data, students can collaboratively determine that we live in a spiral galaxy, that we orbit its center in a clockwise direction, and that there must be dark matter. Perhaps even more impressive is that through the Pulsar Search Collaboratory, we have actually had students discover pulsars. It has changed their lives. They go on to pursue STEM careers at extremely high rates, and they are some of the most impassioned champions of science that I've ever seen. This is simply amazing. I have never seen any educational programs that even come close to rivaling the quality and impact of programs offered by Green Bank. And personally, despite years of studying astronomy and physics, I never truly appreciated science until I was in Green Bank. I came to Green Bank with a doctorate degree but no practical professional experience, and I left with an ability to communicate science, a drive and passion to inspire the next generation, and the skills to actually make a difference. I am sure I would have never gotten my position at WVU if not for my time in Green Bank. It launched my career forward in ways that I could have never expected. Now I still engage the hundreds of college students I teach each semester in radio astronomy projects via Green Bank's 20-meter telescope controlled remotely on line through Sky net. The 20-meter is the only radio telescope on the Skynet network, making it the only way to provide authentic, modern, multi-wavelength research experiences to a large sample of students who represent society's future politicians, business people, teachers, and parents. The following pages show the impact of this experience in students' own words.</p> <p>As you contemplate the future of the facility, please recognize the tremendous scientific, educational, and emotional importance of the Green Bank Observatory for many people, including scientists, the public, and students. I can't emphasize enough how much it means to science and to our community. Using the Green Bank 20-meter Telescope West Virginia University Introductory Astronomy Students' Quotes -</p> <p>Using the 20-meter telescope showed me how to relate my findings that I got to real data others have gotten. Using the telescope and being able to gather my own data and see that everyone else was using it correctly, boosted my confidence, and made me realize how doing scientific research could be so helpful. - I thought the most enjoyable thing about using the 20m was that it gave students the chance to actually see how measurements like this can be made to determine the rotation of our galaxy from the data. I thought it made learning about the topic more interesting when we did it this way, rather than by reading it from a book or the lecture slides like we did for most other topics in class. - It was an amazing experience to use such a big telescope and to actually use that data to come up with conclusions of our galaxy. - I enjoyed everything about using the 20-meter. I have never been able to use something like that. - It was interesting to see how real astronomers get to use telescopes just like this, and to see what conclusions they make based on their findings. It was cool to see that what I had entered in, came back to me exactly how I wanted it to. I felt like a real astronomer. - It helped with applying understanding of material learned in class. Showed me how much you can learn from a single observation. - The radio telescope helped me understand how the frequencies of a section of stars relates to what direction they are moving relative to us. - It helped me understand the type of galaxy we live in. And how many spiral arms are present. - It directly reinforced what we learned in class. Not only did we learn how to apply data, but we actually obtained the data. - I understood better because I was actually interested in my own data. - The 20 meter helped me understand how radio observations work and also why they are important for understanding things in the universe. - I believe that it helped us understand how we know that our galaxy is a spiral and helped me understand how we know that the galaxy rotates counter-clockwise.</p>	Against Closure	Email - Scanned	11/8/2016	GBO letter of Support3.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
653	a	Anne	Smith		<p>I am writing out of concern for the proposed changes to the operation of the Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in the area of pride and motivation for school children in the community. I have been a teacher at Green Bank School for 15 years, and during this time I have taught children in the middle school, grades 5-8. I would like to explain how one important area of a child's development would be impacted if the Observatory was no longer funded to the extent that it would have to close.</p> <p>Let me first state that because of the Observatory and their sponsorship and innovation, I, along with the Education Specialist at the Observatory, were selected from teachers throughout the nation, to be part of the second cohort of Airborne Astronomy Ambassadors. This unique and highly honorable opportunity allowed me to fly on SOFIA, an infrared observatory housed in a converted Boeing 747SP aircraft and flown at an altitude of over 39,000 feet. This fabulous opportunity to bring information back to my students about the science of astronomy and all of its wonders would not have been possible if the Observatory had not been here. But because it was, my students, 67% who are on free and reduced lunch, with over half having parents who have not gone to college, and some who have not finished high school, and who are just now seeing their future, were impacted in ways I didn't imagine. By sharing my experiences with them, they can now dream of one day doing something like this, of seeing these sites, and participating in these adventures. Most of my students respond best to things that are concrete and real, and things are always more real and tangible when you know someone else who did it, and has the pictures and videos to prove it. The kids were proud and excited about my journey into the stratosphere, and still talk about it to this day. This adventure did much more than allow me to do cool stuff; it allowed my students to dream. And that is the first step to successfully be what you want to be, and not what you are expected or forced to be.</p> <p>Children all need a chance to dream. To explore. To see new things and experience new information. All children, including children from the regular joes, from the drug addicts and alcoholics, from the ones being raised by their Grandmothers, or in most cases their great-grandmothers, and for the ones in foster care and those that are homeless, all need an equal chance to dream, to feel like they can do anything, to see the world through different eyes and hear a different side of the story. We are teaching innovators and exceptional thinkers, as most people who have to do so much with so little often are. The Observatory is tangible proof that things can be different, that higher education is a reality, that people can do cool things for a living. It is a unique and powerful message that our students experience every day, one that encourages them and in some cases motivates them (however, I won't give the GBT the mystical powers needed to motivate 8th graders in the spring; some things really are too far-fetched). All kidding aside, the Observatory, its generous and involved staff and the irreplaceable positive impact it has on our school system is something we cannot afford to lose, as it is something we simply cannot replace.</p>	Against Closure	Email - Scanned	11/8/2016	
653	b	Anne	Smith		<p>The Observatory gives these Appalachian children much more than freedom from cell phones and wifi. It gives them pride in their community, and pride in themselves, something that is often lacking in their lives. Recess duty is a difficult time that involves stopping 85 children from trying to do dangerous things. But as I am refereeing the "touch" football matches, and directing the soccer kids away from the building roofs, I always get a thrill of seeing all of this played out under that magnificent structure called the GBT and I am always thankful for our school business partner and generous neighbors, the staff and facility of the Green Bank Observatory. And I am going to beg you, please don't take this away from us.</p>	Against Closure	Email - Scanned	11/8/2016	
654		Anne	Smith		<p>I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in many areas, but most specifically, for me, in education.</p> <p>The Green Bank Observatory has provided Green Bank Elementary Middle School with a resource like no other in the country. And I do mean, in the entire USA. To have something like the Green Bank Telescope (GBT) not only next door, but within sight of the school rooms, is an experience like no other. I have taught middle school science (6th, 7th and 8th grades) at Green Bank for 12 years. It is well known that in order to teach middle schoolers successfully, one must hook them in with interesting, hands-on, visual information that is then built on as the units progress. Using the Observatory and the GBT, my class and I have had countless conversations about the telescope, how scientists do science, all manner of space related topics, engineering discussions, cell phones, wireless technology, infrared technology, and many more topics that relate directly to astronomy and the GBT. We were one of the first 8th grade classes to learn about and participate in the Pulsar Search Collaboratory, an initiative project that uses data already collected by the GBT to search for pulsars.</p> <p>Because the property of the NRAO abuts the school property, it has been the perfect outdoor laboratory for my students. Over the years we have placed kestrel, bluebird, bat and wren nest boxes that have all been successful, created a wetland within easy access to the school that students have studied for a number of years regarding the creatures that inhabit our habitat and how habitats change over time. Because I have these students for three years, we are able to do long term studies of habitats and ecosystems that is frankly very unique to our school. For eight years our 8th grade groups have been a part of a team of scientists from WVU that have participated in a Golden Eagle census study, in which we monitored bait sites, baited with deer carcasses and using a trail camera, to add to this innovative and far reaching project. These are all real world science projects where the children act as citizen scientists and contribute to real world, authentic science data bases. None of this could have been possible without the generous and enthusiastic support of the Observatory and its staff.</p> <p>In addition to all of the above items, loss or even continued funding reduction to the Green Bank Observatory would also have a significant impact on the local school system by not allowing us to teach in a manner that is interesting, successful and productive. I cannot imagine teaching science in the way I have been doing without the presence of the GBO and all of its wonderful features.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
655		Alberto	Bolatto	University of Maryland Professor	<p>This is a letter for the environmental process started for the Green Bank Observatory. As a US scientist and an astronomer I care deeply about the quality and availability of public research infrastructure in the US, critical for not only for research but also for training of the next generations of scientists, and for education of the public. The GBO is a key part of that infrastructure.</p> <p>In my view the portfolio review recommendation of 'divestment' for Green Bank was short-sighted. The GBT has unparalleled ability to push the frontiers of astronomical knowledge. In particular, I would like to call your attention to a white paper posted in ArXiv by a group of North American astronomers from seventeen different institutions, among whom I am included. There we call for preserving the only public US single-dish observatory capable of observing at frequencies of up to 115 GHz, and we outline a number of key science cases that can only be addressed with a facility such as the GBT. In fact, it is clear that with modest further investment in high-frequency instrumentation the GBT would outperform any existing facilities in the US and abroad (https://arxiv.org/pdf/1610.09014v2.pdf). The forerunners of those instruments, led by university groups and funded by the NSF, are currently being deployed at the GBT.</p> <p>I want to also highlight the importance of preserving our ability to educate and train the next generations of scientists and leaders in research. I became an astrophysicist doing my PhD work on publicly-funded radio observatories, not only observations but also instrumentation. Single-dish facilities have a unique role in educating the future generations of instrumentalists. Because of their complexity and cost interferometers are poorly suited as testbeds of new radio instruments and new concepts in instrumentation. It is impossible to lead as a student or a postdoc cutting-edge radio instrumentation on a facility such as ALMA or the VLA: such projects are developed in single-dish telescopes. Precious few of those are US observatories, and with the demise of NSF's University Radio Observatory program the only remaining public single-dish capable of operating at mm-wavelengths is the GBT. Divesting of GBO to the point that it cannot support its high-frequency and mm-wave operation would have dire consequences for the formation of the next generations of high frequency instrumentalists, paradoxically at a time when the NSF is heavily investing in ALMA. I urge NSF to take this very seriously into account when considering its next steps.</p>	Against Closure	Email - Scanned	11/8/2016	letter_GreenBank.pdf
656		Dawnelle	Muff		<p>My kids and I love visiting the Green Bank Observatory. They are always impressed with the many telescopes on the property and the interactive visitors center. We even found out that there is a telescope on the property built by Grote Reber who is from out home town of Wheaton Illinois!!! We had never heard of Grote Reber until a visit to the Observatory, how sad our own town doesn't talk about him when the 3rd class does their presentation on important people from Illinois. We had to come all the way to West Virginia to find out this cool fact.</p> <p>The kids marvel at the idea of what it must be like to live in a area without cell phones and are fascinated with the talks given at the Observatory about studying space with radio waves and how little things like cell phones can cause problems for the scientist and researchers. Visits to the Observatory always end with discussions of hows and whys as they are trying to process what they have just learned. They are always excited about space and science after our visits!</p> <p>This is a great place to bring kids to get a real hands on feeling about space and science. It would be a shame to loose it.</p>	Against Closure	Email - Scanned	11/8/2016	
657	a	Natalia	Schmid	Professor, Advanced Engineering Building, Room 354 Department of CSEE	<p>My name is Natalia Schmid. I am Professor of Computer Science and Electrical Engineering at West Virginia University (WVU). The intention of my letter is two-fold. First, I want to present the Green Bank Telescope (GBT) as a world renowned hub in science, engineering, and education. Second, I would like to raise the question of maintenance of the GBT.</p> <p>My personal acquaintance with GBT first happened three years back, when our departmental Chair and I took an exploratory trip to Green Bank. With very successful new hires in the Department of Physics and Astronomy, WVU had just announced Radio Astronomy (having in mind the GBT, the great resource that we have in West Virginia) as a "Mountain of Excellence" (one of five selected by WVU). The result is that radio astronomy has become a main focus of the university. The trip to Green Bank was a great success. My own, initial involvement with the Green Bank Observatory (GBO) developed over three years into a broader collaboration between the Department of Computer Science and Electrical Engineering, the Department of Physical and Astronomy and the GBO. For myself this collaboration resulted in two new projects recently funded by NSF.</p> <p>I truly believe that GBO and WVU have formed a unique and highly productive team. Engineering researchers are in need of new data, which GBT provides, while GBT is in need of new research ideas that the Department of Physics and Astronomy as well as the Department of CSEE bring to the table. Green Bank is a very special place. It is home of one of scientific marvels of 21st century, the GBT, and each of us acknowledges this. This radio telescope is special not only due to its exquisite performance, but also due to its very special placement in terms of educational activities, real world experience, new scientific data and unique opportunities to collaborate with real world specialists in radio astronomy. The GBO's researchers and engineers are collaborating not only with WVU. The GBT is truly a scientific hub. Nearly every group in the world working on radio astronomy and cosmology is engaged with the GBT. One recent collaboration, initiated two years back, is known as the Software Enabled Radio Astronomy (SERA) project. This project involves multiple groups working on Digital Signal Processing for radio astronomy within the United States as well as groups from Europe, Asia and Africa. The multifaceted focus of the project is on the development of new DSP solutions for beamforming and radio interference removal supporting state-of-the-art data collecting radio astronomy equipment such as phased array feeds. It also places a focus on education, bringing newly developed engineering and DSP concepts to graduate and undergraduate students, to teachers in high schools and to high school students. Over the past two summers, while visiting and working with my colleagues at GBO, I have had a chance to observe (and even be a part of) many unique educational and social events happening around the GBT: where the best in country engineering and astronomy graduate and UG students are working on their summer projects with their world renowned supervisors from the GBT; where you are invited to join a group of high school teachers in listening to a series of lectures on radio astronomy and cosmology. High school students come for a two-three week visit to Green Bank later in the summer. They are excited when they learn that they will be allowed to be a part of an observing team and will be the first to work with newly collected data. There is absolutely no doubt that the GBT is a really special platform for education.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
657	b	Natalia	Schmid	Professor, Advanced Engineering Building, Room 354 Department of CSEE	<p>The second point of this letter is more of a question. What is it about NSF (and probably the US in general) that it always spends huge amount of money on building new and great pieces of equipment (and GBT is one of these examples), but then has no funding to support and maintain them after they are built? This happens nowhere else in the world. As an example, the Parkes 64m Radio Telescope is a very old telescope (over fifty years old), but it is still in service. It is well maintained and is up to date in terms of its scientific abilities. This has been achieved by equipping it with new multi-horn receivers and new phased array feeds. It generates incredible amounts of high quality data and serves many radio astronomy groups in the world. Why cannot the GBT - which is significantly more capable - serve the same purpose?</p> <p>I hope that you will decide to pursue the "no-action" alternative proposed for the GBO - "Continued NSF investment for science-focused operations". This will allow the GBT to retain its status as the pre-eminent single dish radio telescope in the world, and continue to play an active and vibrant role in science, research and education.</p>	Against Closure	Email - Scanned	11/8/2016	
658		Cathy	Mitchell		<p>As a retired science educator in Pocahontas County I can assure you of the importance of the Green Bank Observatory to our community. Whether supporting science fairs by teaching and modeling the processes involved in developing a project, mentoring high school students at the facility through a schools to work program, supporting the county's 4-H program by hosting the National Youth Science Day, providing science based continuing education for teachers or providing general education and tours for the public, The Green Bank Observatory is a vital part of our county.</p>	Against Closure	Email - Scanned	11/9/2016	
659	a	Michelle	Holstine		<p>I am writing in response to the hearings being held at the newly appointed GBO on November 9, 2016. I wanted to make my voice heard on the decisions being processed.</p> <p>I grew up in Green Bank, WV, starting when i was 3 years old. I did not know then that i grew up in what most would consider, an "odd" place. To me, the mountains were my playground, the woods were my safe place, and waving hi to everyone as you pass them on the road was completely normal. It wasn't until i moved to a completely different state that I realized what a special place Green Bank truly was.</p> <p>I was not raised thinking i was being held at some disadvantage because i did not have cell service or WiFi. Going to Green Bank Elementary Middle School and looking out our classroom window to see the beauty that are these telescopes was mystifying. We played under the shadow of one of, if not the, greatest scientific achievement in space exploration that can be achieved by staying grounded, the Robert C. Byrd Green Bank Telescope.</p> <p>Growing up there and moving away has not only taught me how special it is, but also has shown me just how impactful the knowledge of what is in our backyard can be. Now, people are more concerned about their next Starbucks order, or what WiFi password they should use, when in reality, the GBO is attempting to locate life in space. LIFE. This is something some people only see on TV, and being raised in the midst of that has helped me have an idea of the much bigger picture.</p> <p>I encourage the funding of the GBO, and hope the right decision is made. Thank you.</p>	Against Closure	Email - Scanned	11/8/2016	
659	b	Michelle	Holstine		<p>What i have come to find out, if this Observatory were to be completely shut down, is that \$95,000,000 dollars over 50 years will have been for absolutely no reason. The GBO employs 140-150 people in the busy summer months, and about 100 people generally. It also brings 50,000 people a year in as tourists. 50,000. To put that in perspective, the population of Green Bank is approximately 200 people. Not only are they able to learn and explore, they also bring much needed revenue into Pocahontas County. Whether tourists come as a focal point to their trip, or pass the GBO and think it looks neat, that is 50,000 a year that keep our tiny town on the map.</p>	Against Closure	Email - Scanned	11/8/2016	
660		Sherry	Radcliff	Director of Finance/Treasurer Pocahontas County Board of Education	<p>I am a long-time resident of Pocahontas County and I am writing to express my support of the Green Bank Observatory (GBO) as a science-focused operation. I am the Director of Finance/Treasurer of Pocahontas County Schools and worked in the banking business 25 years, so I understand the economics of businesses.</p> <p>Green Bank Observatory is a good financial and educational partner of our education system, as well as a viable networking piece of our tourism county. Green Bank Observatory provides economic stability to approximately one-hundred GBO families. This in turn assists our rural county's economic stability. If Pocahontas County would lose Green Bank Observatory as an employer, Pocahontas would suffer financially, approximately \$11.15 million in salaries would vanish. GBO employees would leave our county for other jobs; taking their children from our school system and tax dollars would decrease-a major funding source for the Pocahontas Schools. This would leave a large void for many businesses too. Pocahontas County Schools need students and we need the Green Bank Observatory!</p> <p>Secondly, the tourism aspect of not having the annual 50,000 visitors to the Green Bank Observatory would have a negative impact of county economic stability. The tourism dollars equates to about \$7.5 million if they only spend \$150 a day. I believe the tourism dollar impact to be much more than \$7.5 million.</p> <p>As I remember a few years ago when this same study was going on it was to take Green Bank funds to another country, Chile. Is that what the plan is now? Please support American jobs and Pocahontas jobs- Pocahontas Schools!</p> <p>I thank the National Science Foundation for the past financial support of the GBO and I encourage you to continue to support Green Bank Observatory as employer of Pocahontas County. This is the place where you can trust your dollars are being spent wisely. Where employees and citizens take pride in jobs and the place they live. Where people want to work. Pocahontas citizens have found a way to live in a quite zone. I can be reached at 304.799.4505, extension 2225, if you would like to talk further.</p>	Against Closure	Email - Scanned	11/8/2016	GBO letter.PDF

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
661		Ashley	Yu		<p>My name is Ashley Yu and I am a 2016 graduate from the University of Virginia. During my five years at UVa, I was involved in the Astronomy Club. We did sunrise and sunset hikes, went stargazing, and even took trips to the Air & Space Museum.</p> <p>Today and always, I will treasure my opportunities and experiences. The National Science Foundation's decision to cut off funding to the Green Bank Telescope negatively impacts today's citizens and future leaders. Without the continued support of NSF funding, students and researchers become threatened to lose access to this rich Astronomy resource.</p> <p>Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	11/8/2016	
662		Aina	Palau Puigvert	Instituto de Radioastronomia y Astrofisica Universidad Nacional Autonoma de Mexico	<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/8/2016	
663		Michael	Rosolina		<p>I am writing in support of the Green Bank Observatory which is a major asset to West Virginia and to the science and education community at large. I would like to see continued funding of the GBO by the NSF at a full or partial level.</p> <p>As a retired public school educator I know first hand the positive impact that the GBO has on students. This facility is too valuable not too support and maintain to the maximum.</p>	Against Closure	Email - Scanned	11/8/2016	
664		Miguel Angel	Trinidad	Departamento de Astronomía Universidad de Guanajuato Apdo.	<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/8/2016	
665		Todd	Ensign		<p>I work at the NASA IV&V Facility in Fairmont, and have been collaborating with the outstanding education department at the Green Bank Observatory for over a decade. This program is invaluable to the citizens of West Virginia both as an economic engine and a hub for innovative science education. I believe that the NSF should continue funding this program in full, or seek to identify and build collaborations that can result in funding lines which would reduce the NSF's investment. The philosophy of spending billions to establish a research facility, but failing to fund the actual science research is fundamentally flawed. Our federal dollars are not best spent by abandoning a fully functioning and productive research telescope simply to spend those dollars building a new telescope somewhere else. Following that model, we will waste tax dollars in construction, simply to abandon that new telescope, in favor of yet another site. This does not further science, nor is it an approach that helps the mission of the NSF.</p> <p>I implore you to find ways of encouraging all NSF funded research facilities to identify external funding sources, contracts for research with industry, education, and government as a means of reducing your ongoing investments. But, do not pull funding from our national laboratories and telescopes simply to shift those dollars to building another site that you will then mothball or decommission.</p>	Against Closure	Email - Scanned	11/8/2016	
666		Deidre	Hunter		<p>A few hours before I received the email about the public scoping meetings concerning Green Bank, I gave a guest lecture in an observational astronomy class for undergraduate and graduate students at NAU. My lecture was on radio astronomy. When I told them about side-lobes, I said that the Green Bank Telescope has a unique design that makes it exceptionally sensitive, and told a story about another astronomer on a different telescope who "detected" highly extended gas around a galaxy that turned out not to be real and instead was Milky Way emission picked up in the side-lobes of his beam. I said that, in fact, the GBT is the premier single dish radio telescope in the world. And then I told the students that, sadly, NSF had decided to close down this exceptional telescope just when it was hitting its stride, or at least no longer make it available to astronomers like me or like them.</p> <p>If this "scoping" means that NSF is still considering whether to close GBT down, on behalf of myself and future astronomers like the students I spoke to, I request that GBT continue to serve as the premier single-dish instrument in the world and to be publicly accessible so that today's and future astronomers can do exceptional science with it.</p>	Against Closure	Email - Scanned	11/7/2016	
667	a	Patrick	Gibson	Building Construction Instructor Mentorship Facilitator	<p>This letter is in support of continued funding for the Green Bank Observatory.</p> <p>As a resident of Pocahontas County, I understand the impact the GBO has in our area. There is the obvious economic influence from being a major employer. The tourism impact due to the Science Center and GBT is of extreme importance. This is due to national and international acclaim. Our school systems are effected in multiple ways, too.</p>	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
667	b	Patrick	Gibson	Building Construction Instructor Mentorship Facilitator	<p>As a teacher at Pocahontas County High School, I know firsthand of the Observatory's positive attributes to the school system. Many employees are volunteers within our schools as coaches, workers, consultants and assistant teachers. The GBO is a business partner of the high school. We have used the expertise of the GBO employees on many occasions to assist us with our projects. Several PCHS graduates are now employed at the Green Bank site. I personally know many of them and know they are proud to be a part of the GBO. They love the jobs they do, and represent the organization with respect and dignity.</p> <p>For the past several years, I have been the senior mentorship facilitator for PCHS. As students went out to complete mentorship requirements, many were placed, and welcomed, at the Observatory site in Green Bank. I had students investigate careers in Carpentry, Culinary, Engineering, Computer Programming, Business, Electricity, Welding and several other areas. Each student was placed with a mentor and shown various aspects of the job they thought they wanted to pursue for a lifetime career. It is rare that all of these opportunities are available at one location.</p> <p>On a larger scale, the GBO is a vast resource for students in general, from all grade levels including kindergarten through college graduates. From across West Virginia, and surrounding states, elementary, middle and high school students visit the site and view the GBT and science center with awe. Local high school students have the opportunities I described previously. National and International college students use the site facilities for their studies. The next innovative discovery by a student, or seasoned scientist, could come from the Green Bank site, if it continues to receive funding, and is left intact. I would view the possibility of missed opportunities of discovery as an atrocity.</p>	Against Closure	Email - Scanned	11/7/2016	
667	c	Patrick	Gibson	Building Construction Instructor Mentorship Facilitator	<p>Total divesture of the GBO would mean devastation to Pocahontas County in several ways.</p> <p>Business would suffer due to the economic impact. The housing market would be inundated with vacant homes in the case of employees having to relocate. As many of our school personnel have ties to the GBO, several of our schools would feel the effects of losing knowledgeable, qualified and caring teachers due to relocation of their spouses. A decline in the school system, no matter the reason for the decline, has a serious impact on the attraction of the area for future residents. Tourism would be adversely affected without the GBO drawing visitors, (local, national and international visitors) to our beautiful area.</p> <p>Losing any part of the GBO funding or site will have a far reaching impact on many levels. A careful decision must be made with consideration that it is not just dollars being considered, but that the decision has a countywide, statewide, and national impact. The livelihood, neighborhoods, and mere existence of many are dependent on the continuation of the Green Bank Observatory's operation.</p>	Against Closure	Email - Scanned	11/7/2016	
668		Betty	Schwimmer		<p>Please help save the Green Bank Observatory!</p> <p>In addition to its scientific projects, it is an important educational center and tourist draw for the area.</p>	Against Closure	Email - Scanned	11/7/2016	
669	a	Courtney	Curran	Educator/Parent/Community Member	<p>I am writing this letter to support the Green Bank Observatory. I am a resident of Dunmore and a teacher at Pocahontas County High School.</p> <p>This facility is a great asset to our community in many ways. As a teacher I see professionals come to the high school to meet with classes and help with projects, this is a valuable learning experience for the students of Pocahontas County. I have taken groups of students to the GBO to tour the various jobs that are available for the students in the future and have had many students complete their mentorship there.</p> <p>My son is a student at Green Bank Middle School or is a business partner with the GBO. Without their support there would many activities that could not take place at his school. This past year he participated in the science fair and math fair and both were held at the GBO. What a wonderful opportunity for the students in the small rural area.</p>	Against Closure	Email - Scanned	11/7/2016	
669	b	Courtney	Curran	Educator/Parent/Community Member	<p>As a community member I visit the GBO many times throughout the summer when I have family in visiting. I enjoy just going to the science center to grab a bite to eat, look at the goodies in the store and walk through the cool center with my son and many other children that are always tagging along.</p> <p>I am asking that the funding and support continue for this wonderful facility. Without it this County would be in a bad shape. Please keep the GBO up and running so the future generations will get to experience all this place has to offer.</p> <p>Thanks for your time.</p>	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
670		James	Di Francesco	Senior Research Officer National Research Council of Canada	I am writing today to respond to the announcement of a public comment period for the planned environmental impact statement and proposed changes to Green Bank Observatory operations. Please note that I am writing as a user of the Green Bank Telescope (GBT), not as a representative of the National Research Council of Canada. ...The GBT is a technical marvel. Its modern design makes it the most important single-dish radio observatory on the planet. Other observatories may be larger (e.g., Arecibo and FAST) but are limited to a narrow fraction of the sky. Others may have similar frequency coverage (e.g., Effelsberg) but have smaller sizes, blocked reflectors, much poorer surfaces, or narrower frequency ranges. In addition, the GBT is located in a large, nationally recognized radio-quiet zone, unlike other observatories. Finally, the GBT has modern instrumentation such as focal- plane arrays (e.g., KPFA and ARGUS) and spectrometers (e.g., VEGAS) that make it a powerhouse for large-area mapping of the sky. Such instruments were not available during earlier evaluations of the GBT. The above capabilities make the GBT unique. The GBT draws scientists from around the world to address major issues facing astronomy, topics from the composition of Solar System objects to the processes of star- and planet formation to the rate of the expansion of the Universe. The GBT is particularly adept at observing higher frequencies (15-100+ GHz) for which there is simply no counterpart for its mapping capability. Such data are also critical for interferometers such as the Jansky VLA, ALMA, and the upcoming SKA. Though such facilities may have larger surface area in aggregate, they cannot detect emission over large scales that the GBT can. In particular, the GBT + Jansky VLA is a very potent pair of observatories whose data can be combined to reveal the distribution of sky emission both at high resolution and over large scales. Utilization of the Jansky VLA itself would be diminished without the availability of the GBT. The GBT is also an important educational tool. Graduate students use the facility and get direct hands-on experience with astronomical observing, a skill that is becoming increasingly rare in the evolving astronomical observatory operations model. These students include my own, all five of which (so far) have used the GBT for their dissertations. Though I am based in Canada, these students include Americans and Canadians that have worked or are now working in the U.S. In addition, the GBT provides an important berth for new receiver technology, e.g., the great leap made between single-pixel receivers and the focal-plane arrays now available. Hence, the GBT is a key facility for proving technical concepts, propelling technological innovation forward. Moreover, thousands of students from primary school to college visit the facility every year and are inspired to learn about STEM. ... The GBT is a cornerstone in the U.S. astronomical observatory landscape, providing unparalleled views of the universe. Given the GBT's unique capabilities, low operational cost, continued scientific importance, and broad educational relevance, I ask that the National Science Foundation (NSF) please consider maintaining its earlier levels of support. Removal of NSF support places the GBT in an extremely delicate, if not precarious, position; there simply is no other means for long-term support of this vital facility. Moreover, NSF support allows the broader national and international community access to the GBT's unique capabilities. Such wide access effectively promotes the highest level of competition for observing time, ensuring that only the best projects are conducted and making the telescope as scientifically productive as possible. Again, there is no viable alternative to the GBT, so its community cannot simply go elsewhere to get similar data. First light for the GBT was in August 2000, just over sixteen short years ago. Over that period, it has produced impressive scientific discoveries. Nevertheless, there remain vast reaches in the universe yet to be explored by the GBT. Reduction of NSF support for the GBT at present will prevent its promise from being fulfilled.	Against Closure	Email - Scanned	11/7/2016	nsf.eis.pdf
671		Louise Ann	Rinehart	KA8ZGY	The Green Bank Observatory has provided educational program from many throughout the work which brings together learning of not only science, etc. as well as many years of friendship. The world's largest fully steerable radio telescope (Robert C. Byrd Green Bank Telescope) is part of this facility. The facility provides many programs and tours for vacationers, scientists and observers from throughout the world as well as jobs within the State of West Virginia. It would be in the interest of the US Government and NSF to continue to fund the Green Bank, and to visit the facility as a learning and pleasure trip. Please do not change the facility. Yes, I have visited the facilities more than once.	Against Closure	Email - Scanned	11/7/2016	
672		Warren	Brown	Smithsonian Astrophysical Observatory	Green Bank Observatory is a high-impact scientific observatory that should have continued science- focused operations. I am an optical astronomer, best known for my discovery of hypervelocity stars and now for merging low mass white dwarf binaries. My understanding of radio astronomy largely comes from what I read on astro-ph everyday. Green Bank Observatory produces a large quantity of interesting papers, second only to ALMA, and Green Bank Observatory will be increasingly important in the era of gravitational wave detections from pulsar timing. Thus I urge continued science-focused operations.	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
673		Samantha	Gray	Hedgesville High School	<p>Three years ago, my parents drove me to Green Bank for the first time. I was unsure if I would be able to make it two weeks away from home, at a math and science camp with no familiar face but my own.</p> <p>Yet soon those unfamiliar faces became family, and my nerves were forgotten among the experiences Green Bank gave me. In those two weeks, I was able to not only use the 40-ft telescope, but the GBT as well - and it was because of those hands-on experiences that my love for astronomy grew beyond merely loving the mystery of it all - because now I was solving these mysteries. There is honestly nothing more inspiring than seeing data that you collected on that data sheet or on that computer and knowing that you were the one to find that data. That this was real, tangible, that there was physical proof in your hands. It made me realize that even at the age of thirteen - and sixteen now - I had more potential than I knew. I had maneuvered the Green Bank Telescope to study the cosmos above - that made me realize I was capable of so much more than I had initially believed.</p> <p>I took this new-found passion to my school's pulsar search team. I had a need to find more data and to make more discoveries. Green Bank had instilled in me a yearning for discovery and a greater appreciation for astronomy and the sciences in general, and I was not about to let that fade away. The Governor's School for Math and Science gave me two weeks to study data and use the telescope - but the Pulsar Search Collaboratory gave me the opportunity to study the sky through data from the GBT to find pulsars throughout the entire school year.</p> <p>The opportunities Green Bank gives to students is something incredible and should not be taken for granted. Because of what they do, they have made students realize their love for astronomy and, for some, have even led them to a career they never thought they would pursue. There are so few opportunities to work hands-on like this, with real data and real equipment, and this can be a real eye-opener to many. It's one thing to study and learn about something in your daily science class. But to actually be able to apply your knowledge and explore the endless expanse of the universe surrounding us, right from your school computer lab or laptop at home, is a brilliant opportunity that, if taken away, may prevent students from realizing their true passions and developing important science skills such as reasoning and interpretation of data.</p> <p>It was at Green Bank that I not only made discoveries, but also made friends. Green Bank, perhaps most importantly of all, brings people together. Whether they be students, teachers, or scientists, Green Bank allows for people of all kinds to collaborate and bond over astronomy. This is something we simply cannot lose.</p>	Against Closure	Email - Scanned	11/7/2016	
674	a	Elizabeth	Wasiluk	Earth and Space Science Instructor Hedgesville High School	<p>I am a teacher who has worked with students on the pulsar search collaboratory for the last eight years. Students involved in the collaboratory have had a unique educational experience by using three different radio telescopes on site at the Green Bank facility. They also do not have to be at the site to use at least two of the telescopes and I have seen students use the telescopes to gather data and create winning science fair projects.</p> <p>Because of the dorm facilities on-site, it makes the site a great place to fire students interest in science and outer space as well as do cutting edge research. Many of my students who have participated in the pulsar search collaboratory have gone on to careers in science at university at later dates.</p> <p>In the twenty-eight years I have taught in West Virginia, I have not seen students so excited and fired up about science , as when participating in this program. If the observatory is closed, great scientific tools will go to waste and students will have no place to go to participate in a program where they can make important scientific discoveries.</p> <p>Studies made at Green Bank using the program have attacted many high school girls at a time when we are concerned about keeping female students interested and involved in science.</p>	Against Closure	Email - Scanned	11/7/2016	
674	b	Elizabeth	Wasiluk	Earth and Space Science Instructor Hedgesville High School	<p>Having a world class observatory in Pocahontas County is a great tourism draw to the area. Thousands of people from around the world visit it each year and are turned on to science. In return, these people visit Cass railroad as well as the Snowshoe resort. Closing down the science center at the National Radio Astronomy Observatory will impact these other sites as well, creating an economic downturn in a area that can not afford to lose revenue.</p>	Against Closure	Email - Scanned	11/7/2016	
674	c	Elizabeth	Wasiluk	Earth and Space Science Instructor Hedgesville High School	<p>The Green Bank Telescope is still collecting a great deal of data and making new discoveries each year. It is also used to make follow up observations that are critically needed...Closing down the National Radio Astronomy Observatory would have a many faceted effect on students, scientists, science done in the United States in general as well as tourism and the economic livelihood of Pocahontas County. I would strongly urge you to continue funding the National Radio Astronomy Observatory at Green Bank, at current levels if at all possible.</p>	Against Closure	Email - Scanned	11/7/2016	
675	a	Linda	Simmons	Pocahontas County Chamber of Commerce Liaison	<p>The Pocahontas County Chamber of Commerce supports continued funding of the Green Bank Observatory utilizing National Science Foundation's continued investment for the science-focused operations, while including collaboration with interested parties for science education-focused operations. This effort will enhance continued funding for the Green Bank Observatory.</p> <p>The Green Bank Observatory is host to over 50,000 visitors per year providing a unique view of the universe. This results in added local economy for the county. Education and outreach are at the center of this strong research-oriented facility. When tourists visit, they spend time at the facility and contribute to the economy of Pocahontas County as well as the State of West Virginia. It is estimated that visitors spend \$150.00 per day for goods and services including transportation, food, recreation and lodging. This amounts to around \$7.5 million per year spent in Green Bank and West Virginia during visits from tourists.</p> <p>Pocahontas County is sparsely populated with 8,719 persons. The tourism industry is one of the county's largest economic industries. The Green Bank Observatory provides research-based information and knowledge to students, visitors and scientists around the world.</p> <p>The Green Bank Observatory employs over 100 people year round with an additional 40 seasonal jobs during the summer months. According to the most recent census, around 5% of the total work force in Pocahontas County is employed by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
675	b	Linda	Simmons	Pocahontas County Chamber of Commerce Liaison	Employees working at the Green Bank Observatory are actively engaged in their communities and county. They serve as volunteer coaches for sports and serve as leaders of various youth organizations such as scouts, 4-H and church youth groups. Many are involved with service organizations including Rotary, lions Clubs, Women's Clubs, and many sit on boards such as Senior Citizens, Chamber of Commerce, the Snowshoe Foundation, and the Convention and Visitor's Bureau. Many are involved as volunteers with local fire departments, a community "Backbone" in times of floods, fires and other natural disasters.	Against Closure	Email - Scanned	11/7/2016	
675	c	Linda	Simmons	Pocahontas County Chamber of Commerce Liaison	Scientists from the Green Bank Observatory are involved in activities such as the annual educational Eighth Grade Luncheon held at Snowshoe Mountain each year. In 2016, local scientist and employee at Green Bank Observatory, Hanna Smith Sizemore, served as the guest speaker during the luncheon. She explained her role as a scientist and told the students if you set your goals high, are determined and are willing to work diligently, you can accomplish phenomenal things such as becoming a Scientist at the Green Bank Observatory. Then, you may be able to live and work in a wonderful, familiar environment, a place that has been your home during your entire life. In conclusion, the Pocahontas County Chamber of Commerce respectfully encourages the National Science Foundation to continue supporting the incredible work taking place at the Green Bank Observatory.	Against Closure	Email - Scanned	11/7/2016	
676	a	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	Removing the GBO will have catastrophic impacts to community organizations and emergency services as well. The community recognizes and appreciates the intrinsic value of over \$30 million contributed annually through community endeavors in various forms by the GBO and its professional and technical staff. Staff members volunteer as emergency first responders serving in capacities ranging from Deputy Fire Chief and firefighters to search-and-rescue team members and emergency medical technicians, each vital to the sustainability of the emergency response system within the local communities proximal to this Pocahontas County site. The GBO staff and research professionals serve in numerous community and educational endeavors. Losing their much-appreciated philanthropic contributions will compromise the delicate balance of community within the region that was, and is, protected for generations as part of the GBO and NRQZ.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	b	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	This region has experienced little investment development, apart from that made by the National Science Foundation and associates of the GBO, in industrial, commercial or residential sectors. Absence of independent private investment most likely is directly attributable to limitations imposed by the National Radio Quiet Zone (NRQZ) and its inhibition of wireless communication technologies. Severe disadvantage to the region is further exacerbated, economically, by federal regulatory impacts imposed on unrelated industries prominent in the region.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	c	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	The National Science Foundation is in the process of preparing an Environmental Impact Statement addressing the future for the Green Bank Observatory located in Pocahontas County, West Virginia. I am writing to urge the review committee to strongly consider retaining the current operation of the facility as it now exists, which is the "No-Action Alternative". The role of the Green Bank Observatory should truly be a fundamental component to the advancement of Science, Technology, Engineering and Math (STEM) education at the facility as well as in distant classrooms. I'm certain you'll agree with me that these educational opportunities and the future science research advancements are worthy of future investment at the national level...It is my sincere hope that the National Science Foundation will select the "No-Action Alternative" outlined in the Environmental Impact Statement scoping statement. Continuing the normal operation of the GBO will assure the research mission in astrophysical science continues revealing marvels in nature, affecting life and nature, and extending to the cosmos. Furthering this endeavor will continue inspiring youth to move into Science Technology, Engineering and Math (STEM) endeavors and to appreciate the Art (STEAM) in the marvels of our infinite universe. I stand available to assist in the future as you move through finalization of the EIS. Moreover, I remain supportive of your work and future science ongoing at this critical piece of research infrastructure.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	d	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	Nestled within the Deer Creek basin, tributary to the Greenbrier River, this national treasure's scientific research viability has been protected since the 1950's when the National Radio Quiet Zone was established to protect the facility from radio interference. Astronomical research at this facility is well document and the Robert C. Byrd Green Bank Radio Telescope (GBT) utilization is highly competitive with uptime research approaching nearly 75%. Thus, the research conducted, particularly in radio bandwidth ranges not included in the capabilities of other radio telescope facilities has justified the essential scientific need for this radio astronomy observatory installation. Productive, efficient functionality of the GBT is well documented. Scientific research, for instance, into those gravitation waves originating from black holes is ongoing and unique to the capabilities of the GBT. This is a new, revolutionary astronomical field originating in this superb, United States based observational tool! Moreover, lead, international researchers recognize the unique, robust capabilities of this monumental scientific instrument as they seek to understand the planetary, pulsar and galaxy interrelationships. This facility is impacting the world!	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	e	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	Green Bank Observatory (GBO) is a vital component to Pocahontas County's and West Virginia's survivability. Though GBO employs around 100 people full time with over 60% from Pocahontas County and 140 during the summer months, 40,000 visitors per year to the facility has tremendous economic impact on Green Bank and to this region of West Virginia. Losing the facility and the associated economic impact of non-resident visitors participating in the GBT science will be catastrophic to the community and region. Additionally, the economic contributions by international scientists, as they conduct leading edge research at the GBO, extends to the region that has supported this important operation for decades...Economic impacts resulting from any closure alternative, partial or complete, will, in my professional opinion, result in adverse environmental impacts. I have grave concerns pollution arising from abandonment of properties, much as has been experienced in the southern West Virginia coal fields, will most likely increase in the Deer Creek valley affecting insect and wildlife populations, as well as aquatic biota, during their lengthy decay.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
677	a	Sonja	Phillips	Teacher of Orthopedically Impaired students DIM Data Coordinator & ESY Coordinator Technology Integration Specialist	I would like to have a moment to respond to the unfortunate consideration of the closing of the Green Bank Observatory in Pocahontas County, West Virginia. Since its construction in 1956, a symbiotic relationship has developed between the surrounding community and the GBO. The establishment of The Quiet Zone around the Green Bank Telescopes has created an oasis of tranquility in the already peaceful and serene setting of the Monongahela National Forest which, of course, is within "Almost Heaven, West Virginia".	Against Closure	Email - Scanned	11/7/2016	
677	b	Sonja	Phillips	Teacher of Orthopedically Impaired students DIM Data Coordinator & ESY Coordinator Technology Integration Specialist	Many West Virginia students regard field trips to Green Bank as a highlight of their school years. My own children have visited multiple times - with my oldest daughter expressing the desire since age 6, to "help live on Mars". Now that my daughters are in young adulthood, I had expected the next generation would be raised visiting such magnificent places as the Green Bank Observatory who would continue to inspire such aspirations.	Against Closure	Email - Scanned	11/7/2016	
677	c	Sonja	Phillips	Teacher of Orthopedically Impaired students DIM Data Coordinator & ESY Coordinator Technology Integration Specialist	This amazing resource cannot be replicated. The projects which GBO have been an integral with range from working with students from multiple universities, teachers from surrounding areas, researchers scanning the skies, and communicating with space-bound vehicles. There are also multiple pieces of equipment that are unique to GBO, as well as the location being remarkable. Packing up these sensitive instruments and carting them elsewhere, just isn't a feasible option... I realize that priorities and fundings shift over time. However, being able to look - and to listen - towards the future must be preserved. Given the on-going investments, not only by the National Science Foundation, but the people of the state of West Virginia as well, the return on this investment must be honored not only to those who currently populate this planet but those who will be sent forward to that future. I appreciate your time and energies towards the efforts to allow Green Bank Observatory to operate with continued National Science Foundation funding.	Against Closure	Email - Scanned	11/7/2016	
678	a	Alexander	Karim	Argelander Institut fur Astronomie EU ALMA Regional Centre (German Node) Universitat Bonn	let me please add that the Green Bank Observatory constitutes an important cornerstone for my scientific strategies and those of my broader scientific community. My institute receives funding from the national funding body in Germany (Deutsche Forschungsgemeinschaft, DFG) to allow my graduate students to work with upcoming Green Bank data to be taken with the newly commissioned MUSTANG-2 camera. However, such pilot efforts should not render our long-term strategy we envision with the GBO obsolete, they merely just mark a start for our ambitious future campaigns... Letter: I am writing in strong support for ongoing regular, ideally internationally open- sky science operations at the Green Bank Observatory (GBO). The observatory is unrivalled world-wide and offers unique opportunities for my science. Particularly, next generation instruments like the MUSTANG-2 bolometer array, offer unprecedented survey capabilities when used in combination with this large dish. Such new developments, being available right now and not having been before, are the reason why I (as a science user) can in all honesty still call the GBO a cutting-edge facility. No other present-day antenna will offer a combination of dish size and site that would allow for the angular resolution at high GHz-frequencies the GBO can. Even when reaching its final 50m dish size and if eventually being equipped with a surveyor operating around 100 GHz, the LMT in Mexico will come with an angular resolution penalty — compared to the GBO — that will hinder the most direct exploration of the very high-redshift universe on large scales. Furthermore, the GBO has a long-standing history of being a very accessible instrument for a wide community, quite different from the LMT in its current form. With the advent of the next generation large-area panchromatic survey capabilities (offered, e.g., by LSST, EUCLID but also a next generation VLA or even Square Kilometer Array) my research area, galaxy formation and evolution, is facing a transformational era that will eventually boost our understanding about the growth of matter on large scales. It is hence literally shocking to see the recently started accelerated descaling or even decommissioning of leading (sub-)millimetre observatories (e.g. JCMT, CARMA). Moreover, new initiatives, particularly to invest in future new single dish observing capabilities (e.g. the CCAT project) are being stopped before even started, right in front of our eyes. With no new space-mission for far-infrared observing capabilities on the horizon, the highly important view onto the dust-enshrouded early universe on large scales is being dramatically hindered. A view on the redshifted thermal dust emission is, however, absolutely critical for my field, not only in a complement to the upcoming optical/near-infrared large area surveys. The GBO with MUSTANG-2 reaches a survey speed already now that is superior to ALMA at comparable frequencies. In fact, in terms of observing efficiency, it is the ideal complement to ALMA as it will serve as vastly important discovery machine to allow for the detailed follow- up studies ALMA was build for.	Against Closure	Email - Scanned	11/7/2016	GBO_support_letter_AKarim.pdf
678	b	Alexander	Karim	Argelander Institut fur Astronomie EU ALMA Regional Centre (German Node) Universitat Bonn	Email: please find enclosed my letter in support of continued NSF operations of the Green Bank Observatory. I hope that my inputs will find consideration in the shortly upcoming public hearings and the subsequent evaluation/decision processes. The GBO has been an excellent observatory for hands-on student training (incl. some of my own graduate student). I hence support giving (graduate) students preferred access in future regular operations. A modern observatory should also have good visibility towards a larger public. However, I would like to strongly discourage the usage of a world-leading observatory as a pure educational site, let alone an amusement park. Science and its high technology facilities serve the public best when focussing on breaking the frontiers of our very understanding of how nature works. This can only be achieved by using the facilities for research, not by making them silent monuments or even tearing them down.	Against Closure	Email - Scanned	11/7/2016	GBO_support_letter_AKarim.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
679		Chris	Haller	Founder	I just noticed you are still collecting public comment via email. Would you be interested to use our CiviComment app for free in your next project to evaluate if it makes your job easier? Simply upload a PDF, collect comments directly on the PDF and generate reports, all automatically. Sign up for a free trial project of CiviComment or reach out with any questions you may have.	General	Email - Scanned	11/7/2016	
680		Anne	Smith		I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community due in part for its contributions in the area of health and safety. West Virginia has the second highest obesity rate in the nation, at 35.6%. Pocahontas County is near that percentage as well. This leads to 1.6 times higher medical costs, including preventable health care costs, for our population. One of the keys to reducing obesity is to create an environment that makes the healthy choice easy and affordable. The GBO does just that in the following ways: Provides an exercise room, including weight machines, free weights, treadmills and elliptical machines to some residents of the county. Provides an outdoor pool that is used by the county and that offers free swimming lessons through the Parks and Rec department. Have staff that are instrumental in creating an exercise center for the residents of Pocahontas County, and that are on the Northern Pocahontas County Wellness board that is actively seeking to open a wellness center with an indoor pool that will be accessible to all citizens of Pocahontas County. (estimated cost: over 3 million dollars). Provide space for both the Parks and Rec center and Observatory staff to offer classes in yoga, ballroom dance, modern dance, Zumba, step aerobics and hot yoga. Arranges and organizes 5k runs and triathlons on Observatory grounds for fundraisers and to promote health and wellness. Provides the community with a free, safe, easy and accessible place to walk, bike ride, and run on the grounds of the Observatory. An average of three people a day use the Observatory grounds for some form of fitness or exercise. Provides safe space for 4th grade bike-a-thon fundraiser. These last two reasons are really the most important. 31% of children in Pocahontas County live in poverty, and finding affordable, and most importantly safe places for play and exercise are not as common as one might think. The Observatory, though its staff and physical plant, provide both of these services in abundance. I believe that the loss or even continued funding reduction to the Green Bank Observatory would have a significant impact on the health and well-being of our community by removing personnel, facilities and land use that is currently used to promote and sustain the health and well-being of all our community members.	Against Closure	Email - Scanned	11/7/2016	
681		Willard	Wright	W8NBG ARRL District 9 DEC	In regards to public comments for the future of Green Bank Observatory...I strongly urge NSF to continue funding for Green Bank's science-focused operations so the facility may continue to serve our worldwide scientific community as it has done for over half a century. So much knowledge has been gained about our universe over the years thanks to this operation...and there is infinitely more to be learned. I also know of so many young people who have been inspired to pursue science careers thanks to visiting Green Bank. The facility is, of course, a tremendous asset to Pocahontas County and the State of West Virginia. It provides jobs directly and indirectly. But most of all it is an asset to our entire world. The studies done there are a benefit to all citizens of the globe. Indeed a black hole would be created in our world if the facility were changed or closed. Please, keep the Green Bank Observatory as is! Thank you for your kind consideration.	Against Closure	Email - Scanned	11/7/2016	
682		Suxan	Ackerman		I am a person who frequently visits your area of West Virginia and have heard about the work that is being done there at the Greenbank Observatory by WVU professors to further their research. I respectfully request that it remain open and viable if at all possible. It is filling a unique position in your beautiful area, and its value to researchers is hard to quantify. Please save this facility! Thank you for listening to feedback and for making an informed decision	Against Closure	Email - Scanned	11/7/2016	
683		Julia	Williams	Adult Education Instructor Pocahontas County Career Center	I am the Adult Education Instructor for Pocahontas County. I think that the observatory is a vital part of our county. Our children greatly enjoy the Science Center, the Science exploration days and all of the unique experiences that the observatory has to offer. I take my children and their friends to the observatory at least 3 or 4 times a year. It is always very exciting and very educational. No matter how many times you have been their in the past, you can always learn something new. My children have gotten many ideas for the Science Fair by visiting the observatory, and I love it that they often host the Science Fair as well. The Green Bank Observatory is not only a great place for our children to play and learn it is also a very educational place for adults as well. I have learned many things from my visits that I can bring back to the classroom and teach my adult education students. I believe that it is extremely important to keep the observatory up and running. I do not believe that cuts should be made at the observatory. It is a major part of our community and our children's education.	Against Closure	Email - Scanned	11/7/2016	
684	a	David	Mitchell		As a native of Pocahontas County, WV, I am writing to encourage the continued funding of the Green Bank Observatory (GBO) by the NSF. The GBO is a local employer in Pocahontas County, primarily employing highly educated individuals who lift up the community around them. The GBO presents many educational opportunities for local children, I certainly gained from my experience there during my high school mentorship program. I was able to shadow many individuals from electronics technicians to machinists to engineers and astronomers during the summer prior to my senior year of high school. It was a very valuable experience, one that I would hope is available to local students for years to come.	Against Closure	Email - Scanned	11/7/2016	
684	b	David	Mitchell		It would be very unfortunate to see the GBO shut down, as it would greatly impact the local economy, and perhaps cause the collapse of the local community. It is a large part of the tourism economy in this part of WV, with many people coming from out of state to see the largest fully steerable radio telescope in the world. The government funding of science should be a priority, as we have many challenges that must be faced now and in the future. The GBO has the ability to significantly contribute to solving the problems we face in society today. Please continue the full funding of the Green Bank Observatory.	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
685		David Michael	Myers		I suggest a free-market solution to the "problem of Greenbank's future." It seems to me that it would be most appropriate to pu the Greenbank property up for sale to the highest bidder with a stipulated minimum bid. Said minimum bid-price should be based upon more than one (several, if possible) assessment by competent real- estate assessors from the area. If widespread and timely notice such as in FedBizOpps, Fed Biz Ops, FedBizOps, Fed Biz Opps (formerly known as "CBD --- Commerce Business Daily") URL: http://cbd-net.com/ would notify many who would be highly interested in developing a productive use of the site. For your consideration.	Alternatives Consideration	Email - Scanned	11/7/2016	
686		Linda	Yoder		I live in West Virginia. Ever since I arrived here almost 40 years ago, I have been proud of and awed by the work of the Green Bank Observatory, the jewel of Pocahontas County. let's do what it takes to keep it going. The research done there cannot be done without it.	Against Closure	Email - Scanned	11/7/2016	
687		Robert	Reid		I would like to express my support for the continuation of the NSF's involvement at the Green Bank Observatory. Although I'm not a U.S. citizen I do feel a special connection to the Observatory as I met Mr Grote Reber on a number of occasions when he lived here in Tasmania. As you no doubt know, Grote Reber is considered to be the father of radio astronomy with particular connections to Green Bank. Please add my voice to those who support the Observatory.	Against Closure	Email - Scanned	11/7/2016	
688		Jonathan	Sievers	Professor, School of Chemistry and Physics University of KwaZulu-Natal, Westville Campus ASTROPHYSICS AND COSMOLOGY RESEARCH UNIT	I am writing in support of continuing operations of the Green Bank Telescope. It provides several unique capabilities that will be lost if it shuts down. My particular interest is in galaxy cluster studies with the MUSTANG2 camera via the Sunyaev-Zeldovich effect. The vast majority of SZ clusters have been seen by CMB survey telescopes like Planck, ACT, and SPT. The GBT offers an order of magnitude improvement in resolution, which will open an qualitatively new window on cluster science. High resolution interferometric images with sufficient sensitivity to detect cluster structure have extremely limited fields of view and so miss much of the essential physics taking place, particularly in cluster outskirts. If the GBT is shut down, key questions about the behavior of gas in clusters, questions that are absolutely critical to understanding if the SZ effect can be used to constrain fundamental cosmology, will go unanswered for the foreseeable future. The GBT cluster program is so exciting that I already have a young South African working on it her at UKZN for her postdoctoral fellowship. She is just one of many promising scientists who would suffer from the untimely closing of the GBT. Please do not hesitate to contact me if I can provide any further support for continued GBT operations. My phone is +27 81 798 0489, and email is sieversj@ukzn.ac.za.	Against Closure	Email - Scanned	11/7/2016	sievers_gbt_letter.pdf
689		Peggy	Moore	Science teacher, 104-D Mercer County Public Schools PikeView High School	I was fortunate to spend two weeks in Green Bank, WV this summer with the ESS Passport program. I cannot begin to tell you how awe-inspiring this experience was. To know that West Virginia is home to an internationally reknowned facility makes me proud to teach science in West Virginia. The thought that this facility may not be here to educate and inspire future generations of West Virginia teachers and students is unimaginable. We need this radio observatory as a critical asset in space exploration. Please consider renewing funding for Green Bank for many years to come. The Green Bank Telescope has so much potential that it would be a shame to not utilize it to its full capacity. I would ask that you consider spending some time at this facility before deciding its fate so that you can appreciate everything this site has to offer.	Against Closure	Email - Scanned	11/6/2016	
690		Michael	Vick		It is my firm belief that we should do everything in our power to keep the Green Bank Observatory in operation for as long as we possibly can. There is no ONE single platform like this that has given us everything we were seeking. However, when we have the facilities working together, there is no telling what answers they may reveal. I spent three summer seasons working in the whole of Antarctica and what we are receiving in return is immeasurable. Please keep the Green Bank Observatory open.	Against Closure	Email - Scanned	11/6/2016	
691		Phillip	Groves	N8SFO ARRL WV SM	In regards to public comments for the future of Green Bank Observatory...I strongly urge NSF to continue funding for Green Bank's science-focused operations so the facility may continue to serve our worldwide scientific community as it has done for over half a century. So much knowledge has been gained about our universe over the years thanks to this operation...and there is infinitely more to be learned. I also know of so many young people who have been inspired to pursue science careers thanks to visiting Green Bank. The facility is, of course, a tremendous asset to Pocahontas County and the State of West Virginia. It provides jobs directly and indirectly. But most of all it is an asset to our entire world. The studies done there are a benefit to all citizens of the globe. Indeed a black hole would be created in our world if the facility were changed or closed. Please, keep the Green Bank Observatory as is! Thank you for your kind consideration.	Against Closure	Email - Scanned	11/6/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
692		James	Damron		<p>In regards to public comments for the future of Green Bank Observatory...I strongly urge NSF to continue funding for Green Bank's science-focused operations so the facility may continue to serve our worldwide scientific community as it has done for over half a century.</p> <p>So much knowledge has been gained about our universe over the years thanks to this operation...and there is infinitely more to be learned.</p> <p>I also know of so many young people who have been inspired to pursue science careers thanks to visiting Green Bank.</p> <p>The facility is, of course, a tremendous asset to Pocahontas County and the State of West Virginia. It provides jobs directly and indirectly.</p> <p>But most of all it is an asset to our entire world. The studies done there are a benefit to all citizens of the globe. Indeed a black hole would be created in our world if the facility were changed or closed.</p> <p>Please, keep the Green Bank Observatory as is! Thank you for your kind consideration.</p>	Against Closure	Email - Scanned	11/6/2016	
693	a	James	Reese	N/A	<p>Here are some potential answers and thought that I hope may be a solution for many caught up in this dilemma.</p> <p>With the alteration of the GBO status to one of a negative status for GBO employees and EMF/EHS people there would be a large ripple effect.</p> <p>Commerce would slow considerable within the area due to loss of people living here. This would happen quite quickly depending on factors that I will speak about below.</p> <p>The eventual close of existing business would be the outcome of loss of people in the area....Now what about all of the employees who work at the GBO and the homes they would have to try and sell as well. There property would most likely never sell. Who would move to this area and purchase a home besides a new EMF/EHS family? Most all of the homes that have sold in the 10 mile and surrounding areas have sold to EMF/EHS families. There are no jobs here for others to want to come here and not other motivation to be here once the GBO was decommissioned.</p>	Against Closure	Email - Scanned	11/6/2016	N/A
693	b	James	Reese	N/A	<p>I have written a previous letter to you a couple of days ago. This morning and idea came to me that I thought might be an answer at least in part, for some aspects of the dilemma surrounding the management and final disposition of the GBO.</p> <p>It seems that what will occur has a couple of listed outcomes (as stated in the newspaper) of which most aspects do not serve a bigger overall purpose. I have always been a believer that we can find answers to problems if we think in terms of kindness as the reasoning process for the answer and solution.</p> <p>My wife and I are five year residents here came here for the Quiet Zone Protection.</p> <p>I would guess from my observations and awareness that there are now between 100 to 200 or more people and families living within the 10 mile area of the GBO and even further out, that are faced with several negative potential outcomes of the closure and reorganization of the the GBO. Many of which I have stated in my previous letter...Those who are here as EMF/EHS would have to walk away from their homes and lose all of their equity in their homes (due to the putting up of Cell Towers and Sender Receiver Smart Meter units,)which for most is their savings not to mention the black marks on their credit that would result, if the Cell Towers and Smart Meters with Sender/Receivers were allowed to be installed in the 10 mile and close surrounding area.</p> <p>There are no other areas set up in the USA for people who have these problems. So they would be essentially be immediately forced into homelessness and have no where to go thus effectively making the refugees. For many the illness from these EMFS effects are life threatening and very severe.</p>	Against Closure	Email - Scanned	11/6/2016	N/A

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694		James	Reese	N/A	<p>Now that I have stated the problems here are some potential answers. Which I am sure would require adequate thought and preparation and more. These are just ideas that can be easily expanded on. The Media and Political benefits to providing a great solution can be great if handled properly.</p> <p>These are in not specific order of importance.</p> <p>1. If the GBO cannot find immediate funding then the next logical step would be to make it into an education center. This then negates the need for Mothballing it and the huge amount of money to return the land back to its original state. The amount of money to make it into and manage an education center would be small in comparison.</p> <p>2. By doing this and leaving the area as it is with the Federally Mandated Quiet Zone in place as it stands, the area would now have people staying in their homes and any homes that needed to come up for sale would be bought by new EMF/EHS people.1. In Europe there are three countries that have created actual safe zones (more are now implementing plans) for EMF/EHS people. This has been a feather in their cap in the world humanity category.</p> <p>1. This could be done here in Green Bank as well. This may also free up some outside funding for the people to help this to occur, by grants and support from other government agencies.</p> <p>1. Also the GBO has I believe 2000 plus acres of land. Much of which is just vacant.</p> <p>1. What if there was an allowance of say 500 acres set aside to be leased out to those who are EMF/EHS in say 6 acre parcels. Each person to pay for their own installation of Septic, and Well. Each person to have their own responsibility to obtain electricity to their home, all underground set up of course.</p> <p>1. They would of course be mandated to meet certain criteria as set up by the GBO/NSF, (to be determined). Such as no wireless devices or broadcast devices In any form. They would be mandated to keep the land in pristine condition at all times and meet all ecological constraints established.</p> <p>1. They would have an initial lease purchase to obtain the land. The lease could be set up for automatic renewal every 10 years lets say. Each resident would sign a form removing the GBO/NSF from and liability or responsibilities.</p> <p>1. Each home would have to be mobile and have no permanent foundations. This would allow for easy removal if needed somewhere down the line if it became necessary to do so (to be determined how this would occur.</p> <p>1. The details of this could be worked out between interested persons and GBO/NSF etc.</p> <p>1. This would allow for the future return and use of the GBO telescope should a re- establishment of funding come available.</p> <p>1. There is much more one could say on these thoughts and subject but this may be a place to begin to explore options from that have not been thought about.</p> <p>1. Lastly the increase of new residents in the area would spawn more potential income to the existing businesses in the area. The new residents may even bring job opportunities to many locals who are already here and need work. The new residents may also create new businesses that may increase the value of the local area by this. There are many reasons to deal with the this problem in a manner that is not ultimately detrimental to many, and in the end actually be a very beneficial outcome to many.</p> <p>Thanks for listening to this.</p>	Alternatives Consideration	Email - Scanned	11/6/2016	N/A
695		Carol	Lambdin		Just read an article in the charleston gazette mail paper about potential closure of Greenbank observatory. I think closing it would be a tragedy.	Against Closure	Email - Scanned	11/6/2016	
696		Michael	Oldaker	Vice President Bobcat Nation, Inc.	<p>I attended college within the National Radio Quiet Zone at WVWC and recognize the Green Bank Observatory as one of our country's unique national treasures.</p> <p>I currently am involved in several unique science based business development projects as I have worked as a contractor within a highly successful innovation center at Johns Hopkins University on their Montgomery County Campus. The key developer of that innovation zone is to direct the development of a new innovation zone as a collaborative effort between West Virginia Wesleyan College and the Upshur County Development Authority. Honing into the services and science at the Green Bank Observatory would represent at the very least an interesting opportunity for discussion of potential development of synergistic relationships.</p> <p>The sense of urgency and its unique science would certainly realign our networking and scheduling focus if mutual interest is discovered.</p> <p>The Green Bank Observatory is also a destination visit for friends and family within our rolodex of activities we like to share. It is always been a very special experience for our children and now looking forward to introducing our new grandson.</p> <p>While I acknowledge that austere times require changes, I implore you to retain the facility for continued use, under scenarios one thru three, and in that order of preference.</p> <p>1) Continued NSF investment for science-focused operations (No-Action Alternative)</p> <p>2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p> <p>3) Collaboration with interested parties for operation as a technology and education park Thank you for your consideration, and best wishes to the folks at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/6/2016	
697		Rose	Messer		This facility should be kept open for future generations and to provide important scientific research.	Against Closure	Email - Scanned	11/6/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
698		Mark	Trodden	Department Chair Fay R. and Eugene L. Langberg Professor of Physics co-Director, Center for Particle Cosmology Department of Physics & Astronomy University of Pennsylvania	As chair of the Department of Physics and Astronomy at the University of Pennsylvania I would like to express my strong support for continued NSF-supported operations of the Green Bank Telescope. The GBT is a unique national resource that has enable the work and scientific output of our faculty members and their students. It also provides essential data supporting wide ranging experiments from millimeter observations of the Cosmic Microwave Background (CMB) to X-ray observations of clusters of galaxies both of which are active areas in our department and across the country.	Against Closure	Email - Scanned	11/6/2016	
699		Susan	Reynolds		I am writing to share my support of the Green Bank Observatory. Personally, I love the observatory, and visit it many times every year. I enjoy the indoor exhibits, the movie and bus tour, the gift shop, and the yummy cafe. One time I even met Frank Drake there! looking at the bigger picture, this facility is important in the scientific growth of our planet. We are training our youngsters (STEM curriculum) to move forward into the science fields and we have a duty to keep opportunities in place for them. It just makes sense. Thank you for your consideration.	Against Closure	Email - Scanned	11/5/2016	
700	a	Jennifer	Hempelmann		I would like to take a moment to comment on the benefits of an incredible resource in West Virginia, the Green Bank Observatory. West Virginia is fortunate to be home to a scientific asset that exposes students to an educational experience unlike any other. The Green Bank Observatory offers students in West Virginia and across the United States a chance to experience what a career in astronomy and science can hold for them. Many West Virginia students come from underprivileged areas, and our school systems are often strained in providing unique educational experiences. Therefore, the Green Bank Observatory must remain open and all current education and science operations need to be funded so these students can continue to profit from its services.	Against Closure	Email - Scanned	11/5/2016	Hempelmann_GreenBankObservatoryletter.docx
700	b	Jennifer	Hempelmann		The reasons are plenty for why Green Bank must remain open with the backing of the National Science Foundation. One of the great things that NSF does is to increase opportunities in science careers for women, minorities, and underrepresented students. Green Bank offers field trips for students where they can hear from scientists and those working on cutting edge discoveries. It also gives students an opportunity to stay overnight and to search the skies for pulsars yet to be discovered. These are experiences that many in our state cannot experience in a traditional classroom or even through their home lives. Unfortunately, families in our state cannot afford the opportunities to expose their children to careers in STEM in the ways the Green Bank Observatory can for thousands of students. The Observatory also offers a professional development program for teachers where the facility provides them hands--on experiences so that they can then give our future scientists the tools they need for success. The Green Bank Observatory is providing teachers an experience they can take back to the classroom to give their students an extraordinary perspective on astronomy and science. The Green Bank Observatory is an exceptional asset that is teaching the next generation of scientists and giving our children and teachers experiences they will never forget. In a state that is trying to expand educational opportunities, especially for underrepresented groups of students, the Green Bank allows our teachers that chance. Green Bank is providing education for the next generation of astronomers who will make groundbreaking discoveries. The Green Bank Observatory must remain open and fully operational for our students and our community to continue to thrive in science.	Against Closure	Email - Scanned	11/5/2016	Hempelmann_GreenBankObservatoryletter.docx
701		Jayne	Ford	AFT Greenbrier President	This e-mail is intended to show support for Green Bank Observatory and its' mission by the members of AFT - Greenbrier County. We are a union composed of teachers and service personnel who believe that the observatory provides valuable educational information as well as jobs to the community. We support continued NSF investment for the operations of the observatory to continue without interruption to present operations. We do not support suspension of operations or deconstruction of the facility.	Against Closure	Email - Scanned	11/5/2016	
702		Ed	Norman		I want funding for the observatory continued. It is a valuable resource for all of us.	Against Closure	Email - Scanned	11/4/2016	
703		C.M.	Tanner		What about the disabled that still hasn't got help??? My brother and i are disabled no has ever came around to help us, i pay for everything we get, and the help we get but if we were druggies, we get all kinds of help!! Personally I think WV sucks!!! I plan on taking an ad out in the main newspapers right before election to let everyone know what politications our like!!!! So everyone a cross the internet and WV papers will know!!! Thank You	General	Email - Scanned	11/4/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
704		Sabrina	Savage	Hinode US Project Scientist NASA/MSFC, ZP13, NSSTC	I am a concerned citizen as well as a colleague of the Green Bank Observatory. I am a solar physicist by trade, so I am fully aware that the GBO is a vital part of our scientific culture as a premier national radio observatory. While the large baseline radio observatories utilizing many dishes may be a significant step towards progress in radio astronomy and tend to receive broader media coverage, GBO has distinct capabilities that necessarily complement the interferometers. And as with all ground-based observatories, having them spread around the world is vital for reducing gaps in coverage. The citizen side of me feels saddened by the potential loss of such a grand and inspiring instrument. I visited colleagues at the GBO just last summer and traveled with my family so that we could all experience this impressive* structure that explores the universe in very unique ways. Standing above the dish is a feeling of profound awe that I will never forget, but I was even more moved by the effect the visit had on my children. Specifically, a colleague of ours from the observatory took us all into one of the smaller dishes to learn how to operate a radio telescope. My 9- year-old daughter, Quinn, operated the dials and obtained data showing that one side of the Milky Way was moving away from us. She was so excited that she was the one to make these measurements and was actually beginning to grasp the scale of even this small experiment. She promptly asked if our colleague could take her back early the next morning before we had to leave so that she could take measurements from the other side of the galaxy. Her request was eagerly obliged, and I was awoken by my daughter standing by my bedside with a huge smile on her face. The first words out of her mouth were, "I measured the blue shift of the galaxy!" Makes my chest swell every time I think of it. This is why we do science. And to do science, we must have these beautifully intricate, technologically challenging, and often expensive tools. Not just for professional scientists, but for everyone who wants to know a little more than they did yesterday. For the Quinns. I realize that it is a difficult and constant struggle to keep GBO up and running, but all fundamentally worthwhile investments are. I urge the committee to maintain this exquisite machine.	Against Closure	Email - Scanned	11/4/2016	N/A
705		Heinz	Andernach	Professor, Departamento de Astronomia Universidad de Guanajuato	Through this letter, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community not only in the US but in large parts of the world. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world. Moreover, the GBT was developed with a unique and novel design as the largest steerable single radio dish (together with the Effelsberg antenna in Germany). It is well known that these antennas are essential to complement the radio interferometers (like JVLA, VIBA, ALMA, etc.) for their sensitivity to large diffuse sources to which these interferometers are blind. The GBT was put into operation only about 15 years ago. This age is well below the necessary one to explore all its capabilities I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.	Against Closure	Email - Scanned	11/4/2016	
706		Donna	Martin		I strongly encourage you to consider keeping the Green Bank Observatory open in some capacity. It has been such a wonderful asset to our state, and we would certainly hate to lose it. Surely a foundation as creative as yours could find a reasonable, cost effective solution to put the observatory to good use in the future. Thank you for your consideration	Against Closure	Email - Scanned	11/4/2016	
707		David	Hughes	Large Millimeter Telescope (LMT) Director and Principal Investigator	As Director of the large Millimeter Telescope (IMT), a bi-national facility and collaboration between the Consejo Nacional de Ciencia y Tecnologia (CONACYT), Mexico and the the University of Massachusetts, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Mexico has participated financially in the upgrade of the GBT capabilities to carry out interferometric observations together with other telescopes in the US, Mexico, and the rest of the world. Furthermore, as the IMT significantly increases its performance at 1mm with the transition from its current 32- meter diameter format of the primary reflector to the full-sized 50-meter diameter aperture in 2017, the IMT will continue to seek new scientific projects in collaboration with the GBT scientific user community that require data from both of these unique world-class facilities to address common and impactful scientific questions. The GBT and the IMT complement each other, both in their respective capabilities as single dish telescopes, each with their own suite of instrumentation, and also when working together as part of international VIBI networks such as the NRAO HSA and the GMVA. I sincerely hope that a solution can be found to guarantee the continuing operation of the GBT at a level that will not affect its important scientific legacy.	Against Closure	Email - Scanned	11/4/2016	
708		Joshua	Shaffer		I just wanted to encourage you not to negate the future of the Green Bank Observatory. It is not only a point of interest in West Virginia but also a place of employment. Our state has suffered enough from relocations of employers in the past years. Please keep it here, in West Virginia. let our children truly see that even the sky has no limit.	Against Closure	Email - Scanned	11/4/2016	
709		Ed	Connors	Co- Observatory Director of Breezy Point Observatory of the Kanawha Valley Astronomical Society	My name is Ed Connors and I am the Co- Observatory Director of Breezy Point Observatory of the Kanawha Valley Astronomical Society. The facility at Green Bank has been extremely useful to our club and many scientists for many years. It is a landmark and even vacation spot for many people over the years, but it's usefulness as an educational facility far outweighs it's other wonderful uses. It would be an extreme lost to science and our great state to do anything with it, but keep it functioning and even grow it's usefulness! It would seem Education and Science would be one of the worst possible places to cut funding. I know of many people who hold this same view! I won't belabor the point. I just wanted you to know where myself and many other astronomers stand on the issue of the Green Bank Observatory! Standing with you all at Green Bank, sincerely,Ed	Against Closure	Email - Scanned	11/4/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
710		Bruce	Partridge	Haverford College	<p>The decision to close the GBT, either permanently or temporarily, is a momentous one for radio astronomy in this country and indeed world-wide, since we maintain an "open sky" policy. I am well aware of the financial pressures facing NSF and the AST program specifically, having served on the 1999 Portfolio Review Committee, the MPS Advisory Committee and a variety of other NSF and NRAO groups. AST bears a particularly heavy burden of supporting many facilities - including those at NRAO - while also trying to fund many worthy requests from individual PIs.</p> <p>The problem, in a sense, is that all of the radio facilities supported by NSF, including the GBT, are unique and best in the world. The one possible exception is Arecibo, given the new Chinese dish (FAST). That is not the case for NSF supported optical facilities. A decision to drop any one of the current NRAO facilities --- GBT, JVIA or the VIBA - would leave a distressing and unfillable hole in the field of radio astronomy. The current portfolio of instruments available to radio astronomers, including these three instruments, AIMA, the IMT, FAST and smaller specialized instruments, is a balanced one. It includes productive and powerful interferometers, with their high resolution capabilities, and single-dish telescopes that cover the wavelength range from meters to sub-mm (FAST/Arecibo, GBT and IMT). MY own research in radio astronomy (as separate from work on the CMB) has largely involved interferometers, especially the JVIA. I readily acknowledge, however, that there many projects (including a handful of mine) that either require or benefit from filled-aperture observations. GBT is central to these, and to the balance I just mentioned.</p> <p>Not surprisingly, therefore, I favor either the No-Action alternative, or some sort of collaborative venture than could ease the funding burden on NSF (I recall just such proposals being made for both Arecibo and the VIBA in the past). Now let me turn to the other listed alternatives for Green Bank. Deconstruction and site restoration would surely be far more expensive in the near run than continued No-Action operation. It seems entirely wrong to spend money that way at this time, when funding is stretched thin and the future of support for science in general hangs in the balance of a contentious presidential election. Mothballing would be better, I suppose -- but the cost/benefit compared to continued operation should be looked at carefully. Finally, despite my deep interest in science education and outreach, I think converting Green Bank into a science education park would be a mistake. The Green Bank site was chosen on purpose to be remote (not what you want for EPO). Worse, imagine the impression on kids and other visitors if all they see is mothballed or dismantled instruments. What better way to reveal that the US is letting its lead in science slowly slip away?</p>	Against Closure	Email - Scanned	11/4/2016	
711		Phyllis	Tuckwiler		<p>I have not been to the observatory for years so am totally ignorant re what they do now or if they have had success in hearing from outer space!!! Has this experiment been totally wasteful? Has there been any results that produced something of value? I recall that due to the observatory there had to be a "hush" over all the area.correct? How much money has been spent on this project? I have yet to visit the site on the internet but will do so now.</p>	General	Email - Scanned	11/4/2016	
712		Laura	Newburgh	Dunlap Postdoctoral Fellow Dunlap Institute, University of Toronto	<p>I am Dr. Laura Newburgh, currently a postdoctoral fellow at the University of Toronto and will be a new faculty member in the physics department at Yale University on January 1, 2017. I am writing in support of continued investment in the GBT for science-focused operations.</p> <p>The GBT is a unique resource for the radio community and has been the premier platform to support a variety of innovative and important instruments. As an experimental cosmologist I am keenly aware of the enormous role the GBT has played in creating new methods of cosmological measurement. In the past 5 years alone, cosmological measurements with the GBT have:</p> <p>(i) demonstrated the technique of 'hydrogen intensity mapping', a new method we will use to study the nature of Dark Energy. This measurement has been enormously fruitful, and initiated a separate, dedicated instruments purely for the purpose of making hydrogen intensity measurements at high redshift. Three large interferometers are currently under construction (SKA, CHIME, and Tianlai) to improve on this groundbreaking work and continue to use neutral hydrogen to understand our high redshift Universe.</p> <p>(ii) GBT has also been the platform for ARGUS, a pilot instrument designed to measure high-redshift CO, also an 'intensity mapping' technique. This instrument will lay the groundwork to use the CO line to understand how the first structures ionized the Universe (the epoch of reionization).</p> <p>(iii) supported MUSTANG-2, an innovative new detector array designed to use the high-resolution of the GBT to image high-redshift clusters to better understand the interplay between astrophysics and cosmology. Currently, using galaxy clusters for cosmology is limited by our ability to estimate their masses, which is in turn determined by our lack of understanding of their merger history and thermal history. This will be characterized and probed with MUSTANG-2, which is also the only instrument using a new, developing detector technology (MKIDs) and readout (microwave multiplexing) which has great promise as a technology for future Cosmic Microwave Background measurements.</p> <p>The GBT continues to initiate new programs, instruments, and measurements and is unique in its visionary approach to improving U.S. radio astronomy. GBT has remained critical to U.S. radio cosmology, trained generations of astronomers, and continued to support innovation in instrumentation, data processing, and analysis. I very much hope you will consider how rare and important GBT is to cosmologists and radio astronomy when making your decision.</p>	Against Closure	Email - Scanned	11/4/2016	
713		Luis	Zapata	Instituto de Radioastronomia y Astrofisica UNAM, Mexico	<p>I would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star- formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/4/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
714		Arturo	Gomez-Ruiz	CONACYT Researcher Large Millimeter Telescope (IMT)	<p>Through this letter, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world. In particular, VIBI observations joining the GBT and the IMT provides a very good example of the binational scientific collaboration between two major facilities run by the national scientific agencies in the USA and Mexico. The GBT and IMT are the largest telescopes of their kind, hence their scientific actives have a huge outreach potential as well.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/4/2016	
715		Christopher	Wiley	Lecturer in Art & Design Coordinator ART-118, First Year Program Digital Studio Practice liaison, Hubei University of Technology Department of Art and Design Art Building 203 University of Wisconsin Milwaukee	<p>"We all have a thirst for wonder. It's a deeply human quality. Science and religion are both bound up with it. What I'm saying is, you don't have to make stories up, you don't have to exaggerate. There's wonder and awe enough in the real world. Nature's a lot better at inventing wonders than we are." — Carl Sagan, Contact</p> <p>We ned to keep looking so we can find more of nature's wonders. Please find a way to keep funding instruments like this and Arecibo.</p>	Against Closure	Email - Scanned	11/4/2016	
716		James and Wendy	Reese	Residents	<p>I and my wife Wendy are residents of Green Bank. We have been here for nearly five years now. In fact we live right across from the GBO Landing Airstrip. 6328 Potomac Highlands Trail.</p> <p>We, like many people moved here for my wife an myself benefit of not having extensive exposure to high EMF's. This is the only place in the USA where you can do this and still live in a town. That is a big deal psychologically. Not having to isolate yourself.</p> <p>We have invested all of our savings in a home and coming here. We are in our late 60's now. This has become our home. We love living here for all of the great reasons. Fresh air, no crime, friendly people and great peace.</p> <p>We are shocked that there is a immanent possibility that the GBO may close. This would be disastrous to us for obvious reason and for others who have made this town and surrounding areas their home.</p> <p>Besides that fact of the EMF protections the GBO brings us in our daily lives here, there are other benefits that the GBO provides the people of this community. Just the fact the GBO employees live here is a big deal for the socio-economic aspects of the area. The GBO adds culture to the area and education for all.</p> <p>If this alone was lost it would be devastating to the financial stability of this area for at least 75 square miles or more. So many businesses and people are here and function here because the GBO is here.</p> <p>What the GBO has done for this area and surrounding areas from its presence is quite amazing. Just the fact that it is what it is draws people here from around the world. This benefits all of Pocahontas County in tourist trade and more.</p> <p>To lose this would create severe hardships on many people. Many would have to just walk away from there homes and mortgages, as they would never be able to sell their homes. There would be many homes for sale and few if any would sell. This area and related areas would collapse and become another West Virginia ghost town. So many people will be affected in so many ways. The ripple effect would be felt for years.</p> <p>It is my hope and I know I speak for many that there is some way of saving the GBO.</p> <p>Well I guess I have communicated my feelings.</p> <p>I am sure that you will have heard nearly this same thing from several by now.</p> <p>I hope there is a way to save the GBO.</p> <p>Look forward to the meeting November 9th. I will be at the early meeting.</p>	Against Closure	Email - Scanned	11/4/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
717		Gayle	Boyette		<p>The following is a comment on the funding issues with the GBO.</p> <p>I am a resident of Pocahontas County married to a fourth generation Pocahontas native. Together we operate a lodging business, a property maintenance service and co-parent a student of Green Bank Elementary/Middle School. Our interest in the GBO is multifaceted. Not only do we glean income for our own business from tourists visiting the GBO, but our son has benefited through educational opportunities associated with the GBO. On the latter, everything from using their piano for lessons to a NASA sponsored robotics class. The GBO has been a delight to all our county's students who are rewarded with field trips to learn about radio astronomy. The GBO often hosts academic tournaments such as Science Fairs and Math Field Day.</p> <p>When you consider all of the educational benefits and the tourism it seems logical that GBO funding would continue. There's more to the GBO than valuable scientific research. So many discoveries yet to be realized, this is true, but the GBO is like one of those critical organs of the body..... the county would suffer without it.</p> <p>In these economically challenging times, losing one of our significant resources is even more difficult to accept. And, even though we are a sparsely populated area, we are within easy travel distance to a major population of the United States. The GBO funding should not be cut! The GBO has too much to offer. Rather than spending energy and time on ways to cut its funding, wouldn't it be better to look at ways to market it and make it profitable?</p> <p>The Green Bank community is a lovely village in the forefront of this amazing telescope. The contrasts of technology and our pristine environment make this a unique landscape. It's viability alone stimulate interest. Keep the GBO going!</p>	Against Closure	Email - Scanned	11/4/2016	
718		Terrence	Beam	Superintendent of Schools, Pocahontas County Schools	<p>I am writing this on behalf of the Green Bank Observatory. I understand that the future of the observatory, may be in question, and that is of great concern to me personally and to the citizens of Pocahontas County.</p> <p>The observatory is a landmark of the entire state of West Virginia and is well-known to many of our state's students. It is the destination of many academic field trips and a symbol of the importance of science instruction and understanding to our students.</p> <p>Also, it is important to note that the Green Bank Observatory employs many people that have spouses that work in our school system. It is very difficult for our school system to attract employees because of the rural nature of the area and lack of employment opportunities. We have many excellent students whose parents work at the observatory. If there are elimination of jobs, that translates into less students, which in turn translates into less dollars for our school system. The Green Bank Observatory staff works in cooperation with our schools to assist in academic areas of instruction and supports our county science fairs, math field day competitions, and other academic competitions.</p> <p>I understand that in these rough economic times, changes are inevitable. However, I would encourage you to do all that you can possibly do to keep the Green Bank Observatory operational and continue an on-going commitment to the citizens of Pocahontas County.</p>	Against Closure	Email - Scanned	11/4/2016	Green Bank-letter of support.docx
719		Josep	Maria		<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies.</p> <p>Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/3/2016	
720		Laurent	Loinard	Professor of Astronomy Universidad Nacional Autonoma de Mexico	<p>Through this letter, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/3/2016	
721		Luis	Rodriguez		<p>I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/3/2016	
722		G. Paul	Richter		<p>My recommendations are as follows, in the order shown (most preferred is 1st; least, last):</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3. Collaboration with interested parties for operation as a technology and technology and science education park 4. Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) 5. Deconstruction and site restoration 	Against Closure	Email - Scanned	11/3/2016	

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723		Robert	Sheets		<p>I am a lifelong resident of Green Bank, WV. I remember Green Bank without the Radio Free Quiet Zone, and I can tell you it was really quiet. My mother was employee #3 at NRAO and my father also gained employment a few years later.</p> <p>These jobs had a great impact on our families socioeconomic status and on many other families in Pocahontas and surrounding counties. The consistent payroll and access to health insurance made life in Green Bank much more comfortable. I was a recipient of one of the early AUI scholarships that are awarded each year. These have been instrumental in furthering the education of many of our students over the past 50+ years. The socioeconomic impact of the Observatory cannot be overstated.</p> <p>The cultural/educational enhancement of the area because of the presence of highly trained scientists and technicians is another area where the Observatory has been a stellar citizen.</p> <p>Going back as far as 1965, the staff at NRAO made themselves available to teach in local schools in the areas of electricity and electronics. They have consistently performed this function and now serve as one of the business partners of Pocahontas County Schools. Many students complete their high school mentoring project on the Observatory site.</p> <p>The impact on tourism in this area would be sharply felt as the Science Center is an important stop for many who gain their first understanding of radio astronomy. I can speak from experience about all of the above and know also that the GBT is in constant demand by scientists from around the world.</p> <p>I also think the fact that all other sites which were considered in 1956 for housing NRAO have grown in population. Not so in Green Bank. Pocahontas County now has far fewer residents than when the Observatory was built and thus is even more valuable because of lower RFI. This area is a valuable and resource for this type of science.</p> <p>Because of this, I strongly urge NSF to adopt the No Action Alternative and continue to support the fine science being carried out at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/2/2016	
724		Dave	Williams		<p>Why in the world would you choose to close it the Greenbank Observatory? It is in a quiet zone ... no cell phone service in the area. Where else do you think you could find a comparable environment? For whatever reason I suspect you think you can do it at a lesser cost. Upgrading facilities makes much more financial sense than replacement. Replacement cost will require tax revenue, we are already in the red in spending....</p>	Against Closure	Email - Scanned	11/2/2016	
725	a	Rebecca	Koopmann	Professor and Chair Department of Physics and Astronomy	<p>I write to urge strongly that NSF choose alternative #1 of its "Notice of Intent to Prepare an EIS . . . ", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>As a new scientific user of Green Bank Observatory and as director of the NSF-sponsored Undergraduate AIFAIFA Team (UAT) Consortium for research using radio astronomy data, I have witnessed first hand its potential not only for ground-breaking science, but also its potential for impact on undergraduates from across the nation.</p> <p>Here I would like to emphasize the invaluable role of Green Bank in training the next generation of U.S. radio astronomers with one specific example. For the last 10 years I have led the NSF-sponsored Undergraduate AIFAIFA Team, a consortium of 20 undergraduate-focused institutions from across the U.S. (list available at http://egg.astro.cornell.edu/alfalfa/ugradteam/ugradteam.php). Through this program, undergraduates, graduate students, and faculty collaborate with the AIFAIFA (Arecibo legacy Fast AIFA, where AIFA refers to the Arecibo l- band Feed Array detector) consortium (PI, Riccardo Giovanelli, Cornell) on a major legacy astronomical survey and associated followup of neutral hydrogen gas in the nearby Universe. This program has impacted more than 280 students (40% women and members of underrepresented groups) and 26 faculty.</p> <p>Critical to the success of our program is the opportunity for undergraduates and their mentor faculty to visit national radio observatories. Many of our past workshops and observing runs have been hosted by Arecibo Observatory, but as part of our newly awarded grant, we have introduced observing experiences at Green Bank Observatory. Visiting Green Bank adds several advantages to our program: (1) learning how to use the GBT sets the UAT up for additional projects that can take advantage of the higher declination sky not available at Arecibo and/or make use of the lower systematic temperature and radio frequency interference at the GBT. (2) UAT members will be able to see and learn about the phased array feed FLAG prototype that will be similar to the ones used for upcoming HI surveys. Our aim is to engage the UAT at the earliest stages of planning for such future surveys so that they can fully participate in them. (3) A Green Bank workshop will be available to significant numbers of students and faculty each year at reasonable cost.</p>	Against Closure	Email - Scanned	11/2/2016	
725	b	Rebecca	Koopmann	Professor and Chair Department of Physics and Astronomy	<p>We held our first workshop at Green Bank last June and were very excited about our experience there and the potential for our activities. The conference facilities and the management were outstanding. The value of the student experience at Green Bank Observatory cannot be overstated as they discover the physical instrument and as they develop as scientists. Their understanding is not limited to specific AIFAIFA training, but also extends to an appreciation of work going on at the observatory in other research fields. Most importantly for such a diverse group, they realize that there are opportunities to become involved in great scientific efforts and that they are capable of becoming involved. More than 80% of the student attendees in our project to date have completed undergraduate research projects within AIFAIFA and many cite their visit to a national observatory as the major factor in their participation. Faculty and students trained onsite return to their campuses prepared to carry out remote observing. In this way students and faculty contribute to the AIFAIFA survey and followup while extending observing opportunities to students, staff, and faculty on their local campuses, many of whom would never have an opportunity to experience an astronomical observing run. Undergraduate AIFAIFA Team training has had a positive, and often defining, impact on student development, as judged by their career paths to date. The majority of students involved in the project have completed or are still enrolled in an undergraduate STEM program. Of 195 students who have completed their undergraduate degrees and have known status, 59% will be or have been enrolled in graduate school in a science by Fall 2016. 35% of those students are women. The majority of those not in graduate school are pursuing careers in STEM fields, including teaching and engineering/industry.</p>	Against Closure	Email - Scanned	11/2/2016	

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726		Vance	High		Thus, the partnering of Green Bank Observatory with the AIFAIFA consortium will continue a model of undergraduate education in which a large number (>280) of undergraduates contribute directly to HI studies of the local universe. The undergraduates experience the workings of a major national observatory and the way that a science collaboration functions through their interactions with their faculty mentors, their peers, Green Bank Observatory staff, and the leaders of the AIFAIFA project. Transformative research experiences develop student skills not only within AIFAIFA, but also with other astronomical tools such as SDSS, NED, and programming. They present and publish their results in the astronomical community. Faculty at a wide range of U.S. schools contribute their expertise and improve their scholarly collaborations. The effectiveness of the program is especially relevant in the era of large astronomical surveys. The model we have developed will apply to future surveys by the next generation of instruments, including proposed Phased Array Feeds. Continued support of Green Bank will thus ensure the success of countless researchers and also provide meaningful experiences to very bright minds early in their careers, a contribution vital to the long term success of science in this country.	Against Closure	Email - Scanned	11/2/2016	
727		John Michael	Strubhart		Please consider continuing operations at the Green Bank Observatory. I'm from Texas, where there is much government endorsed stupidity and we need something in the USA to balance that nonsense. Besides, the work that Green Bank Observatory does is important, interesting and inspiring. We need s stronger science future for all Earth's citizens, so please let them keep doing their part.	Against Closure	Email - Scanned	11/2/2016	
728		Justin			The area is a park except for a few large structures. There is no heavy traffic and they are not producing toxic wastes. The Green Bank Observatory area is very beneficial to the local flora and fauna.	Against Closure	Email - Scanned	11/2/2016	
729		Patrick	Rawlings		When I was a youngster I visited the Green Bank site with my uncle who worked for the company doing the original construction. I have the memory of standing on top of the concrete base of the 140 ft scope before the scope was installed. When I became an adult with a family I made regular trips to Green Bank to share with my children. We were sorry for the loss of the 300 ft scope but celebrated the installation of the 450 ft scope. It would be a shame for current and future generations to not have the opportunity to visit this facility as it has become a big part of WV's history, as well as the many visitors that share the same memories traveling to WV to visit this site.	Against Closure	Email - Scanned	11/2/2016	
730		Randy	Fry		Please consider further funding a project "where discoveries begin ". It is one of West Virginia's most precious assets.	Against Closure	Email - Scanned	11/2/2016	
731		Vaia	Meador	WV citizen	Hello! I'm a West Virginia citizen, taxpayer, and voter. I'm also an educator. I've had the pleasure of bringing students to Greenbank for the wonderful programs that they offer for about 8 years now. Each year my students talk about how much they enjoyed the field trip. The tour to the GBT, the discovery museum and other programs including Starlab and other activities equally impressed my students...all the students remember the demonstration with liquid nitrogen and the video about the facility...over the years we've run into students from other schools and random tourists enjoying the program. Hopefully these programs will continue to be offered so that students and citizens alike can learn about this resource that we have here in West Virginia!	Against Closure	Email - Scanned	11/2/2016	
732	a	Kelsey	Offutt		My name is Kelsey Offutt. I am a sophomore at West Virginia University majoring elementary education. My hometown is Huntington, West Virginia, where both of my parents have lived and worked for over 25 years. Although Huntington is home to me, my roots go much farther back, into the hills of Pocahontas County. My father's family has lived in the Green Bank area for over one hundred years. In 1955, my great grandmother, Mary Beard, sold her 140-acre farm to the National Science Foundation, and this land became the very heart of the National Radio Astronomy Observatory (NRAO). After selling the farm, my great grandmother moved a few miles away from to a small house in Arbovale. Nearby, my grandparents raised my father and my uncles and their home is still in our family's possession today. Because of his close ties with his hometown and family, my father would often take my brother and me on a four-hour drive to Pocahontas County for the weekend. We would spend the day walking around the Observatory and visiting the nearby Arbovale Cemetery, where many of my ancestors are buried. Those weekend trips are a valuable part of my childhood memories. I can remember how proud I felt to look up at the monstrous telescopes and realize their important role in scientific research and my family's role in their development...The Green Bank residents who sold their land in 1955, including my family, would be proud of all that the Observatory has accomplished and continues to accomplish since its establishment over sixty years ago. Some of the biggest proponents for building the Observatory were the teachers of the local schools, including some that taught my father. They knew that it would bring new opportunities and dreams to the students of the area, as well as students around the State. To tear down the Observatory is to tear down over sixty years of education, discoveries, and progress. West Virginia children that hear about the Observatory feel empowered, because they see that they are able to go to college, study science and continue to live in their home state while contributing to this field of science in huge ways. If the Observatory were to disappear, so would that vision. Not only is it an incredibly important site for astronomers and physicists, the Observatory serves as a beacon of hope for students hoping to advance while living in underprivileged communities. I hope that the National Science Foundation truly considers the massive impact that they could have on the futures of West Virginia's youth.	Against Closure	Email - Scanned	11/1/2016	Greenbank letter.docx

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732	b	Kelsey	Offutt		<p>Today, I am still incredibly proud of what the Observatory represents for West Virginia. When I arrived at WVU, I joined the Science Public Outreach Team, which allows me to visit schools all over West Virginia and talk to children about the remarkable scientific endeavors that are in progress in their own State. SPOT has allowed me to spend more time at the Observatory over the past couple of years, and get to know it as a scientific community, rather than just a landmark to look at. I have met so many brilliant people that live and work in Green Bank and use the telescopes to make scientific breakthroughs that will affect people all over the world. They go above and beyond in terms of outreach. The public tours offered by the Observatory are extremely informative and entertaining. Numerous school groups visit every year bringing students from far and wide to experience this wonderful site. Some only stay for the day, while others attend programs in the summer lasting for weeks at a time and proving to be an invaluable experience for these students. For example, the Pulsar Search Collaboratory, created by a WVU professor, allows West Virginia high school students to spend several weeks looking through real data from the telescopes in the search for pulsars.</p> <p>Since I am studying to be an educator, the children of West Virginia's futures are extremely important to me, as I think they should be to everyone in this State. A lot of children in our State do not believe that they have the potential to become scientists, doctors, or lawyers. They feel destined to blue-collar jobs in their hometowns, just like the many generations before them. Although there is nothing wrong with choosing that particular path in life, these children do not understand that they have other options. They rarely have family members that have attended college, and they generally feel destined for the same life they have seen repeated over and over in their families, neighbors and friends. When we, as college students, show up at their schools and tell them about these incredible educational and scientific opportunities that exist within a few hours of them, it truly opens up a new world to them. Without the Observatory, I fear that these thousands upon thousands of children will never know a world where they could go to college and contribute to our ever-expanding scientific knowledge. The Observatory's history, location and current work is truly exciting to West Virginia children and adults alike, and has become a part of our state's identity.</p>	Against Closure	Email - Scanned	11/1/2016	Greenbank letter.docx
733	a	Mack	Samples		<p>I am certain that you have received numerous letters of support for maintaining the Greenbank Observatory in its present form because of the enormous impact it has on the education of young people from, not just West Virginia, but all over the nation (and world). The National Youth Science Camp is just one example. I know that West Virginia colleges use the facility on an ongoing basis. Plus, college students from all over that nation come for extended stays. I don't know where else students could get such exposure. But I leave such letters of support to those who know more about use of the facility than I do.</p>	Against Closure	Email - Scanned	11/1/2016	
733	b	Mack	Samples		<p>It is my purpose here to encourage you to think about the economic impact the closing of the GBO would have on the local economy. In a state that is teetering on economic collapse, closing of that facility would be another nail in the coffin. The GBO has been for many years, and continues to be, a major tourist attraction. It brings many people into West Virginia that otherwise would never cross its borders. Also, closure would cause an exit of a multitude of families. That would be devastating for a state that is already losing throngs of people because of mine closures.</p> <p>I suppose what would happen if closure did occur is that the federal government would then come in and squander millions of dollars on a useless, meaningless retraining program. I have witnessed that drill on a number of occasions here in the Mountain State. Folks who go through those programs end up making half of what they were making before they lost their jobs, then most of them leave the state anyway.</p> <p>What kind of sense does it make to close a facility that is obviously providing a useful service while at the same time providing good-paying jobs and generating tourist dollars for the area where it is located? I guess it makes the same kind of sense as closing coal mines to protect the environment while the rest of the world is free to mine, sell, and burn all the coal they want to. After all, we all live on the same planet. Sometimes it is advisable to look beyond your own selfish nose and consider what is best for the good of all.</p>	Against Closure	Email - Scanned	11/1/2016	
734		Gabriel	Stevens		<p>My name is Gabriel Stephens and I am currently a Neuroscience Ph.D. student at Baylor College of Medicine in Houston, Texas. In Summer 2011, I attended the National Youth Science Camp as an Indiana delegate. This experience was greatly enriching to me as a young scientist and shaped me in ways both professional and intangible.</p> <p>One of the highlights of my stay at NYSC was visiting Green Bank, as well as exploring the surrounding area owned by the observatory. Learning about cosmology at the observatory, though I was a biologist, was a lesson in scope (no pun intended). I study synapses in the brain, infinitesimally small structures thought to be critical to cognition and all the things that make us human. To consider the vast scale of the universe, to hold in my eye entire worlds that we may never fully understand nor fully observe, yet see the scientists of Green Bank devoting their lives to understand those expanses while not knowing whether they ever would, is an experience enriching to young researchers in any discipline. To be a scientist is to discover and seek to understand worlds inside us, below us, and above us in hopes that one day we may know who we are, where we are, and where we are going.</p> <p>It would be a great loss if these formative experiences had by America's young scientists were lost by a dismantling of the Green Bank facilities. As a working scientist, I know well that funding difficulties are a boot on the neck of many valuable studies and research programs, and understand that Green Bank has some hard fiscal realities to face. However, I urge you, even if the primary research capacity of Green Bank is lost, that priority be given to continuing the use of some of the facilities as an educational endeavor and that federal/non-profit requests be made to open these educational opportunities at Green Bank to a wider audience.</p> <p>I am grateful for the time I spent in the West Virginia hills and I wish others to have the same opportunity as well.</p>	Against Closure	Email - Scanned	11/1/2016	

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735		Mary	Crone Odekon	Professor and Chair, Department of Physics Skidmore College	<p>This letter is in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to the operations at Green Bank Observatory (GBO).</p> <p>As a member of the NSF-funded "Undergraduate ALFALFA Team" (PI: Koopmann), a collaboration that includes dozens of educational institutions, I participated in a three-day workshop at GBO in June 2016. The workshop was enormously informative and inspiring for me and my students. Besides providing well-run conference facilities, it was a great opportunity for us see radio astronomy equipment across the spectrum of historical and educational facilities to state of the art telescopes and detectors. Our collaboration is hoping to continue holding regular workshops there in the future.</p> <p>The impact of the workshop and the collaborative work it facilitates extends far beyond the participants themselves. The results of our work were presented to groups on campus through campus-wide research symposia, department presentations, and educational modules designed for introductory astronomy courses. The Undergraduate ALFALFA Team model has been described in two recent articles, in Mercury magazine and the CUR Quarterly:</p> <ul style="list-style-type: none"> • Parker Troisht, Rebecca Koopmann, Aileen O'Donoghue, Mary Crone Odekon, and Martha Haynes, "The Undergraduate ALFALFA Team: A Collaborative Model for Undergraduate Research in Major Legacy Projects," 2016 CUR Quarterly on Undergraduate Research Collaborations: Partnering for High(er) Impact • Mary Crone Odekon, 2015, "Harvesting ALFALFA," Mercury, Vol. 44, No. 3 <p>The support of GBO has already been important for our collaboration, and I expect it will become even more so in the future. I hope this statement about the value of the GBO helps inform any decisions for the future of the observatory.</p>	Against Closure	Email - Scanned	11/1/2016	Green Bank 2016.pdf
736		Karen	Pennebaker		<p>I don't think "mothballing" the facility is a good idea. A partnership (public and private) to use the facility would make a lot more sense. Even if some of the technology is outdated, it is the only facility quite like this in the world. Not only is it an educational facility, it attracts tourists. Having a site with "radio silence" might, in the future, be extremely valuable in this world of "instant access" to everything.</p> <p>I would hope that the NSF would consider a partnership with one or more private agencies to keep the facility open and to continue its use for education.</p>	Against Closure	Email - Scanned	11/1/2016	
737		Robert	Colgan		<p>Please add my voice to those who are advocating for the continuance of the GRT either through continued NSF funding or a combination of NSF and commercial funding-----but PLEASE DO NOT CLOSE the facility. Science is too important.</p>	Against Closure	Email - Scanned	11/1/2016	
738		Ted	Nelson, Jr.		<p>I am shocked and beyond disappointment that you would even think about mothballing or deconstructing the Green Bank Observatory, as I read in the Charleston (West Virginia) Gazette-Mail.</p> <p>My wife, Cindy, and I visited Green Bank three years ago. It was a privilege just to be standing in the site of so many scientific discoveries and to see a facility that is so heavily used. The Green Bank Observatory also has been involved in exoplanet research, the most important astronomical research now being conducted. I am convinced that this research will lead to discoveries of life and intelligent life in the universe. A recent example is the studies of KIC 8462852 (Tabby's Star) to try and determine what causes it to dim at times by 20 percent.</p> <p>With so many important discoveries to be made, I am horrified that you would consider closing the observatory. Please, please reconsider. Add this your list of public comments and keep the marvelous Green Bank Observatory open. Dedicate it to exoplanet discoveries. From this can come the most important scientific discovery in the history of our Earth: that we are not alone and the universe is full of life and intelligent beings.</p>	Against Closure	Email - Scanned	11/1/2016	
739		Guy	Sims		<p>I believe that this letter shows our collective value for the Green Bank Observatory as an educational resource for the state.. Well said.</p>	Against Closure	Email - Scanned	11/1/2016	
740		Anne	Cavalier		<p>Excellent and thank you!</p>	General	Email - Scanned	11/1/2016	

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741	a	Ellie	White		I am 16 years old and in the 11th grade. I am extremely interested in astronomy, physics, and engineering, and hope to be a radio astronomer someday. My fascination with astrophysics began when I was 13, after reading Carl Sagan's Cosmos. Later that year my interest was sparked further by a visit to the National Radio Astronomy Observatory in Green Bank, West Virginia for a Family Science Day. When I was 14, I learned that the National Science Foundation intended to cut funding to the Green Bank facility, and was (and still am) very worried about losing such an amazing place. So I decided to do something about it - I opened a small business to sell hand-sewn dolls made to look like famous and not-so-famous scientists (e.g. Einstein, Marie Curie, Henrietta Leavitt, and Grote Reber), to Green Bank's Galaxy Gift Shop, at a special price so that they can make a little extra profit off of them. I know it isn't much, but I wanted to do something to help, after all they've done for me and so many other young people who are interested in science...The close contact with Green Bank has really kept my passion for science strong over these past few years. They got me started in astronomy with their Radio Astronomer for a Day program, in which I was allowed to stay onsite and operate their 40 foot telescope, then analyze the resulting data. Another program they introduced me to was Skynet Junior Scholars, which is a great way to learn about astronomy while doing real science and taking your own remote observations with participating telescopes, such as the Green Bank 20 meter radio telescope. The Observatory has continued to be an amazing resource - this summer/fall I am excited to be working with Green Bank on a radio frequency interference mitigation project under astronomer Dr. Richard Prestage alongside Keith Omogrosso, a Research Experience for Undergraduates student from Oregon Tech. It has been an absolutely amazing experience - I worked in their historic Jansky lab, met scientists and engineers from all over the world, and, most exciting of all, I was given a bottom-to-top tour of the Robert C. Byrd Green Bank Telescope (GBT)!...Of all the NRAO facilities, Green Bank has, by far, the strongest STEM programs in place; there are several science camps for school-aged kids, including the PING (Physicists Inspiring the Next Generation) camp for minority and female students, to try to make sure that in the future no one is left out of, or underrepresented in, the physics and science world. Their 40 foot radio telescope is used exclusively for educational purposes; school-aged children are taught how to use the scope, take their own observations, and are then shown how to analyze the data they collect. Green Bank provides opportunities for undergraduate and graduate students as well, with their Research Experience for Undergraduates program, Co-Op/Internship programs, Grote Reber Doctoral Fellowships, the Student Observing Support program, and WVU Senior Design and Research Projects. There are opportunities for teachers as well, as part of the Research Experience for Teachers program. If funding is decreased or cut to this facility, the educational programs will lack the resources they need to continue the high-level programs that are currently such a big part of inspiring young people from all over, and especially in the hard-hit area of rural West Virginia, to explore new horizons and find their passion.	Against Closure	Email - Scanned	11/1/2016	
741	b	Ellie	White		I am writing with concern about the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on October 19, 2016. I wanted to express that I think it is extremely important that the full funding and operation of the Green Bank Observatory continues in the future...The Green Bank Observatory is a world-class facility in so many ways. The telescopes onsite are really engineering wonders - the technology that is required to keep them up to date and operational is extremely advanced, and still moving forward. The 100 meter GBT, which is currently the largest fully steerable single-dish radio telescope on Earth, is a tremendous tribute to the skill and expertise of the engineers, astronomers, machinists, and Green Bank personnel who designed, built, and continue to maintain it. Its 100 meter offset parabolic dish is almost as large as two football fields and is made up of 2,004 adjustable panels, with a total surface accuracy to within a standard deviation of 300 microns (0.01 inches - thinner than a business card). It is a vastly sensitive instrument; the amount of energy it is capable of detecting is equivalent to that of a single snowflake falling to the ground. The extremely wide range of frequencies that the telescope is capable of observing (0.3-116 GHz) allows it to be extremely versatile in the research projects it can participate in. Reduction or elimination of funding to this facility, or decommissioning the telescopes would tremendously hinder the technological progress that can be made in radio astronomy and related fields, due to the unique nature of the engineering skills required to operate, maintain, and upgrade one of the few large fully-steerable radio telescopes in the world. The science that is being done there is cutting-edge - from mysterious pulsars and fast radio bursts to the exciting new Breakthrough Listen project to search for extraterrestrial civilizations - Green Bank's scientists and visiting researchers are really moving us another step toward understanding the Universe and our place within it. Particularly intriguing and relevant research topics include studies on gravitational waves (in collaboration with the North American Nanohertz Observatory for Gravitational Waves (NANOGrav)), star formation, galaxy evolution, dark energy, and the search for the chemical precursors to life in space, not to mention locating a lost NASA solar satellite and mapping a nearby asteroid. Full NSF funding is really the very best option available for continued astronomical research at the GBO; if funding is reduced or cut, the GBO will be forced to seek out other avenues for funding, which could entail the loss of the vital "open skies" policy which allows data to be freely disseminated among scientists so progress in research can continue to move forward. Converting the GBO into a non-operational facility would mean the loss of not only the uniquely sensitive and versatile GBT, but also a loss in a significant amount of precious observing time which astronomers are already short on. Scientific discoveries and research projects aren't the only exciting things going on at Green Bank, though; there are many progressive and unique educational opportunities and initiatives on site too.	Against Closure	Email - Scanned	11/1/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
741	c	Ellie	White		<p>The GBO is a vital part of the West Virginian economy as well - it is the life force of the rural and remote Pocahontas County, where it provides jobs to people from around the world as well as from West Virginia, all of whom in turn contribute to the local shops and services. Funding cuts or elimination would decrease or even totally eliminate the positive influence of the GBO, creating a gaping hole in the local economy, not likely to be filled anytime soon due to the remoteness of the surrounding area.</p> <p>Green Bank means a lot to me, both on a personal and a practical level, and I would really like to see it continue to thrive. If funding were to be reduced or cut, or if it were to be converted to a nonfunctioning facility, it would be a devastating loss to science, technology, West Virginia, and the rest of the world. It is a very important resource in my state of West Virginia, as we are really starved as far as research and technology goes. The educational resources provided at the GBO are really the best we have in this state; if it were not for this facility, I and so many other students in West Virginia would never have had the opportunity to learn in such a high-level and inspiring atmosphere that does so much to foster interest in pursuing STEM careers. We have focused for far too long on the declining coal industry, which will soon be gone - but science, like that done at Green Bank, will continue to grow and provide future opportunities. I am writing because I want to do all I can to make sure we never lose this national treasure. The Green Bank Observatory means so much to so many people, and compared to many high- budget scientific endeavors, this state-of-the-art facility is run on a relatively low operating budget.</p> <p>If the NSF decides to secure total funding for the GBO in the years to come, it would mean that the observatory would be able to continue to push the frontiers of what is known about the cosmos, keep building super-advanced technology, and it would stand as the wonderful STEM resource it is for young, excited potential scientists like me and many others. I can't overstate just how much this beautiful place means to me - it has helped me develop from the time I first discovered the wonder of astronomy to now, when I am starting on my journey into the field. I want to make sure that I'm not the last generation of young people to benefit from Green Bank's influence - I really hope it stands for many more generations of young explorers yet to come. I really believe that science is the key to a better, healthier, and more peaceful and prosperous future.</p>	Against Closure	Email - Scanned	11/1/2016	
742		Angela	Hoffman		<p>I am writing in support of continuing operations and funding of Green Bank Observatory in Green Bank, WV. As a long time resident of the area and a frequent supporter of the science and education that occurs at this facility, I believe that the impact to the community, regional area, state, and overall science community would be seriously detrimental. The detrimental impacts would indeed be financially devastating to the region, as the observatory employs numerous residents. Additionally, the observatory bring in tourism funds through visitors and educational groups.</p> <p>I sincerely advocate for the continued funding and expansion of the science and education services occurring at Green Bank Observatory. I appreciate you taking the time to consider my input and reading this email.</p>	Against Closure	Email - Scanned	11/1/2016	
743		Christopher	Evans		<p>I just read about the telescope and I just want to say that I definitely want it to stay!!!! As someone who loves Science and is majoring in General Science Education it would make my heart sore if they remove it. I have seen it only once but it would make for a good field trip for my science classes when I begin teaching.</p>	Against Closure	Email - Scanned	11/1/2016	
744		John	Kyer		<p>The present operation of Green Bank has been a life threatening situation for all Fire and EMS services operating in Greenbrier County. The ability to operate our emergency radios at full capacity or very limited capacity in some areas, affects response calls and endangers lives. Many tax payers are not aware that limitations set by Green Bank interferes with emergency responders'ability to communicate with 911 calls.</p>	Resource Considerations	Email - Scanned	10/31/2016	
745		Leslie	Stone		<p>Please continue this facility as described in options 1,2 or 3</p>	Against Closure	Email - Scanned	10/31/2016	
746		Joyce	Izat		<p>As a resident of West Virginia my family has visited the Green Bank facility many times over the years, each time it has been more enlightening. We always take our out of state and overseas friends there, all have enjoyed the experience, not to mention their surprise that our state even has such a facility. I wish it was a mandatory field trip for every school in the state, our own children enjoyed and learned from each visit we made as a family.</p> <p>I hope the facility continues to operate for many years to come, to even consider closing a usable facility that continues to give good data seem a waste and a loss to the scientific community that use it for their research.</p>	Against Closure	Email - Scanned	10/31/2016	
747		Jason	Murphy		<p>The Green Bank Observatory is a critical peice of our science infrastructure and exploration mission. It should be restored to full funding and continue to operate. Shutting it down would be a huge mistake.</p>	Against Closure	Email - Scanned	10/31/2016	
748		Melinda	Russell		<p>Please accept this email as a public comment. The quiet zone that exists around this facility is rare and special and should not be allowed to deteriorate. Once cellphones, etc. are free to proliferate in this geographic area, they will permanently degrade this pristine site. The Observatory is on the brink of attracting more respectful visitors and private industry users. If the Observatory were to be deconstructed or mothballed,the impact on the local economy would be catastrophic. Generations of bright, STEM-focused children have grown up in and around Green Bank, the children of scientists who are employed at the facility. Our country needs more of these future STEM professionals. And Green Bank is an idyllic environment in which to nurture them.</p>	Against Closure	Email - Scanned	10/31/2016	
749	a	Lonnie	Henderson		<p>West Virginia was selected for the location of this Green Bank Radio Telescope due to its unique topological structure and was responsible for the 13000 square mile National Radio Quiet Zone.. It is insulated from our increasing radio polluted world. It is also used by our government for the same reasons. I am sure that our governments secret radio observations will not cease to operate. So why allow our scientific observations be allowed to stop?</p>	Against Closure	Email - Scanned	10/31/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
749	b	Lonnie	Henderson		<p>As a citizen of West Virginia and the United States, also a concerned individual I am amazed of the article that I recently read in the Charleston Gazette Mail about the current situation of the Green Bank Observatory Radio Telescope.</p> <p>The devaluing of this scientific observatory to one of lesser value by the National Science Foundation is stunning . How can or national scientific community allow this to happen? Most of or great national achievements have been directly related to our scientific discoveries in many disciplines of scientific endeavor. Many not entirely decipherable until our scientific minds have had a chance to analyze it and determine how to use it. Much of the knowledge obtained from this device is of our unobservable universe, much of which is still unknown and new to us. It is used for astronomy about 6500 hours every year, with 2000–3000 hours per year going to high-frequency science. Part of the scientific strength of the GBT is its flexibility and ease of use, allowing for rapid response to new scientific ideas. It is scheduled dynamically to match project needs to the available weather. The GBT is also readily reconfigured with new and experimental hardware. The high-sensitivity mapping capability of the GBT makes it a necessary complement to the Atacama Large Millimeter Array, the Expanded Very Large Array, the Very Long Baseline Array, and other high-angular resolution interferometers. Facilities of the Green Bank Observatory are also used for other scientific research, for many programs in education and public outreach, and for training students and teachers. This observatory has divined exceptional scientific knowledge in the past and can continue to do so in the future. We need the data and new findings from the radio telescope to improve our knowledge of our universe, our own galaxy and any other structures or objects that pique our interest. Why this was done to a premier device which has expanded our knowledge of black holes, pulsars, star formations, gravitational wave and non visible structures throughout or universe which have featured great improvements to our knowledge.</p> <p>How this has been allowed to happen is very disturbing to me. To close down or lessen the operation of one the largest radio observatories in the world is just unfathomable...To limit its operation would be a blow to our Nation. Who decided to why this is to happen should be reviewed also. A Foundation portfolio review committee in 2012 recommendation of dropping financial funding should be looked into deeply. Why it was decided to perform an Environmental Impact Statement in the guise or stop operation is like the method used to shut down companies using poisonous compounds to manufacture objects we use everyday. If this was going to be done why was it not performed after the failure in 15 November 1988?</p> <p>I strenuously oppose any reduction of funding or lessening of support to the Green Bank Radio Telescope observatory by the National Science Foundation.</p>	Against Closure	Email - Scanned	10/31/2016	
750		Richard	Mitnick		You cannot possibly not see the value of keeping Green Bank as a functioning radio telescope. No one could be that blind.	Against Closure	Email - Scanned	10/31/2016	
751		Derek	Bas		<p>I'm writing you to express my concern for the future of the Green Bank Telescope. The telescope needs to stay fully funded. I am a recent Ph.D. graduate from West Virginia University's physics program, and I was close to many colleagues (especially Dr. McLaughlin and her students) who did some really fantastic work with the telescope. I recently attended a conference talk where Dr. McLaughlin discussed her group's future plans for the project and as a physicist I can tell you that her goals are incredibly important. Her work with pulsar timing arrays to detect low frequency gravitational waves will absolutely redefine the field of astrophysics, and it is in our nation's best interest to keep it funded and stay at the leading edge. Consider the amount of press gravitational waves has already received from the LIGO project: The GBT project is a complementary project that is just as groundbreaking (if not more), and its cost pales in comparison.</p> <p>LIGO is one of the largest and most successful science projects in history- and the GBT has the potential to use pulsars to replicate it, but on an almost unimaginable scale! Even setting aside the future gravitational wave findings, such a project can surely be used to draw in generation after generation of new STEM students, excited to play the next big role in our search for an understanding of the universe. Just as a past generation needed the moon landing, our future generations need this to keep our nation's kids excited about science and technology so that they can continue to lead the world in innovation.</p>	Against Closure	Email - Scanned	10/31/2016	
752		Kris	Dixon		Please don't take this site from WV. The state is already losing so much. It would be another big hit to them. Thank you	Against Closure	Email - Scanned	10/31/2016	
753		Josh	Deem		Don't get rid of greenbank	Against Closure	Email - Scanned	10/31/2016	
754		Nate	Van Wey		<p>As the NSF considers the future of the Green Bank Observatory, I would like to add my support of the observatory and the work it does both in astronomy and especially in science education.</p> <p>I have been a teacher for 44 years, teaching physics and astronomy at both the high school and college level. I have attended numerous teacher workshops and student workshops at the observatory, and can testify that the impact that the observatory and the personnel have had on my teaching has been no less than phenomenal. In a time when the United States is concerned about education and especially STEM education we should not be considering doing away with the facility such as the Green Bank Observatory which is a strong supporter of STEM education both in West Virginia and in the United States. The impact on the hundreds and hundreds of teachers and thousands and thousands of students by the dedicated personnel at the observatory is something that will stay with the teachers and the students for years to come. The people at Green Bank and the work that they do in their dedication to the education of our youth has brought about major changes in the teaching style, the curriculum content, and enthusiasm for science education and science itself.</p> <p>The observatory provides a very unique setting for focusing research in astronomy for scientist worldwide, but also for teachers and students who wish to focus specifically on scientific research, understanding astronomy, and learning how to become better teachers and better learners. The loss of such a facility would severely impact science education in this region.</p> <p>From the perspective of this science educator, I strongly urge the NSF to consider continued support of the Green Bank Observatory in the future.</p>	Against Closure	Email - Scanned	10/31/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
755	a	Scott	Garber		<p>Where do I begin? My name is Scott Garber and I am the forestry teacher at Pocahontas County HS. Not only do I teach here but I live within a few miles of the GBO and grew up around it as well.</p> <p>From an educator stand point my program would be greatly affected by the loss of the GBO. In recent years we have partnered with the GBO to affect the hands-on learning environment of many students. Four years of my students have gotten true, on-site work experience due to this project, a project which probably is the largest class/partner project in county and school history. Through this project my students get to actually work through all aspects of forestry. Aspects that include forest planning, timber volume estimation, forest harvesting, product evaluation, mapping, and reforestation just to name the major components. They also get to see how business relationships work between partners, our program, the company forester and the GBO. This kind of education is priceless, losing this opportunity would effect the opportunities of countless potential future foresters or land managers to come. Our program has been very successful and part of that success is because students know what kind of projects we get to work on and that it is real life experience in the field!</p>	Against Closure	Email - Scanned	10/31/2016	
755	b	Scott	Garber		<p>As a community member the devastation would be similar. The GBO is such a meaningful place for all ages of our community. The many events that are held there that benefit folks. The positive culture that comes from the diverse employees and students that come there to work and study cannot even begin to be measured or put into terms. As a parent I love the fact that my children get to see how limitless their science education can be and where it can go. Socially what other cultures they can be around just by living and going to school by the GBO. This diversity and the advanced science and math type people is extremely rare for such a rural community anywhere in the world and we would never want to lose those opportunities for our young people. And those folks immerse themselves into our communities. Which can open so many eyes and worlds for all people, both local and transplants! This has inspired 1000's of kids over the last 40+ years to explore more in the science, math and computer fields. The starwatch events, biking events, science exploration days, soccer leagues and the tours are a big part of our young childrens lives as well as everyone else for that matter. Where else can a rural kid take a simple bike ride and possibly be inspired to actually listen and look for life in space and study stars, moons and planets, and actually see that this really is a possibility and that how far you can take it is truly limitless! All that from a simple bike ride when you are a little kid. Then they just might be neighbors with someone who does this and studies these things or works on the telescopes which takes it even farther.</p> <p>So to say it would impact our community negatively would be such an understatement. All ages would suffer but most of all our young people, our little children, our children to come and their education. Which means the future of our county, our communities and the education system would lose way more than we can even comprehend!</p>	Against Closure	Email - Scanned	10/31/2016	
755	c	Scott	Garber		I could go on even more about how the job loss and monetary losses and how it would affect our communities but those are the things most people can see and figure out. I hope that this email helps the cause to keep the GBO here and open! Thank you for taking the time to read my email! Have a great week!	Against Closure	Email - Scanned	10/31/2016	
756		Naveed	Zaman	Professor of Mathematics Interim Dean, College of Natural Sciences and Mathematics	<p>As the dean of College of Natural Sciences and Mathematics, I strongly support the continued NSF investment for science-focused operations for Green bank Observatory.</p> <p>Our student groups have taken trips to the GB observatory for educational purposes. Those trips have always motivated the students and have created an enthusiasm of science in them. Our students visit GB regularly to become ambassadors for the WV SPOT program. I strongly believe that the multidimensional impact of GB Observatory on the Scientific Community and the State of WV is extraordinary. Consequently, I strongly recommend full support of the Green Bank Observatory facility.</p>	Against Closure	Email - Scanned	10/31/2016	
757		Sandie	Chaney		Please do not. Close greenback. This is a very important site for not only the community...but the world. So much has been is so much is yet to be discovered through greenbank. Please keep this place going for future generations.	Against Closure	Email - Scanned	10/31/2016	
758		Christopher	Thomas		<p>It has recently come to my attention that an EIS has been prepared for the Green Bank Observatory in West Virginia. I have reviewed the document and alternatives presented and as a concerned West Virginian and one that has found great inspiration in this unique facility I'd like to offer some comments.</p> <p>To start, I'd like to say that I am an engineer that works in West Virginia and my family and I have visited the facility on many occasions and believe that this facility is one of the most unique and inspirational science facilities that we have ever visited. As a person of science, I see this facility as one of the few places that bring scientist and other researchers together from all over the world while at the same time educating and inspiring the young minds that pass through its doors every year.</p> <p>As for the proposed alternatives listed in the EIS, on the alternative that the NSF fund the whole facility, I'd hope that the NSF would still see the great value and work the facility does to introduce people to science and the research that takes place there. As for the second alternative with collaboration with interested parties for a science and education focused operations, I see as viable but would still like to see scientific work being done at the facility. There are not many facilities on this scale that you can go to and see actual data and the people behind it working and collaborating. For the third option as a facility that operates as a technology and education park, I think really undermines the facility's potential and this kind of shift would lead to the further deterioration of West Virginia's role in science. The fourth and fifth options to mothball or deconstruct it, I feel are counterproductive to all the work that has gone into this great facility. As a site that can bring together a scientific community both at the facility and remotely is truly amazing and helps West Virginia in many ways.</p> <p>As for my family it provided inspiration to know that such a facility exists in our state and that we can see science in real time. This facility has done a lot for my family and I hope that it will be able to in the future.</p>	Against Closure	Email - Scanned	10/31/2016	GBO Public Comment for EIS.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
759		C. Thomas	Beer	Chemical Engineer, and Science Advocate	<p>I read an article in the Dominion Post regarding the possible closure of the Green Bank Observatory. The \$10M dollars per year operating costs are small compared to the discoveries made by this installation, including the most recent "stealth black hole" discovery. This one thing has the potential to have a huge impact on the ability to find and either utilize or avoid these newly found stealthy black holes across the sphere of the cosmos.</p> <p>This is the world's largest steerable radio telescope, has very high sensitivity, and compliments other installations in basic research and discovery. I compare these installations with the Lewis and Clark Expeditions... we don't know what we are going to find, but we need to look. I believe that expanded outreach and enhanced educational opportunities can be a great addition to the Green Bank Mission, in addition to the groundbreaking research functions of the facility. There is so much to learn about the structure of the cosmos and its application to our lives on earth (or beyond), how could we even consider closing our interstellar ears to the possibilities of gaining this knowledge?</p>	Against Closure	Email - Scanned	10/31/2016	
760	a	Tony	Mroczkowski	Submillimeter/Millimeter Instrument Scientist / Astronomer European Southern Observatory (ESO)	<p>The Green Bank Observatory and specifically the 100-meter Green Bank Telescope (GBT), which is the largest steerable single-dish telescope in the world, are unique resources to the scientific and academic community. At high frequencies (20-115 GHz), the GBT is an extremely valuable complement to the AIMA interferometer, and is operated at only a fraction of the cost. As a single dish, the GBT provides faster mapping speeds and a larger field of view than AIMA, and serves as a valuable source finder for detailed high-resolution interferometric follow-up.</p> <p>I therefore write in support of the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they are now performed, including adhering to the Open Skies policy.</p> <p>Please see the high-frequency GBT science case recently presented in Bally et al. 2016, available here: https://arxiv.org/abs/1610.09014 (submitted 27 Oct 2016). As noted in this white paper, the most impressive upgrades to the GBT have only recently been commissioned or are still undergoing commissioning, keeping the GBT poised for great discoveries unique to its capabilities. Specific to my work on galaxy clusters and the cosmic microwave background (CMB), MUSTANG-2 and the GBT will soon map the pressure substructure in galaxy clusters and probe high-redshift dusty star-forming galaxies; the former goal complements lower angular resolution (>arcminute-scale) CMB instruments, while the latter goal complements the mains of the James Webb Space Telescope to find and image the first galaxies to form.</p>	Against Closure	Email - Scanned	10/31/2016	
760	b	Tony	Mroczkowski	Submillimeter/Millimeter Instrument Scientist / Astronomer European Southern Observatory (ESO)	<p>In addition to the groundbreaking science the GBT will continue to deliver, it is a rare resource in education and training of the next generation of astronomical instrument scientists. This is achieved primarily through outreach to the local West Virginia community and through the PI-instrumentation program. While other millimeter/submillimeter facilities have become privatized or shut down in recent years, I find myself working in a field with fewer scientists obtaining hands-on experience with cutting edge instruments, particularly in the U.S. For me personally, the shrinking amount of public facilities has led to my moving from the U.S. to work in Europe, while many of my colleagues have been discouraged and have left the field.</p> <p>Please consider the future of U.S. mm-wave and radio instrumentation as you debate the future of this unparalleled resource. Please also consider the important precedent the NSF has maintained, for the U.S. and the world, of outreach programs, cutting edge science, and the Open Skies policy that anyone with a great science case can obtain observations on the GBT.</p>	Against Closure	Email - Scanned	10/31/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
761		Cheng-Yu	Kuo	Astronomer	<p>My name is Cheng-Yu Kuo, an astronomer in Taiwan and a long term user of the Green Bank Telescope (GBT). I am writing this email to convey my personal opinions on the future operation of the GBT.</p> <p>As a radio astronomer, I still remember that when I first heard the divestment recommendation made by the Eisenstein-Miller Portfolio committee, I thought that this was a really unwise recommendation, given the great scientific values of the GBT. After talking to a key member in the Portfolio committee, the person who made the suggestion to shut down the GBT, I realized that the divestment recommendation was not totally objective and therefore cannot be representative for the entire astronomy community in the US.</p> <p>The original suggestion made within the Portfolio committee was to shut down an optical telescope, rather than the GBT. It was out of the strong "personal" preference and opinion of an optical/planet astronomer in the committee who wanted to protect optical astronomy that the final divestment recommendation went to the GBT. Clearly, the divestment recommendation was not made out of scientific values of the GBT, but also involves personal preference or biases.</p> <p>Therefore, I strongly appeal the NSF to re-assess the recommendation based more on the scientific values of the GBT and see whether it is really the right thing to do to shut down this wonderful telescope.</p> <p>From the point of view of AGN studies, either closing down the GBT or dramatically reduce the science time of the telescope will cause severe damage to astronomy. Our team has been using the GBT to study water megamasers around supermassive black holes at the centers of active galaxies. Our effort has produce the most precise measurements of black hole masses in astronomy, and these precise measurements has become an important part in the black hole-galaxy coevolution study.</p> <p>Based on our data collected in the past 10 years, we are now very close to find a new/efficient technique to discover water maser emissions from gas orbiting around supermassive black holes. As a result, it is very likely that we will be able to find maser emissions from active galaxies in a substantially faster pace, and the number of percentage-level black hole mass measurements will increase significantly in the following years. This new development would definitely bring the black hole-galaxy coevolution research to a new forefront. However, without the survival of the GBT, all these new progress in astronomy will be hampered severely.</p> <p>Above all, I wish that the NSF can reconsider the decision to change the GBT operation in a significant way and re- evaluate the situation based more on the scientific impacts of the GBT, which may be underestimated by the Eisenstein Committee. Thank you !</p>	Against Closure	Email - Scanned	10/31/2016	
762	a	Gary	Gillespie		<p>For many reasons the operational funding of the Green Bank Radio Astronomy Center deserves to continue without changing the original mission of this vital scientific project.</p> <p>Over the years research carried out there has contributed to the knowledge of scientists and astrophysicists. As our nation continues to send sky labs and astronauts into outer space, the Green Bank Observatory will enhance the growing information needed for successful missions and space research. The GBRA Center continues to search for those environments in the universe that are life- supporting for earth's humans. In time the research may learn if intelligent beings inhabit any of the systems making up the universe. Auditory information is an important piece in the puzzle of mankind's understanding of the universe.</p>	Against Closure	Email - Scanned	10/30/2016	
762	b	Gary	Gillespie		<p>GBRA Center is a first rate educational source for visitors from elementary schools to post-graduates. The field trips that help school children learn more about their world and the universe is, in itself, reason enough to continue its funding. Children's field-trip experiences there inspires them to study science and math with vigor. This part of the GBRA mission is a significant building block in the education of children. School children get study guides and work pages on various aspects of science that carry over into their classrooms long after their field-trip ends.</p> <p>On a personal level, the GBRA has a coincidental humanitarian impact on many visitors. As one listens to the guides explain the scopes and what they reveal about space, the realization of the vastness of the universe with its constantly moving parts gives a new perspective on how infinitesimal our solar system is by comparison and how insignificant man is in its myriad parts. Visitors are humbled in the face of its limitlessness where there may be no beginning or end. This is good for mankind to know because it makes us better to know earth's population shares the same destiny.</p>	Against Closure	Email - Scanned	10/30/2016	
762	c	Gary	Gillespie		The GBRA stimulates local and state economy.	Against Closure	Email - Scanned	10/30/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
763		Jeffrey	Zemerick		<p>I would like to provide my feedback regarding the NSF and the Green Bank Observatory.</p> <p>My recommended option is "Collaborate with interested parties for scientific and educational functions with reduced NSF funding."</p> <p>As a citizen with a STEM degree working in what little STEM industry West Virginia currently offers, I would be extremely disappointed to lose the Green Bank facility or for it to lose its primary goals of science and education. It is a world-class facility nestled in a state where you can count the "world-class" locations on one hand (and maybe with a finger or two to spare).</p> <p>The observatory and the surrounding places has long been a popular destination for activities in our family. Seeing the telescopes and learning about them is something I look forward to sharing with my kids. I was very excited to recently see data from the observatory being processed in my home computer's Seti@Home tasks.</p> <p>While any possibility that allows the observatory to remain open is better than any that mothballs it or closes it, I strongly hope the observatory it is able to maintain its purposes of science and education for generations to come.</p>	Against Closure	Email - Scanned	10/30/2016	
764	a	Earl	Scime	Oleg D. Jefimenko Professor and Chair of Physics and Astronomy	<p>I note that in NSF's announcement of the EIS review for the GBO (https://www.nsf.gov/news/news_summ.jsp?cntn_id=190089&WT.mc_id=USNSF_51&WT.mc_ev=click), the Breakthrough Foundation is prominently cited, yet over the past 4 years, West Virginia University has provided significantly more funding to support GBT operations than the Breakthrough Foundation. WVU has been the major partner for the GBO over the past few years. I raise this issue on behalf of the department of physics and astronomy at WVU to highlight the extensive connections our department has with the GBO. Loss of the GBO would affect dozens of undergraduate and graduate students at WVU, over a dozen faculty and research scientists, and hundreds of regional high school students and teachers.</p>	Against Closure	Email - Scanned	10/29/2016	
764	b	Earl	Scime	Oleg D. Jefimenko Professor and Chair of Physics and Astronomy	<p>The GBO facility is a critical element in the growth of astronomical research in West Virginia and therefore there would be a significant educational impact where the GBO to close. It is my opinion that the public scoping process should include a detailed discussion of the potential impact on educational programs in the region.</p>	Resource Considerations	Email - Scanned	10/29/2016	
765		Diana	Buttaro	University of Virginia School of Engineering and Applied Science (CpE)	<p>I am an undergraduate college student at UVA, active member of the Astronomy Club, and huge fan of the Green Bank Observatory. Every year our club has an annual trip to collect data on the 40-ft educational telescope there using old-school equipment. It feels like we are scientists from the 1960s and I love it.</p> <p>I have been informed that public comment is open on the future of the observatory, and I want to provide my input that I find it extremely important to keep Green Bank fully operational and receive funding from NSF. Aside from the educational trips, the Green Bank telescope itself is an important tool for discovery. It is the largest fully movable telescope in the world and this alone makes it an invaluable resource for astronomers to collect data. The telescope needs funding so there is sufficient time for open science. While private projects of those with more money are enticing, it is more important for the nature of discovery to allow astronomers working on various projects to be able to apply for time on the telescope. Many of my friends are already conducting research in astronomy and astrophysics. By keeping Green Bank publicly funded and operational, so many bright minds will have the opportunity to use the telescope, and these people will be able to utilize the telescope to its full potential.</p> <p>The Astronomy Club at UVA is looking forward to returning to Green Bank in the years to come. Thank you for your time.</p>	Against Closure	Email - Scanned	10/28/2016	
766	a	Rita	Kelly	Green Bank Elem. / Middle School Preschool / Preschool Special Needs Teacher	<p>I understand that you are considering withdrawing funding of the Green Bank Observatory. I would hope that you understand the scope of that change in funding on our community. Please let me share just a small portion of what the GBO (NRAO) has meant to us.</p> <p>I have been a teacher in Pocahontas County where Green Bank is located for 30 years, and at the Green Bank Elementary/Middle School since 1995. In that time I have been acquainted with several of the families who have moved here to work at the Observatory, and many who were local people who are and have been employed at the NRAO. I have also had many students throughout the years whose parents are employed by the NRAO. The positive impact that these families have had on our community has been amazing! I can not imagine our small community without having the influence of the NRAO employees.</p> <p>Socially: Many years ago I had a daughter in soccer & soft-ball. Her coaches & referees were mostly NRAO employees. Even today GBO employees coach, volunteer and support many of the sports in our high school and county recreational leagues. It would be a great loss to our community to lose all of that support.</p> <p>There are many more ways that the GBO and it's employees have positively effected our community and the loss of this resource would be absolutely devastating to our community. I hope you will consider continuing to fund this amazing resource.</p>	Against Closure	Email - Scanned	10/28/2016	
766	b	Rita	Kelly	Green Bank Elem. / Middle School Preschool / Preschool Special Needs Teacher	<p>Economical: Our small community would be absolutely devastated if the GBO was no longer one of the largest employers in our county. If I am right, it's the 3rd largest employer in Pocahontas County which is geographically the 2nd largest county in our state. Many of our small businesses would no doubt be forced out of business due to the loss of revenue and our housing market would be devastated. Employees of the GBO would not be able to sell their homes at the market value because no one in the community would be able to afford those houses.</p>	Against Closure	Email - Scanned	10/28/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
766	c	Rita	Kelly	Green Bank Elem. / Middle School Preschool / Preschool Special Needs Teacher	Educational: The NRAO has always been open to help our school in many ways. Anything from educational activities at their science center to offering evening activities that stimulate our students. I am so thankful for the many, many educational resources that they have provided. Also, without the students in our schools whose parents are employed by the GBO, our number of students would drop dramatically, which would mean that our school funding would drop dramatically.	Against Closure	Email - Scanned	10/28/2016	
767		Frederick	Walker	Adjunct Faculty, Marshall University	The future of our country depends on stimulating our youth in math & science. The Greenbank Observatory not only discovers new and important things about our universe, it also discovers new & exciting things. Young potential scientists from all over the Country are able to see directly how their education in STEM subjects is put to use in understanding the physics of space. I implore you to continue funding this work as essential and not discretionary.	Against Closure	Email - Scanned	10/28/2016	
768		Devin	Crichton	Ph.D. Candidate Department of Physics and Astronomy Johns Hopkins University	As graduate student and prospective user of the NSF supported MUSTANG-2 instrument, I am writing this letter to advocate for maintained NSF investment in the Green Bank Telescope. In particular for my work, the efficiency with which the recently commissioned MUSTANG-2 instrument can make high resolution Sunyaev-Zel'dovich (SZ) effect followup observations of galaxy clusters represents a significant advancement. By enabling efficient, high resolution characterization of the pressure distribution of the intracluster medium (ICM), MUSTANG-2 observations will help advance our understanding of the astrophysical processes at play in these high mass haloes. This is not only important for understanding the baryonic processes which affect structure formation, but also for understanding the systematic uncertainties that are holding back cosmological analyses of large SZ selected cluster surveys. As such, MUSTANG-2 observations stand to be exceedingly relevant in enhancing the scientific outputs derived from the galaxy cluster samples of existing and forthcoming surveys, including those from NSF funded projects such as ACTPol and Advanced ACT. Furthermore, having visited the GBT as a student and with other students, I have both personally experienced and witnessed its ability to inspire young astronomers and the general public. The GBT is a truly remarkable observatory in terms of both its scientific output and its potential as an educational tool. As such, NSF divestment of the GBT could potentially represent a significant and tragic loss to the astronomical community.	Against Closure	Email - Scanned	10/28/2016	gbt_support.pdf
769		Devin	Crichton	Ph.D. Candidate Department of Physics and Astronomy Johns Hopkins University	I agree broadly with the statements made in https://arxiv.org/abs/1610.02329 that significant developments of both the GBT, its instrument complement and its context in the field need to be carefully reevaluated before divestment is considered.	Against Closure	Email - Scanned	10/28/2016	
770		Bob	Mikulas	President National Lawn & Garden Show	I attended college within the National Radio Quiet Zone and recognize the Green Bank Observatory as one of our country's unique national treasures. While I acknowledge that austere times require changes, I implore you to retain the facility for continued use, under scenarios one thru three, and in that order of preference. 1) Continued NSF investment for science-focused operations (No-Action Alternative) 2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3) Collaboration with interested parties for operation as a technology and education park	Against Closure	Email - Scanned	10/28/2016	
771		Jerome	Gilbert		I want to register my support for continuing the operation of the Green Bank Observatory and for continued NSF support. This facility is an asset for West Virginia and is of tremendous value in basic science discovery. I had the opportunity to visit Green Bank many years ago and was very impressed.	Against Closure	Email - Scanned	10/28/2016	
772		Charles	Sheets	Green Bank Lifelong Citizen	National Science Foundation publication dated 10/19/2016, under the provisions of section 106 per 36 CFR 800.2(d) is proposing two scoping meetings for an EIS to determine the future of the Green Bank Observatory. These meetings are scheduled for 11/9/2016 at 3:00 PM and 6:00 PM, the same day, located in the Green Bank Science Center, Green Bank, WV. I am a life long citizen of Green Bank, WV, and have seen and read much scientific progress over the years. I was in Green Bank High School when land was purchased and observed ground breaking ceremonies as a student. We were in the automotive business in the community for 90 years closing our leadership in 2012, mostly due to the economy. I am requesting that the Notice of Intent to prepare and EIS be postponed for the following reasons: (1) You have scheduled this just one day after the General Election, (2) Pocahontas County will have just gone through a contentious School Bond Levy Vote to up grade our county schools, (3) because of these two important events I believe our citizens are not focused on this important hearing for our community. We are a small rural community, without cell phones, and only one weekly newspaper. I am confident that most of our citizens have not been informed and postponement of the hearing is necessary.	General	Email - Scanned	10/27/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
773		Donald	Martin, II		<p>As a returned native West Virginian, living for more than 30 years within the NRQZ at French Creek, I take great pride to include Green Bank Observatory as one of our country's unique national treasures, pushing the frontiers of our understanding of our universe.</p> <p>Over the years we have visited the GBO a number of times, with friends, family, and school classes, and I always find it inspiring. It stimulates the senses and imagination in so many ways. And conducts good science.</p> <p>While I recognize that austere times require changes, I implore you to retain the facility for continued use, under scenarios one thru three, and in that order of preference.</p> <p>1) Continued NSF investment for science-focused operations (No-Action Alternative) 2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3) Collaboration with interested parties for operation as a technology and education park</p> <p>As noted in the email string below, the GBO and the NRQZ has been the subject of some recent email exchanges with friends across the country (my brother-in-law was stationed at Sugar Grove with the Navy a number of years ago & that too is intriguing).</p> <p>I'm retired from the WV Department of Environmental Protection and have kicked around the idea of getting tee shirts printed (as outlined below) and distributed in the tourism spots here within Our Home Among the Hills. Any objections?</p> <p>Thank you for your consideration, and best wishes to the folks at the Green Bank Observatory. FYI, attached are a couple of photos I took last year.</p>	Against Closure	Email - Scanned	10/28/2016	image002.png, IMG_1882 v-2.jpg, IMG_1878 v-2.jpg
774		William	Lively		<p>As a West Virginia resident and tax payer I want to express my disapproval of the Green Bank Observatory (GBO), being dis-commissioned. I feel that the GBO contributes immensely to our understanding of the cosmos and there's still a lot to be discovered!</p> <p>The United States Government is wasting monies in many other places and being that a small portion of those monies are mine I am of the mind that they be spent on projects such as the GBO.</p>	Against Closure	Email - Scanned	10/28/2016	
775		Laura Jo	Elliott		<p>Last year, I had the opportunity to visit an old friend who was, at the time, employed at the Green Bank Observatory. Although the visit to Green Bank was social, I took the opportunity to very briefly tour the observatory. I wasn't expecting to have a strong reaction but I ended up being so impressed with several aspects of the facility. Firstly, everyone I met that was connected with the observatory radiated intelligence and passion. It was obvious that the observatory attracts the top in the field, by measure of ability and ambition. That should stand alone as a credit to the importance of the Green Bank Observatory. Moreover, people not only cared about what they were doing and studying but also about making it accessible to the public. Evidence of public outreach programs was around every corner. I heard about camps and school groups and programs in schools that teach students about science and space. I believe there is almost nothing more important to the future of humanity than educating and encouraging students interested in science. Green Bank Observatory excels at that. Although I was using vacation time to make a social visit to an old friend when I visited, I couldn't help but wander around and feel excited at the knowledge and energy of the place.</p> <p>As the future of the observatory is being determined, please consider the huge impact the facility has on the public. I believe the importance of encouraging the next generation's interest in the sciences can't be overstated.</p> <p>Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	10/27/2016	
776		Collette	Ridgeway	Administrative Support Assistant Academic Affairs	<p>I wanted to add my comments to the list as you consider the future of the Green Bank Observatory at your meeting on Nov 9th.</p> <p>A visit to the Green Bank Observatory in the late 1980's played a huge part in the role of science in my life. Although I am not currently in a career in the sciences, a lifetime of curiosity was encouraged when those great telescopes appeared on the West Virginia horizon. My family made an unscheduled stop, and we were able to get a tour. I was even lucky enough to see the 300 ft telescope before it's collapse.</p> <p>The idea that a place like that existed, and work like that was going on, captured my imagination. For the remainder of my high school years, Green Bank and radio astronomy were the subjects of most any project on which I could use those topics. My college years then allowed me to explore engineering, earth sciences, and environmental policy. After never being able to settle on just one discipline, I now find myself enjoying work in an academic setting supporting all sorts of faculty members doing all sorts of interesting things... and a lifetime of learning continues.</p> <p>Thank you to everyone who has done the good work of funding and operating this facility. I hope Green Bank can continue to inspire curiosity and innovation into the future.</p>	Against Closure	Email - Scanned	10/27/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
777		Kavilan	Moodley	Associate Professor, University of KwaZulu-Natal, South Africa	<p>I am writing in support of maintaining full NST operations on the Green Bank Telescope (GBT).</p> <p>I have a very talented former graduate student who is working on MUSTANG-2 on the GBT on her first postdoctoral fellowship, and her future career in astronomy is largely based on the scientific interpretation of the data that will come from MUSTANG-2 on the GBT.</p> <p>Together with my former graduate student, a current graduate student and a host of colleagues in South Africa and across the world, we are involved in a survey of Sunyaev-Zel'dovich selected galaxy clusters on other radio facilities across the world, specifically the GMRT in India, with a planned survey on MeerKAT in South Africa, for which complementary MUSTANG-2 observations on the GBT will be critical to delivering a comprehensive understanding of astrophysical (thermal and non-thermal) processes in galaxy clusters. This in turn will contribute greatly to understanding the scaling relation between Compton Y parameter and cluster mass, specifically how it depends on the dynamical state of the cluster. This relation is the key challenge in using clusters to constrain the equation of state of dark energy, a key goal of current and future cosmology surveys. Moreover, MUSTANG-2 observations on the GBT will contribute significantly to understanding detailed astrophysical processes in the intracluster medium, which provides a unique astrophysical environment.</p> <p>I urge you to consider seriously continued support from the NSF in maintaining GBT operations to enable the above science, and a range of other high-impact science, to be accomplished on this unique facility.</p>	Against Closure	Email - Scanned	10/26/2016	
778		Brian	Koopman	Physics Department	<p>I am writing to voice my opinion on supporting observations at the Green Bank Observatory. I have friends and colleagues in both the NANOGrav and MUSTANG2 collaborations whose work depends on the operation of the Green Bank Telescope. The work of NANOGrav complements the recent discovery made by LIGO and the work of MUSTANG2 will provide exciting high resolution measurements of galaxy clusters, complementing x-ray observations. The GBT is a valuable and unique facility from which to perform these measurements and I hope the NSF will continue to support these efforts.</p>	Against Closure	Email - Scanned	10/26/2016	
779		Michael	Niemack	Assistant Professor Physics Department	<p>I am writing to encourage continued NSF support of the GBT. It is a unique astronomical resource and is currently playing an important role in multiple exciting fields of astronomical and cosmological research.</p>	Against Closure	Email - Scanned	10/26/2016	
780		Jud	Worth		<p>I strongly urge you to keep the Green Bank Observatory as one of our Nation's Treasures. Please consider "Continued NSF Investment for Science-Focused Operation" (No-Action Alternative.) The Green Bank Observatory has many new investments including the new telescope and visitor's center. The wealth of technology and investment on this campus is epic. Your continued support is paramount for this premier facility to continue its operations. The educational dynamic of this campus is international and is reliant on its continued on-line operation.</p>	Against Closure	Email - Scanned	10/26/2016	
781		Shawn	Henderson	Cornell University Physics Department	<p>I am writing to express my support for continued National Science Foundation (NSF) involvement in the Green Bank Telescope (GBT). The GBT is a unique astronomical and educational resource. I am a postdoc at Cornell University working on the Atacama Cosmology Telescope (ACT), a National Science Foundation project, and I have collaborated closely with colleagues at the University of Pennsylvania who are working to deploy the GBT MUSTANG2 instrument. Over the next three years, MUSTANG2 will map galaxy clusters through their thermal Sunyaev-Zel'dovich signatures, enabling unprecedented constraints on cluster physics and models describing the formation of galaxies and cosmic structure. In particular, MUSTANG2 will significantly enhance the science impact of ACT's planned lower angular resolution survey of galaxy clusters over more than half of the sky, a large fraction of which are observable from the GET. The GET is also a critical platform for testing new technologies and techniques for future NSF projects like CME-Stage4, which will rely on improvements in microwave instrumentation first developed for projects like MUSTANG2 on the GET in order to map the sky in the mm- and sub-mm using ground-based telescopes to the fundamental limits. Ongoing work at the GBT is well aligned with the NSF's core science mission, and is critical to the success of other current and future NSF-funded efforts. I urge you to consider continuing support for this valuable community resource.</p>	Against Closure	Email - Scanned	10/26/2016	N/A
782		Federico	Nati	Department of Physics and Astronomy	<p>This letter is in support of continued NSF operations of the GBT.</p> <p>I am an Italian postdoc researcher currently working at the University of Pennsylvania in the field of Cosmology and Astrophysics. I've been working for around 15 years on several experiments designed for high resolution observations of clusters of galaxies, in particular to study the SZ effect (Planck/HFI, ACTPol, and balloon projects dedicated to SZ effect). These missions have demonstrated a strong impact on cosmology and astrophysics, with an enormous amount of data and publications, and still leave open many relevant questions that make GBT a unique tool to find their answer. We need the resolution provided by GBT and an instrument like MUSTANG-2 to address questions like: how do hot diffuse baryons dynamically evolve in dark matter potentials? How and when was the excess energy we observe in the intergalactic medium generated? What is the thermodynamic state of the ICM, and what determines it? Besides, understanding the complex internal SZ structure of clusters could help to untangle the Y-M relationship which limits our ability to constrain cosmological parameters from cluster surveys.</p> <p>The MUSTANG-2 instrument received a three year award to begin science observations on the GBT and should be installed up on the telescope in a few weeks. It's a state of the art instrument which, among other things, attracts the interest of a world-wide community, and people like me moved from Europe also to have the opportunity to work on it. I really hope that these opportunities will still be there in the future.</p>	Against Closure	Email - Scanned	10/26/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
783		Renee	Hiozek	Assistant Professor of Astrophysics	<p>I am a faculty member at the University of Toronto working as part of the Atacama Cosmology Telescope Collaboration (ACT). My work in the field of microwave cosmology is to understand the physical processes in galaxy clusters and in the cosmos through effects like the Sunyaev-Zeld'ovich effect.. As such, multi-wavelength observations from telescopes like the GBT are essential if we are to accurately probe the physics of SZ clusters.</p> <p>This impacts on our ability to disentangle astrophysical processes from cosmological ones, which is key to understanding the structure and evolution of the universe and the nature of dark energy: one of the major goals of the Decadal Survey.</p> <p>The continued funding of the GBT will ensure that we move forward on our science goals, and leverage the precision measurements that GBT provides. The telescope has been upgraded in recent years, and there are funded projects ready to be placed on the GBT that will bring significant astronomical rewards.</p> <p>I urge you to continue funding this world-class telescope which provides a eye to the radio universe so key for my science and that of my colleagues.</p>	Against Closure	Email - Scanned	10/26/2016	
784		Arthur	Kosowsky	University of Pittsburgh	<p>I know there has been talk of closing down Green Bank, and I hear that one of the options on the table is simply demolishing this facility. I think this would be a short-sighted misstep for US science.... programs at Green Bank are highly relevant to my interests in cosmology and gravitational wave physics. I am a long-time member of the Atacama Cosmology Telescope collaboration, which makes arcminute resolution maps of the microwave sky from a site in the Atacama Desert in Chile. Our collaboration has achieved a number of notable scientific firsts, including the first detection of six acoustic peaks in the microwave temperature power spectrum, the first detection of gravitational lensing of the microwave background, the first detection of galaxy cluster motions through the kinematic Sunyaev-Zeldovich effect, and the discovery of the most extreme galaxy cluster in our visible universe. One of the very interesting data products from our experiment, and from similar sky maps made by the South Pole Telescope and the Planck Satellite, is a catalog of all the largest galaxy clusters, detected via their thermal Sunyaev-Zeldovich distortion of the microwave background spectrum in the sky direction of the cluster. It has long been appreciated that the growth of galaxy clusters in the universe is a sensitive probe of structure growth, which can in turn provide insight into the nature of dark energy. Selecting clusters via the SZ effect is by far the cleanest way to do this. But galaxy clusters are not quiescent static objects: they continually accrete smaller objects, and the state of their gas is in constant dynamical upheaval, with larger departures from equilibrium at large radii and early times. We have a limited array of possibilities for measuring these nonequilibrium effects, and thus calibrating our cosmological probes. Thermal SZ bservations on angular scales smaller than one arcminute is one way to do it, and the GBT equipped with a bolometer array like MUSTANG-2 is one of the only instruments in the world which has that capability. It would be my hope that, as part of our multifaceted approach to understanding dark energy, that we would be seriously looking at prospects for building a succession of increasingly sensitive mm-wave detector arrays for the GBT to probe galaxy clusters. X-ray satellites, which are often cited as an alternative way to get at the same astrophysics, are vastly more expensive, and X-ray data is far more difficult to interpret than SZ data. ... This group is one of the world leaders in discovering millisecond pulsars, and using them as precision clocks for the detection of gravitational waves with wavelengths on the order of the distance to nearby stars. I don't need to remind anyone of the jolt sent through the entire physics and astronomy community by the LIGO detection last spring: we are truly at the doorstep of the gravitational wave astronomy era. It is my hope that we will see accelerated plans for a space-based interferometer at ten million-kilometer wavelengths, to complement ground-based efforts at thousand-kilometer wavelengths. The only known probe of gravitational waves at even longer parsec wavelengths is a pulsar timing array. Such an array puts limits on stochastic backgrounds at wavelengths longer than those dominated by white dwarf binaries. With enough pulsars and observation time, it may be possible to put important limits on (or detect!) a stochastic background of gravitational waves from inflation in the very early universe. GBT is a workhorse for discovering pulsars and for doing precision timing measurements; its loss would greatly hamper this unique route to gravitational wave detection. Not to mention the rich field of neutron star astrophysics, which also is likely to experience a renaissance once LIGO starts detecting neutron star binaries. As someone who has no direct involvement with radio astronomy, I still have professional interests in two completely different observing programs at GBT. I think this speaks to the versatility and importance of this instrument, and the limited alternatives available world-wide for doing this science. It is hard to accept that serious consideration is being given to shutting down a facility with unique science capabilities, high potential impact, and relatively low cost. Other contemporary observational efforts probing dark energy and gravitational waves are huge and vastly more expensive enterprises. I urge the NSF to continue supporting science at GBT.</p>	Against Closure	Email - Scanned	10/26/2016	
785		Tobias	Marriage	Assistant Professor Johns Hopkins University	<p>This is a letter of support for continued NSF investment for science-focused operations at the Green Bank Observatory. The GBT and associated facilities are crucial tools for the astronomical community and thus a valuable asset for advancing science. They both enable ground breaking science now and provide crucial training to young scientists to ensure scientific progress into the future. I can offer two examples from my own experience. (1) My student Ting Su traveled to Green Bank in the spring of 2015 to train and use the Z-Spec instrument to measure the redshifts of high redshift lensed star forming galaxies. These observations are part of her thesis to understand galaxy evolution at the peak of star formation 11 billion years ago. (2) My student Devin Crichton is collaborating with the MUSTANG(2) team to use the GBT to measure the gas profiles in galaxy clusters from a cleanly selected cosmological sample reaching back to the half the age of the universe, when the first massive clusters were formed. By studying the pressure in this sample, we learn how these most massive objects formed. For both of these projects, the samples come from the Atacama Cosmology Telescope, an NSF sponsored project. These projects illustrate how the different NSF initiatives rely on one another for full realization of scientific potential. It is important to note that these student-led projects would not have been realized with ALMA simply because the demand for time is too great to support the rich ecosystem of science we have in the US. Without facilities like the GBT this ecosystem will suffer, and the public good of scientific knowledge will not be served at the level commensurate with our society's expansiveness and potential.</p>	Against Closure	Email - Scanned	10/26/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
786		Laura	Solliday		<p>A letter in support of the GBO.</p> <p>I have always said that we live in the best place. We live in a community that has people that never finished school to people with PhD's and yet our pre-k through 8th grade school only has about 270 students. How is it possible such a tiny little place has such a beautiful variety of people? People, that speak many languages and have all levels of education, The Green Bank Observatory is how. I grew up with NRAO. My grandfather and father were both engineers there. I have been blessed to be part of all the NRAO facilities from Tucson to Green Bank. I know that it is no longer through NRAO, but the impact is no different. Every time I see that big ole GBT I feel privileged to live in a tiny place that is constantly searching all the bigness there is.</p> <p>The resources, partnership, and culture that the GBO offers in this place is priceless. Without the GBO this community will die. I know that is an age-old problem, communities die and we shrug our shoulders and say "oh well". Shoe factories close and move somewhere else, perhaps even out of country. Coalmines shut, things close down to save money to move elsewhere. Oh well, towns die, communities die,.oh well. We seem to live in a time where we shrug and say "oh well"..</p> <p>Yet shutting a place that studies, examines, searches and educates, well that feels wrong beyond measure. I don't say that just because I know what will happen here in our tiny little community. I say that because I have always felt so blessed to be part of a tiny little community that is doing big big things. We don't have an abundance of things in this world that are just doing things because it is furthering our knowledge and expanding our worldview it seems to me that preserving a place of curiosity and examination and true exploration is a noble thing to do. However, maybe being noble and true is something we can shrug off easily now too.</p> <p>The people that make up the observatory and the community that surrounds it, it is a special beautiful thing. I know that many others and I will not find it so easy to shrug off if they disappear. There will not be a chorus of "oh well's" it will be a chorus of a far more desperate and sadly whispered "Oh No's"...</p>	Against Closure	Email - Scanned	10/26/2016	
787		Edward	Wollack	Research Astrophysicist NASA/Goddard Space Flight Center	<p>Please find resubmission of comments below.</p> <p>Observation: The email address text provided reads "envcomp-AST-greenbank@nsf.gov". In my mail client if one directly copies or clicks the link in email the address is "envcomp-AST@nsf.gov". This "feature" could potentially reduce the number of successful comment submissions.</p>	General	Email - Scanned	10/26/2016	
788		Edward	Wollack	Research Astrophysicist NASA/Goddard Space Flight Center	<p>The 100 meter Green Bank Telescope (GBT) represents a unique world class scientific asset. For example, the potential discovery space the MUSTANG2 camera has opened for the study the formation of galaxies and cosmic structures in the primordial Universe has high scientific merit and is of great interest to the community. In particular, this imaging system's mapping speed, sensitivity, and optical configuraiton allow efficient and precise surveys which could not be previously envisioned. Similarly recent NFS instrumentation efforts under the AST-ATI program, namely the 16-pixel Argus array and the VEGAS spectrometer, have opened the promise of high angular resolution wide-field mapping at 3mm. Considered from a multi-wavelength astrophysics perspective the GBT offers the sensitivity, control, and high resolution of an off-axis filled-aperture which is suitably matched for resolving cold cores within local star-forming regions as-well-as efficiently mapping X-ray and optically selected galaxy clusters for cosmology. These instrumentation attributes are unique and well posed to provide new and valued astrophysical insights.</p>	Against Closure	Email - Scanned	10/26/2016	
789		Mark	Devlin	Reese W. Flower Professor of Astronomy and Astrophysics	<p>I am writing to express my strong support for continued NSF support of science operations with the Green Bank Telescope.</p> <p>The GBT is a unique astronomical and educational resource. It is also essential for our high resolution observations of galaxy clusters in addition to a host of other science goals. We recently received a three year award to begin science observations with the MUSTANG 2 instrument on the GBT. It is slated to go up on the telescope in a few weeks. In addition to being fascinating objects on their own, understanding the complex internal structure of clusters could help to untangle the relationship between the mass of the cluster and the Sunyaev-Zel'dovich effect which limits our ability to obtain cosmology from cluster surveys.</p> <p>The amount of time for general observing proposals has already been reduced. A further reduction in NSF support of the GBT operations would have a major negative impact on our science. This is especially true for MUSTANG2 because our 3mm observations require the best observing conditions, so the number of nights we can use is limited. last year, scheduling our observations around the non-NSF supported observing was difficult. If things go more in the same direction, our observations could become impossibly to schedule.</p> <p>Of course, the above assumes that there will be some ongoing support for the GBT. I would consider decommissioning the Green Bank Observatory based on short term funding issues to be a tragedy that we would regret for many decades.</p> <p>Finally, I want to point out that the Green Bank Observatory has inspired thousands of young scientists. My very small example of this comes from bringing a van load of Penn undergrads to the Green Bank site this past summer. It was a fantastic experience that has inspired several of them to take up a career in astrophysics. Extending this to the large numbers of students who cycle through the observatory each year points to a very valuable tool for inspiring the next generation of STEM students.</p> <p>In summary, while the Green Bank site has been around for a while, it continues to produce ground breaking science that cannot be done any other way. I hope you can find a way to maintain this valuable resource.</p>	Against Closure	Email - Scanned	10/26/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
790		Matt	Hilton	Senior Lecturer, University of KwaZulu-Natal	<p>I'm writing to you to urge the NSF to continue to support science operations with the Green Bank Telescope, in particular with MUSTANG-2, which is a unique instrument with the potential to have a huge impact on galaxy cluster science.</p> <p>I am an astrophysicist who has spent most of my career studying the properties of galaxy clusters, using optical/IR, X-ray, and Sunyaev-Zel'dovich (SZ) observations. In particular, I have been involved in the search for SZ clusters with the Atacama Cosmology Telescope (ACT). Cosmological cluster surveys have had a high impact, and beyond the cosmological implications, there is much still to learn about the impact of cluster galaxies and AGN on the intracluster medium (ICM).</p> <p>Current SZ surveys, conducted by ACT, South Pole Telescope (SPT), and Planck, have been limited by their coarse resolution (1'-5'). To interpret the SZ signal, we must at the moment rely on the assumption of an average pressure profile for the cluster population, and assume that it does not change with redshift. Given the orders of magnitude change in AGN activity and star formation up to redshift 1, and the increased frequency of cluster mergers at high redshift, this seems unlikely. The unique combination of GBT and MUSTANG-2, which provides arc-second level resolution, promises to be game changing - for the first time, it will allow us to measure, in detail, how cluster pressure profiles change with redshift. This will tell us a lot about the processes that shape the ICM, such as feedback by AGN, merger shocks, and cold fronts, which can be interpreted in the context of hydrodynamical simulations.</p> <p>Without GBT and MUSTANG-2, it is hard to see how and when this science will be done. Current x-ray observatories lack the sensitivity to study the ICM at cluster outskirts (which the GBT is able to see) and are expensive, taking 100 ksec to study clusters at redshifts. Moreover, we will not see a significant advance on the Chandra until well into the next decade (the European-led ATHENA+ mission). GBT and MUSTANG-2 can do this science now - and will certainly have a huge impact on cosmological studies of clusters with both current (ACTPol, AdvancedACT, SPT-3G) and future (Simons Observatory, CMB-S4) mm-wavelength survey facilities.</p>	Against Closure	Email - Scanned	10/26/2016	
791		William "Skip"	Crilly, Jr.	Education & Public Outreach Volunteer Science Ambassador Green Bank Observatory	<p>My name is Skip Crilly. I am a recently retired executive of the wireless industry, and now an unpaid volunteer electrical engineer, working at the Green Bank Observatory. I primarily help with educational and telescope performance objectives, during the last two years.</p> <p>The Green Bank Observatory is a scientific and engineering center of excellence.</p> <p>It is extremely important that humans who seek scientific explanations, and have an interest in the future, fund the work of the outstanding Green Bank Observatory.</p>	Against Closure	Email - Scanned	10/25/2016	
792		Carolyn	Kender	Archaeologist, WV SHPO	<p>Automatic Reply: Thank you for contacting me. I am currently out of the office and will reply to your message when I get back on October 31, 2016. If you have questions regarding the status of a review for a Section 106 project and need immediate assistance, please contact Belinda Gray at (304) 558-0240 ext. 722 or via email at belinda.d.gray@wv.gov.</p>	General	Email - Scanned	10/25/2016	
793	a	Simon	Dicker	Department of Physics and Astronomy University of Pennsylvania	<p>A reduction in funding to this unique facility would result in the loss of an important telescope, one that is highly complementary to other instruments in the NSF's portfolio. (GBT) has contributed and continues to contribute to our understanding of many astronomical phenomena and has an active, diverse, and growing user base. A few examples that illustrate the breadth of the science enabled by the GBT include the study of solar system objects, the investigation of star formation, gravitational wave research, and the study of giant clusters of galaxies. Many of these fields are listed as priorities in the 2010 decal review and in the more recent 2016 review - "New Horizons, New Worlds". For many types of observations, such as the large scale mapping of low surface brightness features, the GBT is the only telescope able to collect the data needed on any reasonable timescale. Many more examples of projects made possible by the GBT are given in publications and white papers - for example arXiv:1610.02329v1. Letter: As a scientist who has built 90GHz instrumentation for the (GBT) and as someone who has worked with the people at the (GBO) for over 15 years I would like to bring to your attention the importance of this unique facility. To quote from the NSF's 2012 review, the GBT is the world's most sensitive single-dish telescope at wavelengths shorter than 10cm. Since this review was written significant investments have extended the GBT's range of operating frequencies to the 67-116 GHz spectral window. The good resolution and high surface brightness sensitivity of the GBT at these frequencies give it large scale mapping capabilities significantly better than any other telescope in this frequency range. This and other new abilities were not taken into account in the 2012 review yet even so, as the above quote shows, the review noted the GBT's high intellectual merit. A testament to the capabilities of the GBT can be seen in the oversubscription rate for time at both high and low frequencies. Proposals to use the GBT come from astronomers working on diverse topics from cosmology to planetary science. Many of these research projects, such as the study of gravitational waves and the formation of large scale structure, are listed as priorities in the 2010 decadal review and again in the 2016 review New worlds, New Horizons. I would like to take the opportunity to illustrate some of the cutting edge science made possible by the GBT. At the University of Pennsylvania we have started on a program to map at high resolution, a significant number of galaxy clusters. Using a pathfinder bolometer array on the GBT we were able to detect shocks inside several clusters. These shocks were too faint to be seen in X-ray observations and survey telescopes built to find clusters of galaxies using the Sunyaev Zel'dovich effect (SZE) do not have the resolution to detect them. Unresolved features are a major systematic that limits the ability of SZE surveys to constrain the large scale structure in the Universe. The GBT's combination of resolution and mapping speed will enable us to map all known clusters in the northern sky thus removing systematic limitations in cluster surveys with the added benefit of deepening our understanding of these interesting objects. The GBT with its new high frequency capabilities is the only instrument able to map these clusters at a high enough resolution and on a reasonable timescale (less than a few hours per cluster). The above example is just one of the many ways in which the GBT plays a vital role in astronomical research. More examples of how the GBT provides unique capabilities that complement other astronomical instruments include:</p> <ul style="list-style-type: none"> • The GBT is used by the NANOGrav Collaboration in its search for gravitational waves at nHz frequencies. • Large area surveys from the GBT can be used to identify rare sources for follow up with ALMA and JWST. • Spectroscopic measurements of molecules between 67-116 GHz can be used to study star formation. The GBT's 6"-10" resolution at these frequencies is well matched to mid and far- infrared telescopes such as Spitzer, SOFIA, and Herschel. In addition it provides critical short-spacing data for aperture synthesis. • The GBT is used as the receiving element for bi-static radar programs that study our solar system. <p>The loss, or even a reduction in the capabilities, of the GBT would have a detrimental effect across the astronomical community.</p>	Against Closure	Email - Scanned	10/25/2016	EIS_comment.pdf

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
793	b	Simon	Dicker	Department of Physics and Astronomy University of Pennsylvania	<p>Email: When considering future plans for the Green Bank Observatory I urge you to consider the growing importance of this facility to the astronomical community. However I also ask that you consider its importance to the training of the next generation of scientists, public outreach, STEM education, and to the local community that surrounds it.</p> <p>Letter: In closing, I would like to point out that as well as being a critical facility to scientists across the U.S and indeed the world, the Green bank Observatory is a great center for the training of the next generation of scientists, of public outreach, STEM education, and is an integral part of its local community. Reductions in funding put at risk the collaboration behind this great facility, a collaboration which will not easily be recreated, and whose loss would be a detriment to us all.</p>	Against Closure	Email - Scanned	10/25/2016	
794	a	James	Armbrust	Property owner in Pocahontas County, WV	<p>As requested on the Notice posted to the Federal Register: https://www.federalregister.gov/documents/2016/10/19/2016-25213/notice-of-intent-to-prepare-an-environmental-impact-statement-and-initiate-section-106-consultation I am writing you to support operations if changes can occur to the quiet zone to allow the community and surrounding communities to gain access to cellular services and high speed internet.</p>	Against Closure	Email - Scanned	10/25/2016	
794	b	James	Armbrust	Property owner in Pocahontas County, WV	<p>As you are aware, the facility is located in Pocahontas County, WV and is considered by the research and statistics to be a financially depressed area that is facing continued challenges both fiscally and socially by the limitations placed by the quiet zone. At this juncture, the people in the immediate county and surrounding counties must have access to cellular service and high speed internet to become competitive with the rest of the country and global commerce as well. Currently, the lack of proper cellular and high speed internet services is making this county fall further behind in its ability to progress in the future which will have downstream impacts on the Greenbank Observatory by loss of employee potential and of course the complete loss of very limited services from the community as it becomes harder and harder to compete and earn a living or come out of school prepared to work with technology in a global market.</p> <p>I believe that the Observatory is vital for scientific data and information sharing to further scientific endeavors, but at the same time technology is available to counteract the use of cellular and high speed internet services and this needs needs to be determined to move into the future to remain competitive with others that will no doubt have brought to market telescopes and other services that could make the Observatory obsolete quickly and decisively. Of course, it goes without saying that if that occurs it would have severe implications on the surrounding communities and there currently in no mitigation plan in place.</p> <p>The use of people, process and technology needs to occur in the area to revitalize and bring revenue and opportunities forth to the area.</p>	Alternatives Consideration	Email - Scanned	10/25/2016	
795		Deana	White		<p>Good evening! I left a voice mail earlier and then decided maybe it would be better to contact you via email. I had a few questions regarding the public comment period for the Green Bank Observatory Federal Register Notice of Intent to Prepare an EIS published October 19, 2016. I have listed them below for the ease of answering. Thank you so much for your time and consideration on this matter.</p> <ul style="list-style-type: none"> - Does the written public comment need to be received by or postmarked by November 19, 2016? - Is there an accepted or formal length of maximum time issued for each individual's verbal public comment at the public hearing meetings scheduled for November 9, 2016? -Is an actual signature required on written public comments submitted via email? Again thank you and have a good and safe evening! 	General	Email - Scanned	10/24/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
796	a	Kevin	Harrington		<p>Regarding the status of the Green Bank Telescope, and now Green Bank Observatory, I have many concerns with the future alternatives proposed. Before I voice my opinions I would like to start by acknowledging how the United States of America is in a painful time of dealing with current politics and the behavior of those with financial power (many of whom are also corrupt with their power and authority). It is the case, as evidence suggests it is. BUT, the primary saving grace, if you will, is the era changing science taking place across all disciplines, from the microcosm to the macrocosm, right here in the same country that has so many flaws. We need to cherish what is before our eyes that serves as a means to bring people together and change the current awareness of how the universe really appears. Science can do this through the cycle of research and education for everyone. Therefore the most important tools/instruments in any science, which have already been proven effective, must be sustained and developed. There are more than enough reasons to promote the Green Bank Telescope as the premiere telescope of its kind. The engineering feats of physical construction, as well as the success of being the pioneers in surface activated panels on a radio telescope to observe/track objects while simultaneously changing their surface shape according to thermal and gravitational deformations. As you may know, there is a white paper being developed by Senior Astronomer, F. J. Lockman and it is in its final stages of preparation (first draft can be viewed already on the archive).</p> <p>The separation from the NRAO seems to me a logical decision if we are to not take away funds, and so give proper funds appropriate to the fact that the GBT is still the leading telescope of its kind. It is so big that it must build a facility on its own accord, now the Green Bank Observatory, as the NRAO has invested in ALMA and the next generation VLA. It's simply too much for the NRAO to keep these three major telescopes functioning, as they all have outgrown the box, so to say. They are all contributing equally important science, which I repeat is a saving grace in today's time. To restore the natural state of the area rather than utilize this amazing telescope would be wasteful. Any additional funding that could potentially be granted to the GBO could even have an environmental stipulation on it, such that the success of the GBT as a premier educational and research instrument would lead to the responsibility of the GBO to contribute in some way to the sustainability of the environment--which it is already doing by providing educational resources to the public, for example. Also, being the competitive instrument of its kind, many private funds seek usage of the GBT--for instance in the Search for Extraterrestrial Intelligence--and this should be considered supplemental and always welcomed, rather than a competing source of funding from the point of view of the NSF who would be choosing why to justify giving money to the GBT. The NSF needs to cherish the GBT with all its heart because it is one of the driving factors in the interdisciplinary scientific world we live in, and which we in the US are contributing to internationally. In this light, the NSF needs to seriously consider how the state of the GBT, with its surface activators functioning efficiently only since 2010 and multiple new receivers/technology, is worthy of scientific respect, and is worthy of direct funding. On top of this, it should be allowed to receive private funding if the interest of the private funding party is to utilize this instrument to develop our understanding of the universe. Now is not the time to consider taking away any scientific momentum the GBT has. If anything, there has been a distorted shift in funding the military compared to the funding of honest scientific pursuits, and the tradition could possibly date back to when former President Nixon decided to cut NASA funding. The money is there in principle to build multiple GBT's, which would be quite the feat, so it should be possible to give the GBO the financial footing it needs to get its work done and more.</p>	Against Closure	Email - Scanned	10/25/2016	
796	b	Kevin	Harrington		<p>From here on I write from the point of view of someone who is a doctoral student .., who also benefited from the tradition of Green Bank (previously via the NRAO) in hosting summer students for research internships. I have had the unique opportunity of doing two summer internships in radio astronomy, at Arecibo Observatory in Puerto Rico, and last summer in Green Bank. I am now soon publishing the results that were obtained during my undergraduate thesis work as the PI of a GBT proposal to observe the most luminous galaxies and their star forming gas reservoirs, and I am the PI and co-I of two recently submitted proposals using multiple receivers on the GBT, of which the proposals will be evaluated within a month. This would lead to immediate observations at the beginning of my PhD career. The research atmosphere is always something to acclimate to in any situation of a career in science, and for young astronomers to experience the friendly atmosphere at Green Bank it is a vital model for what a positive research environment can/should be. Being in the midst of the radio free zone provides a life lesson in being able to work without something you normally think you need ... This level of maturity in looking at this situation from the point of view of someone who wants to succeed in work aids in future research endeavors where it is important to use one's resources wisely. I understand that many previous summer students from Green Bank have gone on to contribute to society in many ways, and on many scales in science--including a Nobel Prize in Physics. The opportunity to study radio astronomy quantitatively where radio astronomy has many of its origins serves as a huge source of inspiration which can lead other scientists, and young astronomers, to carry out their work most productively and creatively. While doing an internship at Green Bank is significant in an educational experience in and of itself, many of the research projects are of course publication worthy. Thus a student can feel confident in going on to shine in a community (i.e. astronomical or general scientific) as one who has directly contributed to the work published in a journal article. If this is done at the stage before graduating undergraduate, this can lead to advantages for that student to be accepted into competitive graduate schools where this knowledge and research experience will be refined. The opportunity of having a summer research experience with world class faculty and staff also ensures that the student will have a better direction in their careers, and will be a safe alternative to changing fields without having had any experience of the initial field. The benefits of the internship at Green Bank also included personal experiences of education styles, where during the summer there are many scientific talks presented, as well as ""layperson"" talks to the amateur astronomers who come to stargazing parties offered on site at Green Bank. And by doing a research internship at Green Bank, one can in principle experience the propagation of education by observing or contributing to the scientific activities offered to elementary/middle/high-school aged students of varying socioeconomic backgrounds. While at Green Bank I learned first hand that the spectrum of astronomical fields probed with this single instrument (with many receivers of course) is amazing! From the moon to high-redshift galaxies to pulsars (important for gravitational wave astronomy!!). My undergraduate work for my Honors thesis included the study of high-redshift galaxies, and while a summer intern I submitted a proposal as the Principal Investigator, to use the GBT to study my galaxy sample and include these observations in my thesis work to complement the work that was already going to be published from the use of another telescope. To summarize this, with the GBT and its current functioning strategies as a premiere telescope in the professional scientific community, an undergraduate student can use this instrument to do cutting edge research if he/she can write a compelling proposal. This is a true benefit to the GBT as it applies to students' undergraduate Honors / Masters / PhD thesis. I was able to learn how to remote observe by going to GB and taking part in the remote observing school, and here I also grew a deeper level of appreciation for the experts working year-round at the GBT to make this a functioning research facility to support the motivated students up through the hierarchy of a professional career in astronomy in a non-judgmental fashion The GBT would thrive if the funding would cover the costs to sustain the operations of the telescope proposals submitted for proper research, and if the educational aspect is highlighted and developed towards undergraduate and graduate students so that these populations are given access to this world-class telescope amidst the resources of the scientific staff and the experts supporting these students(i.e. the professional community, professors, etc.). This does not take away from the science that can be done educationally at levels below undergraduate as the GB site has of course other functioning radio telescopes, such as the 140 ft telescope. This is currently being implemented and I was impressed by the integrity of the facility when I was a summer student last year.</p>	Against Closure	Email - Scanned	10/25/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
797	a	E. Gordon	Gee	President, West Virginia University	Thank you for the opportunity to register [WVU's] unwavering support for the continued operations of the (GBO) and concerns about the devastating impact that its closure would have upon the University's renowned radio astronomy program and the Green Bank community at large. Because of the GBO, [WVU] has been able to build from the ground up world- class astrophysics research and teaching program. Just over ten years ago, [WVU] was home to one astronomer. Today, [WVU] is home to seven astronomers, 20 graduate students, and 8 post docs, with over 6000 undergraduates having completed the introductory course in Astronomy since 2001. Last year, [WVU] faculty and students conducted a total of 2,700 research hours on the (GBT). In the past decade, university and faculty have produced 56 GBT-related publications, with 19 of those published in the last year alone. And, as described in more detail below, West Virginia University faculty and students across campus have been successful in securing a multitude of competitive research awards from the (NSF) and other agencies that entail the use or enhancement of the GBO. There is no question that the GBO has served as a magnet in attracting high caliber faculty and students around the globe to West Virginia University. Without the Green Bank Observatory, the incredible contributions that West Virginia University has made in radio astronomy, training the next generation of scientists, as well as STEM education, would come to an abrupt halt. As West Virginia's flagship, land-grant institution, West Virginia University's responsibility is to be an all-in partner when it comes to the GBO's future viability. When the Astronomy Portfolio Review Committee made its 2012 recommendation that NSF divest in the [GBO], West Virginia University immediately stepped up to the plate. The University entered into a Memorandum of Understanding (MOU) with the National Radio Astronomy Observatory (NRAO) to procure dedicated research time on the Green Bank Telescope - an agreement that continues to be in place to date. [WVU's] efforts to use and safeguard the GBO go well beyond the MOU. Over the past six years, the University has been successful in identifying opportunities to more fully utilize and strengthen the capabilities of the GBO as outlined below: • In 2010, [WVU] , working with universities and organizations around the world, received a \$6.5 million NSF Partnerships for International Research and Education program to detect gravitational waves, a key prediction of Einstein's theory of general relativity. • In 2013, [WVU], in collaboration with Brigham Young University, was awarded a \$500,000 NSF grant to build a new detector for the Green Bank Telescope that will allow the universities to map regions of the sky three to five time faster. • In 2014, [WVU] and the NRAO inaugurated a new \$8 million super high-speed broadband data network to bolster collaboration and scientific research between our organizations -- the new system is more than 200 times faster than the previous link. • In 2015, the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), of which West Virginia University is a lead member, was awarded a \$14.5 million NSF Physics Frontier Center grant to use radio timing of pulsars monitored by the GBT to detect and study gravitational waves. • Also in 2015, the State of West Virginia was awarded a \$20 million NSF Experimental Program to Stimulate Competitive Research, of which about \$9.65 million is devoted to building both physical and personnel infrastructure to allow [WVU] and other researchers in the state to enhance their ability to detect and characterize gravitational waves. • In January 2016, the West Virginia University was awarded \$364,000 by the NSF to create a three-dimensional map that will provide insight into star formation in the galaxy. • In September 2016, Associated Universities secured \$300,000 in NSF funding to undertake the FIRST TWO project, an initiative in collaboration with West Virginia University and a number of West Virginia education stakeholders to increase the STEM degree completion rate of first generation college students in [WV] with emphasis on the first two years of college. • And, for the past nine years, through NSF funding, [WVU] and the GBO have introduced thousands of high school students to the wonders of science through the (PSC) outreach program. Since its inception, WVU and GBO personnel have trained over 2000 high school students in 20 states to search for pulsars using the radio astronomy data from the GBO. The PSC allows students from all backgrounds to make personal connections with the frontiers of space and make scientific discoveries that they never thought possible such as identifying new pulsars.	Against Closure	Email - Scanned	11/22/2016	Pres. Gee GBO FINAL.pdf
797	b	E. Gordon	Gee	President, West Virginia University	West Virginia University also shares the concerns of many in the Green Bank community about the extreme economic hardships the region would face if GBO were to be closed or mothballed. The estimated annual economic impact of the Green Bank Observatory to our state is approximately \$30 million. Rightly so, the community is grappling with how it could attract an entity that would offer a comparable level of economic impact and community engagement given that most enterprises would find operating in a National Radio Quiet Zone (NRQZ) extremely challenging in today's age of connectivity. As a case in point, just fifty miles away and also located in the NRQZ, the National Security Agency recently closed the lower base of the Navy Information Operations Command at Sugar Grove, an operation that once supported approximately 330 personnel. Unfortunately, a new tenant for the Sugar Grove lower base has still yet to be identified, leaving Pendleton County's economic recovery in question. The people of this region have given up their ability to connect with the world for the operations of the GBT and Sugar Grove for more than a half century. The economy of West Virginia is in a fragile state. It would be huge disservice for the federal government to abandon yet another quality high technology operation in a remote part of West Virginia that has few options in attracting new enterprises.	Against Closure	Email - Scanned	11/22/2016	Pres. Gee GBO FINAL.pdf
797	c	E. Gordon	Gee	President, West Virginia University	While West Virginia University is contributing to the operations of GBO and pursuing research that relies on GBO, it is my hope that the NSF is continuing to aggressively seek out additional partnerships that may be necessary to fully maintain GBO during this EIS process. To supplement NSF's efforts, the University is engaged in seeking out new partnerships and research collaborations. As NSF Astronomy Division staff are aware, West Virginia University personnel accompanied Department of Defense (DOD) and NSF officials to the GBO to explore its potential as a test and evaluation site for a new DOD initiative. On the industry side, West Virginia University has had preliminary discussions with a major space corporation about its potential radio telescope needs for its future space expeditions and has facilitated an introduction with the GBO Director for more detailed conversations. Let me assure you that the University will continue to investigate any and all leads that might result in new opportunities at the GBO, and, again, hopes that NSF will not let up in its pursuits.	Alternatives Consideration	Email - Scanned	11/22/2016	Pres. Gee GBO FINAL.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
798	a	Eugene	Cilento	Dean, and Professor of Chemical and Biomedical Engineering	<p>As dean of the Statler College of Engineering and Mineral Resources, I am writing in support of maintaining the Green Bank Telescope (GBT) located in West Virginia. This unique radio telescope is of critical importance to the scientific community as well as the State of West Virginia. The science being done at Green Bank is at the cutting-edge of our scientific knowledge, and is playing an important role in both astrophysics research and education.</p> <p>It is the largest fully steerable structure on Earth. As such, this radio telescope is used to detect faint signals from celestial sources. The GBT is one of the newest telescopes built by the National Science Foundation. Cutting edge astronomy is being done there currently, including making ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity and gravitational waves, and the search for life beyond Earth. This facility is located in an area of West Virginia that is conducive to this type of research; one where the residents sacrifice many modern conveniences (e.g., cell phones) to support the research.</p> <p>There is other broad based support for maintaining the GBT. For example, Yuri Milner, a Russian billionaire made a very significant announcement with Stephen Hawking. He pledged \$100 million to the University of California at Berkeley to search for alien life. This is an incredible private investment in science, and all the telescopes at Green Bank comprise one of only two facilities worldwide that can be used to search for such long range communications. These facilities are in great demand prompting the case for monetary resources such as this Milner gift to help researchers gain access more than a day or so each year.</p> <p>It is shortsighted and unrealistic to consider such options as deconstruction or otherwise idling this unique facility. In fact, instead of discussing these options, we should elevate the Greenbank Observatory as a major national lab that is a national treasure and among the best facilities in the world for this type of fundamental scientific research so important for the advancement and development of new technology.</p>	Against Closure	Email - Scanned	11/9/2016	Letter of suport for Green Bank - Statler College.pdf
798	b	Eugene	Cilento	Dean, and Professor of Chemical and Biomedical Engineering	<p>The GBT and facilities are excellent at detecting fast radio bursts which enable researchers to study pulsars. In fact, recently high school students from the Pulsar Search Collaboratory discovered six new pulsars. The students had a once in a lifetime experience and were even given the opportunity to explain their pulsar research to President Obama at the White House. Imagine the sense of pride and accomplishment these high school students felt to discuss the amazing discovery they made! And, their experience was recently featured in an award winning documentary called "Little Green Men" (http://lgmfilm.com).</p> <p>A faculty member who directed a summer Science Academy for high school students for fifteen years commented at a ceremony that if he had access to such an amazing scientific resource he could have kept nearly all the students as STEM majors and the ones who did not would have been fans of science for life. Keep in mind that over 3,500 students get a chance to use the GBT facilities, so this is good for STEM education in the U. S.</p>	Against Closure	Email - Scanned	11/9/2016	Letter of suport for Green Bank - Statler College.pdf
798	c	Eugene	Cilento	Dean, and Professor of Chemical and Biomedical Engineering	<p>The Green Bank Observatory welcomes over 50,000 visitors to experience this facility annually. The use of this facility for science also has huge economic impact for the State of West Virginia and region. This is critical for a State in serious need of economic development.</p> <p>In summary, the Green Bank Observatory provides opportunity that changes lives and demonstrates the best America has to offer. This facility is contributing to innovation, economic prosperity, and is a serious tool available to scientist worldwide. It promotes community and excites young men and women to pursue science careers. As a College we urge the NSF to at least continue the current level of support for the research and education being done at the Green Bank Observatory. This is truly a unique facility that has much to offer the country in remaining a competitive world leader in science and technology.</p>	Against Closure	Email - Scanned	11/9/2016	Letter of suport for Green Bank - Statler College.pdf
799		Gay	Stewart	Director, WVU Center for Excellence in STEM Education Professor of Physics and Eberly Professor of STEM Education, West Virginia University	<p>In 2014, I made what was frankly a dramatic change in my career to come to West Virginia and be part of turning a state around in terms of STEM education. I felt this was a state that needed such change, and could provide a national model for doing so. The educational and economic indicators in the state may lead one to doubt such a thing was possible, but The Pulsar Search Collaboratory (PSC) through WVU and the Green Bank Observatory was one of the features that led me to believe this could be done. Just last year, this program has been extended through an AISL program to reach more students.</p> <p>Roughly 2,100 students have been a part of the PSC. In a state with the lowest college degree rate for those under 25 years of age, PSC students intend to major in STEM fields: 99% are either in college or plan to go to college, and 68% intend to receive an advanced STEM degree (doctorate (45%), master's (17%), medical school (6%)) and 62% report good to great increases in STEM career awareness. Approximately 50% of these participants are female or underrepresented minority students. Green Bank Observatory has since my arrival been central to other initiatives in STEM Education. They are the lead organization in our successful NSF INCLUDES grant, Improving STEM Persistence in the First Two Years of College. West Virginia lies completely within Appalachia, an area of great rural poverty. West Virginia's college-going rate is low, STEM course taking in high school is even lower. The efforts of these programs, which rely on the robust research being carried out at Green Bank Observatory for their vitality, is moving the needle for these young people. The impact is far reaching: Imagine breaking the cycle of poverty for the families and communities of these young people! So many Appalachian students have no exposure to STEM careers outside of the mineral extraction industries, which are in a downward spiral. We are working hard to grow a generation of highly qualified mathematics and science teachers for Appalachian public schools, but the need is great, and will not be satisfied in just a short time. Green Bank Observatory serves as a nucleus for efforts to build the STEM pipeline in Appalachia. This is key to our future educational goals, and thus to prepare the future STEM workforce.</p> <p>If I can provide you with any further information, please feel free to contact me at (304) 293-5032 (direct line), (479) 445-2402 (cell) or gbstewart@mail.wvu.edu.</p>	Against Closure	Email - Scanned	11/7/2016	Gay Stewart GBT Final.pdf

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800		Laura	Gibson	Senior Associate Vice President for Research and Graduation Education Associate Dean for Research; School of Medicine Alexander B. Osborn Distinguished Professor	As the Senior Associate Vice President for Health Sciences Research and Graduate Education at West Virginia University ' s Health Sciences Center (HSC), and most importantly, as a native West Vir ginian, I am writing to express my strong support for the Green Bank Observatory (GBO). My role at WVU HSC and growing up in West Virginia has given me a unique perspective of the importance of the novel physical and personnel infrastructure that exists at GBO. It serves as a beacon of scientific exposure, investigation, and discovery for young citizens in the state and region. West Virginia is known for being " wild and wonderful" with a robust history that emphasizes our pride and tenacity. Though our culture and nature prove rich and abounding, having diverse educational opportunities can be challenging. Despite our commitment to education, regional resources that provide formative educational experiences to someone in a more urban area are simply not the same in West Virginia. It is in this way that many West Virginians depend upon the existence of GBO. From a young age, West Virginia students across the state have the opportunity to begin learning about the unique scientific treasure that is GBO. A student' s first chance to see the Green Bank Telescope and experience the GBO Science Center leaves quite an impression of awe and wonder. In these first encounters, either in the classroom or at Green Bank, students begin to develop a sense of quite how big the world is, how big space is, and how much there is still left to be discovered. Not every student who le arns about or visits Green Bank has a direct affinity for astronomy, space, or pulsars, but make no mistake the GBO does provide a formative connection to the spirit of inquiry and learning that is the foundation of much of the STEM disciplines. A student may take a field trip to GBO a few times for science class during the academic year, but they may return independently any number of times for events like science camps focusing on astronomy, engineering, or coding; guest speakers; or even community events. GBO couples its status as home to world-class scientific instruments with its ability to be a community, state, and regional resource to ultimately serve as a catalyst for science and STEM education. There are numerous stories of students that continued their education in the STEM disciplines after their experiences at GBO. These very same students have become engineers, physicists, astrophysicists, professors, computer scientists, to name a few. Their careers may have been notably different had they not had the chance to experience STEM in action at Green Bank. In an area where opportunities are critical and in a state where investments can provide hope and a better future, the National Science Foundation's continued operation of the Green Bank Observatory significantly impacts the future prospects of many children in our state. The National Science Foundation has noted its commitment to promoting science while advancing prosperity, healthcare, and national defense all in pursuit of transfonning the future. I say that in few other places can continuing investment allow NSF to so directly address their mission - promoting science and advancing prosperity and healthcare - as it can at Green Bank Observatory. Providing students, both young and old, the chance to know and study STEM fields promotes science. Exposing students to STEM creates additional educational and career possibilities, which advances prosperity. And, as we know, educated, employed, and prosperous adults attain personal and familial health that can spread throughout communities. In summary, the Green Bank Observatory is not only a point of pride for West Virginia, it is also an integral part of science, technology, engineering, and math education and exposure in the state. In a state that faces uncertain economic futures and challenges of rural America, the Green Bank Observatory is, and I hope will continue to be, a vital tool in spurring educational, social, and economic opportunities for all students in West Virginia, the region, and the Nation. In this way, I reiterate my strong support for the continued existence and operation of Green Bank Observatory in West Virginia.	Against Closure	Email - Scanned	11/21/2016	
801	a	Debbie	Ervine		When I heard about the proposed changes to the Green Bank Observatory, my first thoughts, of course, are on the impact to our community. If we lost the observatory, our community would be devastated!!! We have a very unique & wonderful community here in the Green Bank area. The observatory is the center of our community. If the center is gone, the rest will fall apart. The employees at the observatory contribute to our fire & rescue departments, churches, local radio station, schools, and other organizations in our community. Without the help from the GBO and the GBO employees, most of these organizations would no longer exist in our community. What would our community do???? I think about the doctor's offices, dentist office & hospital. These could very easily have to close without the GBO in our community.	Against Closure	Email - Scanned	11/21/2016	Debbie Ervine.pdf
801	b	Debbie	Ervine		Economically & financially, the observatory contributes a tremendous amount of money into our community, county & state. I have lived in the Green Bank area for all of my life. I am the branch manager of the bank that is across the street from the observatory. My husband owns Trent's Store in Arbovale. Both of these businesses, along with other businesses in Pocahontas County, depend heavily on the observatory. I can't even begin to think what would happen if the observatory were to close.	Against Closure	Email - Scanned	11/21/2016	Debbie Ervine.pdf
801	c	Debbie	Ervine		The GBO contributes greatly to the education of the students in our county, state & nation. When I went to the meeting that was held on November 9 at GBO, I was so amazed at what the students & professors from WVU had to say about how the GBO had impacted their lives. The GBO has made a difference in our community, county, state, nation & world!!!!!! It would be a tremendous loss to lose this facility!!! I strongly believe that option number 1, which is the No---Action Alternative, is the absolute best option for everyone concerned. If you have any questions about anything I have said in this letter, please feel free to contact me.	Against Closure	Email - Scanned	11/21/2016	Debbie Ervine.pdf

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802	a	R. Gregory	Dunaway	Dean, Eberly College of Arts and Sciences	<p>I am the Dean of the Eberly College of Arts and Sciences, the largest college at West Virginia University (WVU) in Morgantown, West Virginia. WVU was founded in 1867, and is the flagship land-grant, doctoral degree-granting research university in West Virginia. Today, WVU consists of 15 colleges and schools offering 185 bachelors, masters, doctoral, and professional degree programs to approximately 30,000 students, and as the only West Virginia institution classified by the Carnegie Foundation as doctoral granting, Research High, the university occupies a unique position within the state.</p> <p>I am writing this letter in response to the National Science Foundation (NSF) invitation for public comment on the preliminary proposed alternatives and resource areas identified for analysis for proposed changes to the Green Bank Observatory Operations, in Green Bank, West Virginia. I would implore you to continue investment of the Green Bank Observatory for science-focused operations and collaboration with interested parties for science and education focused operations.</p> <p>As our nation becomes increasingly dependent on technology, there is a critical need for skilled workers with backgrounds in science, technology, engineering, and mathematics fields. The Green Bank Observatory is of critical importance to the scientific and education community in West Virginia, the United States, and the world. Since 2006, WVU has been awarded \$14.5 million, including \$4.7 million to support a Physics Frontier Center, for Green Bank Observatory related research. WVU faculty, postdocs, and students were competitively awarded over 2,300 hours of Green Bank Telescope time, which resulted in 19 publications in 2016 alone.</p> <p>Further, the education programs of the Green Bank Observatory are impacting countless children across a state that is in desperate need of scientific role models. Specifically, over 2,100 high-school students have participated in the NSF funded collaboration between the National Radio Observatory and WVU, titled the Pulsar Search Collaborative, of those students, 99% are either attending college or plan to attend college, and 68% intend to pursue post-secondary education. Approximately 50% of those students are underrepresented minorities.</p>	Against Closure	Email - Scanned	11/18/2016	Dean Dunaway GBO Letter FINAL.pdf
802	b	R. Gregory	Dunaway	Dean, Eberly College of Arts and Sciences	<p>The observatory has been instrumental in recent astronomy discoveries, such as work on the direct detection of gravitational waves, and because of its location in the National Radio Quiet Zone, it is the only instrument capable of continuing research at redshifts to constrain the expansion rate of the Universe and the nature of Dark Energy. These are just a few examples of the work that would be difficult or impossible to make with any other telescope.</p> <p>In short, the Green Bank Observatory partnerships advance discovery and understanding while promoting teaching, training, and learning to underrepresented groups, while also enhancing the infrastructure for research, education, and economic development. It is for these reasons that I strongly encourage continued NSF investment for science-focused operations at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/18/2016	Dean Dunaway GBO Letter FINAL.pdf
803		Gypsy	Denzine	Dean, College of Education and Human Services	<p>It is with great enthusiasm I submit my letter of support for continued funding for the National Radio Astronomy Observatory (NRAO) in Green Bank, West Virginia. I have personally visited the Green Bank Telescope and the Green Bank Science Center, so I can speak to the high quality educational outreach programs at the site. For example, the telescope tours motivate children to learn about radio waves and observe fundamental chemistry and physics. Moreover, local science teachers in Pocahontas County are able to use the Green Bank Telescope as a teaching tool for units in star formation, cosmic chemistry, and the origins of life. The RFI-restricted Zone provides a terrific learning opportunity for students in Pocahontas and nearby counties. One of the many strengths of the Green Bank Science Center is that telescope tours are offered year round.</p> <p>While many of the educational outreach programs are free, the programs that charge a fee do so at a very low cost. For example, Star Lab Fridays only cost participants \$3 per person. This is important because the most recent United States Census Bureau shows the median household incomes in 2014 in Pocahontas County was \$34,761 and the poverty rate was \$17.6%. Thus, having affordable after-school and summer enrichment programs is imperative for families living in Pocahontas County. The fact that the telescope tour is free for children under the age of 10 is perhaps the best educational outreach program in the state of West Virginia. I note, the NRAO has been a very good educational partner. For example, NRAO recently provided space for the Regional Math Field Day that was comprised of children, families, and teachers from 6 West Virginia Counties.</p> <p>We are very excited about the potential for future collaborations with the NRAO due to the opening of the WVU Tech campus in Beckley, WV. In fall 2016, the WVU Tech campus was moved from Montgomery, WV to Beckley, WV. The Green Bank Telescope is located 119 miles from Beckley, WV. The proximity of the Green Bank Telescope to our regional WVU campus will allow us to consider more outreach activities for students, families, and teachers. West Virginia University is also heavily engaged in The Summit Bechtel Reserve (http://www.summitbsa.org/), which is located 132 miles from the Green Bank Telescope. We anticipate many collaborative projects between WVU Tech, The Summit Bechtel Reserve, and the National Radio Astronomy Observatory. For example, when The Summit hosts the 2017 National Scout Jamboree, we know that thousands of visitors will come to WV in July 2017. The planning team for the Jamboree have developed tourism guides for scouts and families that includes visiting the Green Bank Telescope.</p> <p>In conclusion, the NRAO and Green Bank Science Center are an educational and tourist gem in a beautiful, but economically stressed, part of West Virginia. The Green Bank Telescope is to WV what the Statue of Liberty is to New York. The Telescope is recognizable, children find it "awesome", and it puts West Virginia on the map for STEM education and innovation.</p>	Against Closure	Email - Scanned	UNK	Dean Denzine GBO Letter FINAL.pdf
804		Traves	Lewis		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBT_Traves Lewis.pdf
805		Emily	Rimm		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Emily Rimm.pdf
806		Jesse	Johnson		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Jesse Johnson.pdf
807		Gabe	Arnold		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Gabe Arnold.pdf
808		Caitlin	Mallow		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Caitlin Mallow.pdf

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809		Michael Connor	Kane Taylor		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Michael Kane and Connor Taylor.pdf
810		Dave	Huber	Director of Program Operations	<p>NROCKS Outdoor Adventures, along with our parent company Endless Horizons, are very interested in the continual operation of the Greenbank Observatory(GBO). For over 30 years, Endless Horizons has focused on creating lifelong learning and growth opportunities for our Nation's youth through our operation of Summer Camps, Outdoor Learning Centers and Job Corp Centers in both Virginia and West Virginia.</p> <p>Throughout our endeavors, we continue to invest in our local region and its people. NROCKS Outdoor Adventures, located in Circleville WV, is an extension of this work. Since 2009 we have continued to invest and expand within Pendleton County. We would not be as successful without our regional partners such as the GBO. It is the combination of attractions and activities in our region that have set us apart as a destination experience. Without such a key player as the GBO, we will all certainly feel the consequences. Beyond the scientific significance of this site and the economic impact to the region, a closure of this facility would result in a negative impact on WV's educational system.</p> <p>As we have reviewed the various alternative uses, we believe the only two options that are viable are continued funding at the current level, or Option 2 – collaboration with interested parties and only a slightly reduced rate of funding from the National Science Foundation.</p> <p>We support the continued operation of the GBO and look forward to a successful resolution to maintain the current level of operations.</p>	Against Closure	Email- scanned and Letter - mailed	11/14/2016	Dave Huber.pdf
811		Multiple	Multiple (See list of names in body of comment)	4-H Kanawha County WVU extension	<p>Over 50,000 visitors and 3500 students visit Green Bank a year. We the Plane Janes GWC at 4-H Kanawha County WVU extension visited Green Bank. The level of education program and the staff dedication was superb. We were able to do scientific research.</p> <p>Best regards, Isabel Bombandiere, GWC Facilitation, Jeannette A. Bombandiere, Radnel Coffield, Farah Kisto, Kayla Lucas, Arwa Sidding, Aya Hasino, Hannah Mullins, Sherry Suint, Grace Mullins, Ari Swint, and Askya Patterson</p>	Against Closure	Letter - mailed	UNK	
812	a	MG James	Hoyer	Major General, WVARNG The Adjutant General	<p>I would ask that the National Science Foundation continue their financial support for the Green Bank Observatory. The Observatory has made discoveries in scientific knowledge which have led in extraordinary advancements in understanding our universe. The present telescope began regular science operation in 2001 and is now used for astronomy about 6500 hours every year and 2000-3000 hours per year going to high-frequency science. Its flexibility and ease of use allows for rapid response to new scientific ideas.</p> <p>I ask that you continue funding the Green Bank Observatory so it continues to remain on the cutting edge of astronomy, can still make discoveries in quantum mechanics, the study of gravity and in the search for life beyond Earth.</p>	Against Closure	Letter - mailed	11/15/2016	
812	b	MG James	Hoyer	Major General, WVARNG The Adjutant General	The Green Bank Observatory affects the careers of over 900 astronomers and brings in an estimated \$30M annually in economic benefits to Pocahontas County in West Virginia.	Against Closure	Letter - mailed	11/15/2016	
813		Jill	Molin		Continuation of Green Bank Observatory in West Virginia is vital not only for its services but for survival of the whole area. It carries the community and surrounding space completely, from jobs to schools and all industry. Please don't let an entire area be wiped out!!!	Against Closure	Letter - mailed	11/6/2016	
814	a	Kay	Goodwin	Cabinet Secretary	I am writing to urge continued funding of the Green Bank Observatory by the National Science Foundation. Since its inception in 2001, this exceptional facility put West Virginia at the forefront of international, collaborative, cutting-edge research. The Green Bank telescope is one of the National Science Foundation's newest large telescopes and remains the vanguard of astronomy, making groundbreaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond our planet. The research conducted at Green Bank could transform our understanding of our vast universe.	Against Closure	Letter - mailed	11/12/2016	
814	b	Kay	Goodwin	Cabinet Secretary	In addition to its significance in the global community of science and research, The Green Bank Observatory serves as a powerful tool to improve STEM education in West Virginia. Students visiting the facility have the opportunity to participate in the Pulsar Search Collaboratory using data collected by radio telescopes at the facility allowing them to gain important scientific and mathematical skills as a result. Just last year, more than fifty-four groups spent at least one night at Green Bank using the forty foot telescope and taking part in the facility's unique STEM education programs. In addition, fourteen different week-long residential educational workshops were held at Green Bank last year along with four groups comprising West Virginia science teachers, high school students, college students, and the general public. Citizens travel from all across West Virginia, the nation and the world to learn at the Green Bank Observatory. Collaborative projects with the observatory allow West Virginia's students to gain hands-on experiences while also making real contributions to the scientific community through their classwork and projects completed during site visits. Clearly, the Green Bank Observatory has a profound impact on West Virginia students and STEM education.	Against Closure	Letter - mailed	11/12/2016	
814	c	Kay	Goodwin	Cabinet Secretary	The Green Bank Observatory is a source of pride for all West Virginians. The facility attracts more than 50,000 curious visitors each year which generates a good measure of economic development opportunities, as well as igniting positive impressions of our state.	Against Closure	Letter - mailed	11/12/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
815		Sue	Howard	Community Member	<p>There is a relatively large community of people who have been injured by wireless radiation and who have sought refuge in the Green Bank area. These people suffer from a very real and debilitating medical condition known as Electrohypersensitivity (EHS). This is also known as Radiowave sickness or Microwave Snyderome. I never ever thought this could happen to me, but it did. And now, I am here in Green Bank, trying to find a way to live in peace. Sadly, experts now say that due to the proliferation of wireless-everything in today's world, many more people will develop this devastating condition. And that as many as 3 to 5 percent of the world's population already has.</p> <p>After years of suffering, I am very grateful to have found a safe haven in the National Radio Quiet Zone, where I am able to live, sleep, work, and play without constant sickness and pain.</p> <p>I ask you, in a world now filled with overlapping, omnipresent radiofrequency and pulsed microwave technologies, where exactly do you think these people should go if the Green Bank Observatory were to close? For us, this is not about losing a job or having to move. This is about our very survival. If the GBO were to close, would the National Science Foundation help relocate us to another quiet zone? Is there another quiet zone?</p> <p>I would like to suggest that instead of decreased funding, why not increase funding and not miss out on this golden opportunity to study the effects of wireless radiation on human, animal, and plant biology? You could use the Green Bank residents as a control group, as wireless-free control groups are rapidly vanishing from our planet.</p> <p>The Green Bank Observatory, within the National Radio Quiet Zone, is a rare and precious place. It is a historic landmark and endangered species, if you will. Once it's gone, there is not getting it back. Industry would seep through like a tidal wave and people's lives would be devastated.</p> <p>I leave you to ponder this one final thought; what will you do when one of your loved ones, perhaps a child or grandchild, develop EHS? Will you sit them down and tell them the story of Green Bank? How once upon a time there was a magical little town...but it no longer exists...And I have something to do with that?</p> <p>Or maybe you won't have to. Maybe, with your help, this magical place will still be here as a safe haven for them as well.</p> <p>Thank you for your time and consideration on this most 'sensitive' matter.</p>	Against Closure	Letter - mailed	11/16/2016	
816		Dustin	Madison	NRAO Jansky Postdoctoral Fellow North American Nanohertz Observatory for Gravitational Waves	<p>I write you today to advocate for continuing scientific operations at the Green Bank Observatory (GBO) largely as is. The Robert C. Byrd Green Bank Telescope (GBT) is a singular and powerful scientific tool that is in the prime of its life. GBO provides opportunities to train young radio astronomers in observational techniques and facilitates the testing of innovative new radio astronomy hardware that is, frankly, more difficult or infeasible to do at interferometric facilities such as the Karl G. Jansky Very Large Array. The location, with its strict restrictions on radio transmitters, is becoming rarefied and sacred ground for radio astronomers. GBO provides crucial STEM education and outreach for Pocahontas County and the greater Appalachian Mountain community. Mothballing or dismantling the telescope would be tragic for the American astronomy community and Pocahontas County. Dramatically reducing the amount of open-skies time at GBO would also be detrimental to the astronomy community, not only because it would reduce scientists' access to what is arguably the best single-dish radio telescope in the world, but also because it would advance the unfortunate movement towards the privatization of science. It will be a sad day when the best scientific instruments in the world are completely co-opted by industrial/defense contractors or the whims of billionaires.</p> <p>In addition to the broad detriments of shuttering GBO that I just discussed, it would also directly hurt my career and would essentially doom my research collaboration. I received my PhD a year and a half ago having conducted research on how monitoring an array of millisecond pulsars over decadal time scales can lead to the direct detection of extremely low-frequency gravitational waves generated by the most massive black holes in the Universe. My collaboration, The North American Nanohertz Observatory for Gravitational Waves (NANOGrav) consists of over 100 scientists distributed over more than 30 institutions in the United States and Canada. We rely exclusively on data collected at GBO and Arecibo, which is currently up against comparable existential threat. Both telescopes are extremely important for our science. Arecibo is the most sensitive radio telescope in the world and provides us with much of our very best data, but since the GBT is itself incredibly sensitive and fully-steerable, it can see many more pulsars than Arecibo. GBO is, in my opinion, more critical for the success of our scientific mission and we need it for years to come. I will conclude with a story that has nothing to do with NANOGrav or the broader American radio astronomy community. This is entirely personal. I consider myself an astrophysicist, but I am much more a physicist than an astronomer. All of my degrees are in physics and much of my dissertation work was theoretical. As I began my postdoctoral fellowship at The National Radio Astronomy Observatory, I committed myself to advancing my abilities as an observational astronomer. This past summer I attended many conferences and heard many talks. I synthesized some of the information I learned into an original idea to look for a particular class of radio transients at the sites of short gamma-ray bursts. I developed a science case and submitted a proposal for 50 hours of GBT time in the first half of the coming year. I was recently awarded that time for which I am extremely happy and proud. However, a week after submitting that proposal, one of the closest short gamma-ray bursts ever observed occurred at a quite high northern latitude, a place in the sky for which the GBT is undoubtedly the best and most sensitive radio telescope in the world. I submitted a target-of-opportunity proposal to GBO. It was reviewed and accepted the next day. Shortly thereafter, I got 10 hours of GBT time yielding 2.5 terabytes of data. I am currently analyzing that data and cannot yet tell you if I have found what I sought to find. I can tell you that hours-long spans of the data are gorgeous, suffering from negligible amounts of well-understood radio-frequency interference. I can tell you that the staff at GBO were enormously responsive and helpful to this early-career scientist. I can tell you that this experience has made much more of an astronomer out of this physicist. It has been very professionally and personally fulfilling. I feel deeply that this has been a model for how science should be done. Please do all that you can to preserve GBO.</p>	Against Closure	Letter - mailed	11/18/2016	

Green Bank Observatory -Written NSF Public Scoping Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
817		Carol	Polan		<p>I have three young granddaughters who have not had the chance to explore the galaxy from Greenbank.</p> <p>All of my children had this chance, one is a doctor, one a surgical nurse and one a historian.</p> <p>To visualize science as my children did at an early age at Greenbank Observatory was magic. Science can happen in rural WV and must continue.</p> <p>The economic impact is just a shadow compared to the absence of technology in the unique manner the observatory gives not just W VA but the world S.T.E.M. is the new buzz in education, how dare The National Science Foundation remove our jewel.</p>	Against Closure	Letter - mailed	11/12/2016	

Appendix 5E

List of Research Papers

List of Research Papers

ALFALFA-U (Undergraduate ALFALFA Team). 2016. *The Arecibo Legacy Fast ALFA Survey*.
<http://egg.astro.cornell.edu/alfalfa/ugradteam/ugradteam.php>.

Antoniadis J., P.C. Freire, N. Wex, T.M. Tauris, R.S. Lynch, M.H. van Kerkwijk, M. Kramer, C. Bassa, V.S. Dhillon, T. Driebe, J.W. Hessels, V.M. Kaspi, V.I. Kondratiev, N. Langer, T.R. Marsh, M.A. McLaughlin, T.T. Pennucci, S.M. Ransom, I.H. Stairs, J. van Leeuwen, J.P. Verbiest, and D.G. Whelan. 2013. "A massive pulsar in a compact relativistic binary." *Science*. Vol. 340(6138):1288. June 14.

Archibald, Anne M., Ingrid H. Stairs, Scott M. Ransom, Victoria M. Kaspi, Vladislav I. Kondratiev, Duncan R. Lorimer, Maura A. McLaughlin, Jason Boyles, Jason W.T. Hessels, Ryan Lynch, Joeri van Leeuwen, Mallory S.E. Roberts, Frederick Jenet, David J. Champion, Rachel Rosen, Brad N. Barlow, Bart H. Dunlap, Ronald A. Remillard. 2009. "A Radio Pulsar/X-ray Binary Link." *Science*. Vol. 324. pp. 1411.

arlingtonva.us. N.D. *FY 2017 Proposed Budget*. Available online: <https://budget.arlingtonva.us/fy-2017-proposed-budget-2/>.

Bally, J., G. Blake, A. Bolatto, C. Casey, S. Church, J. di Francesco, P. Goldsmith, A. Goodman, A. Harris, J. Jackson, A. Leroy, F. Lockman, A. Lovell, A. Marscher, D. Marrone, B. Mason, T. Mroczkowski, Y. Shirley, and M. Yun. 2016. *The Case for a Publicly Available, Well-Instrumented GBT Operating at 20-115 GHz*. October 31. Available online: <https://arxiv.org/abs/1610.09014>.

Bevington, M. 2013. *Electromagnetic Sensitivity and Electromagnetic Hypersensitivity (also known as Asthenic Syndrome, EMF Intolerance Syndrome, Idiopathic Environmental Intolerance-EMF, Microwave Syndrome, Radio Wave Sickness): A Summary*. London: Capability Books, <http://www.es-uk.info>.

Breton, Rene P., Victoria M. Kaspi, Michael Kramer, Maura A. McLaughlin, Maxim Lyutikov, Scott M. Ransom, Ingrid H. Stairs, Robert D. Ferdman, Fernando Camilo, and Andrea Possenti. 2008. "Relativistic Spin Precession in the Double Pulsar." *Science*. Vol. 321. pp. 104. Available online: <http://science.sciencemag.org/content/321/5885/104>.

Callandrelli, Emily. 2016. "NSF may shut down West Virginia's Green Bank Telescope and people aren't happy." November 11. <https://techcrunch.com/2016/11/11/nsf-may-shut-down-west-virginias-green-bank-telescope-and-people-arent-happy/>.

Courtois, H el ene. 2016. Observations des grandes structures: Laniakea. Presented at the Conference of the French Academy of Sciences (Institut de France Acad emie des sciences). Video available online: <https://www.youtube.com/watch?v=1g3gD5-uP6A>. October.

Courtois, H el ene. 2016. *Voyage sur les flots de galaxies: Laniakea, notre nouvelle adresse dans l'Univers*. Published by: Dunod, 11 rue Paul Bert, 92240 Malakoff.

С р е д А (in Russian). 2016. <http://www.sreda1.org/>.

Chang T.C., U.L. Pen, K. Bandura, and J.B. Peterson. 2010. "An intensity map of hydrogen 21-cm emission at redshift z approximately 0.8." *Nature*. Vol. 466(7305). July 10. pp. 463-465.

"Collaboration for Astronomy Signal Processing and Electronics Research (CASPER)," last modified December 2016. Available at: <https://casper.berkeley.edu/>.

Crnojevic, D., D.J. Sand, D. Zaritsky, K. Spekkens, B. Willman, and J.R. Hargis. 2016. "Deep Imaging of Eridanus II and Its Lone Star Cluster." *Astrophysical Journal Letters*. 824(1):10.3847/2041-

80205/824/1/L14. Available online:

http://scholarship.haverford.edu/cgi/viewcontent.cgi?article=1432&context=astronomy_facpubs.

Davis, Marc, Adi Nusser, Karen L. Masters, Christopher Springob, John P. Huchra, and Gerard Lemson. 2011. "Local gravity versus local velocity: solutions for beta and non-linear bias." *Monthly Notices of the Royal Astronomical Society*. Vol. 413, Issue 4. June. pp. 2906–2922.

Demorest, P.B., T. Pennucci, S.M. Ransom, M.S.E. Roberts, and J.W.T. Hessels. 2010. "A two-solar-mass neutron star measured using Shapiro delay." *Nature*. Vol. 467. October 28. pp. 1081–1083. Available online: <http://www.nature.com/nature/journal/v467/n7319/full/nature09466.html>.

Eckert, Kathleen D., Sheila J. Kannappan, David V. Stark, Amanda J. Moffett, Andreas A. Berlind, and Mark A. Norris. 2016. "RESOLVE and ECO: The Halo Mass-dependent Shape of Galaxy Stellar and Baryonic Mass Functions." *The Astrophysical Journal*. Vol. 824, Issue 2. June. Available online: <https://arxiv.org/pdf/1604.03957v1.pdf>.

Eckert, Kathleen D., Sheila J. Kannappan, David V. Stark, Amanda J. Moffett, Mark A. Norris, Elaine M. Snyder, and Erik A. Hoversten. 2015. "RESOLVE Survey Photometry and Volume-limited Calibration of the Photometric Gas Fractions Technique." *The Astrophysical Journal*. Vol. 810, Issue 2. September. 26 pp. Available online: <https://arxiv.org/pdf/1507.08669v1.pdf>.

Federal Register. 2016. "Notice of Intent to Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia and Notice of Public Scoping Meetings and Comment Period." A Notice by the National Science Foundation on October 19, 2016. 81 FR 72124. pp. 72124-72125. Available online: <https://www.federalregister.gov/documents/2016/10/19/2016-25213/notice-of-intent-to-prepare-an-environmental-impact-statement-and-initiate-section-106-consultation>.

Green Bank Observatory. 2016. "16 Element 3mm FPA for the GBT." *Argus Observer's Web Page*. Last modified December 27 2016. Available online: <http://www.gb.nrao.edu/argus/>.

Hada, Kazuhiro, Motoki Kino, Akihiro Doi, Hiroshi Nagai, Mareki Honma, Kazunori Akiyama, Fumie Tazaki, Rocco Lico, Marcello Giroletti, and Gabriele Giovannini. 2015. *High-Sensitivity 86 GHz (3.5 mm) VLBI Observations of M87: Deep Imaging of the Jet Base at a Resolution of 10 Schwarzschild Radii*. Available online: <https://arxiv.org/pdf/1512.03783v1.pdf>. December.

Hada, Kazuhiro. 2016. *NRAO Media Tip Sheet: February 2016*. February. Available online: <https://public.nrao.edu/news/tip-sheets/2016-feb-tip-sheet>.

Ham Radio on the Net. "Green Bank Observatory in Danger of Closing. Amateur Radio Newslines Report 2037, Friday, November 11, 2016. <http://www.eham.net/articles/37975>.

Hessels, Jason W.T., Scott M. Ransom, Ingrid H. Stairs, Paulo C.C. Freire, Victoria M. Kaspi, and Fernando Camilo. 2006. "A Radio Pulsar Spinning at 716 Hz." *Science*. Vol. 311, Issue 1901. March 31. pp. 1901–1904.

Hong, Tao, Christopher M. Springob, Lister Staveley-Smith, Morag I. Scrimgeour, Karen L. Masters, Lucas M. Macri, Bärbel S. Koribalski, D. Heath Jones, and Tom H. Jarrett. 2014. "2MTF - IV. A bulk flow measurement of the local Universe." *Monthly Notices of the Royal Astronomical Society*. Vol. 445, Issue 1. November. pp. 402–413.

International Dark-Sky Association (IDA). 2015. *Dark Sky Reserve Program Guidelines*. October 22. Available online: http://darksky.org/wp-content/uploads/bsk-pdf-manager/IDSR_Guidelines_Oct2015_22.pdf.

International Dark-Sky Association (IDA). 2015. *3 Benefits of a Dark Sky Designation*. October 23. Available online: <http://darksky.org/3-benefits-of-a-dark-sky-designation/>.

Keeney, Daniel. 2016. *Let's Save the Green Bank Observatory*. November. Available online: <http://slatyfork.us/Save-Green-Bank-Observatory>.

Korngut, P.M., S.R. Dicker, E.D. Reese, B.S. Mason, M.J. Devlin, T. Mroczkowski, C.L. Sarazin, M. Sun, and J. Sievers. 2011. "MUSTANG high angular resolution Sunyaev-Zel'dovich effect imaging of substructure in four galaxy clusters." *The Astrophysical Journal*. Vol. 734.1. Available at: <http://adsabs.harvard.edu/abs/2011ApJ...734...10K>.

Kramer, M., I.H. Stairs, R.N. Manchester, M.A. McLaughlin, A.G. Lyne, R.D. Ferdman, M. Burgay, D.R. Lorimer, A. Possenti, N. D'Amico, J.M. Sarkissian, G.B. Hobbs, J.E. Reynolds, P.C.C. Freire, and F. Camilo. 2006. "Tests of General Relativity from Timing the Double Pulsar." *Science*. Vol. 314, Issue 5796. October 6. pp. 97-102.

Li, T.S., J.D. Simon, A. Drlica-Wagner, K. Bechtol, M.Y. Wang, J. Garcia-Bellido, J. Frieman, J.L. Marshall, D.J. James, L. Strigari, A.B. Pace, E. Balbinot, Y. Zhang, T.M.C. Abbott, S. Allam, A. Benoit-Levy, G.M. Bernstein, E. Bertin, D. Brooks, D.L. Burke, A. Carnero Rosell, M. Carrasco Kind, J. Carretero, C.E. Cunha, C.B. D'Andrea, L.N. da Costa, D.L. DePoy, S. Desai, H.T. Diehl, T.F. Eifler, B. Flaugher, D.A. Goldstein, D. Gruen, R.A. Gruendl, J. Gschwend, G. Gutierrez, E. Krause, K. Kuehn, H. Lin, M.A.G. Maia, M. March, F. Menanteau, R. Miquel, A.A. Plazas, A.K. Romer, E. Sanchez, B. Santiago, M. Schubnell, I. Sevilla-Noarbe, R.C. Smith, F. Sobreira, E. Suchyta, G. Tarle, D. Thomas, D.L. Tucker, A.R. Walker, R.H. Wechsler, B. Yanny. 2016. *Farthest Neighbor: The Distant Milky Way Satellite Eridanus II*. November 17. Available online: <https://arxiv.org/pdf/1611.05052.pdf>.

Lockman, Felix J., Ryan Lynch, and David T. Frayer (Green Bank Observatory); Brian D. Mason and Scott M. Ransom (National Radio Astronomy Observatory). 2016. *The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper*. October 7. Available online: <https://arxiv.org/pdf/1610.02329.pdf>.

Kaplan, Sarah. "We really need to figure out how to stop a killer asteroid, scientists say." *Washington Post*, November 18, 2016. https://www.washingtonpost.com/news/speaking-of-science/wp/2016/11/18/we-really-need-to-figure-out-how-to-stop-a-killer-asteroid-scientists-say/?utm_term=.04e8180a24a6&wpisrc=nl_rainbow&wpm=1.

Masters, Karen L. (ICG Portsmouth), Aidan Crook (Microsoft), Tao Hong (NAOC), T H. Jarrett (Cape Town), Baerbel S. Koribalski (CSIRO), Lucas Macri (Texas A&M), Christopher M. Springob (ICRAR), and Lister Staveley-Smith (ICRAR). 2014. *2MTF III. HI 21cm observations of 1194 spiral galaxies with the Green Bank Telescope*. June 23. Available online: <https://arxiv.org/abs/1406.5924>.

Masui, Kiyoshi, Hsiu-Hsien Lin, Jonathan Sievers, Christopher J. Anderson, Tzu-Ching Chang, Xuelei Chen, Apratim Ganguly, Miranda Jarvis, Cheng-Yu Kuo, Yi-Chao Li, Yu-Wei Liao, Maura McLaughlin, Ue-Li Pen, Jeffrey B. Peterson, Alexander Roman, Peter T. Timbie, Tabitha Voytek, and Jaswant K. Yadav. 2015. "Dense magnetized plasma associated with a fast radio burst." *Nature*. Vol. 528. December 24. pp. 523–525. Available online: <http://www.nature.com/nature/journal/v528/n7583/abs/nature15769.html>.

McGuire, Brett A., P. Brandon Carroll, Ryan A. Loomis, Ian A. Finneran, Philip R. Jewell, Anthony J. Remijan, and Geoffrey A. Blake. 2016. "Discovery of the interstellar chiral molecule propylene oxide (CH₃CHCH₂O)." *Science*. Vol. 352, Issue 6292. June 17. pp. 1449–1452.

Melis, Carl, Mark J. Reid, Amy J. Mioduszewski, John R. Stauffer, and Geoffrey C. Bower. 2014. "A VLBI resolution of the Pleiades distance controversy." *Science*. Vol. 345, Issue 6200. August 29. pp. 1029–1032.

Montet, Benjamin T. and Joshua D. Simon. 2016. *KIC 8462852 Faded Throughout the Kepler Mission*. October 1. Available online: <https://arxiv.org/abs/1608.01316>.

nasa.gov. 2012. *NASA-NOAA Satellite Reveals New Views of Earth at Night*. December. Available online: https://www.nasa.gov/mission_pages/NPP/news/earth-at-night.html.

National Academies Press. 2010. *New Worlds, New Horizons in Astronomy and Astrophysics*. Contributors: National Research Council; Division on Engineering and Physical Sciences; Board on Physics and Astronomy; Space Studies Board; Committee for a Decadal Survey of Astronomy and Astrophysics. Available at: <https://www.nap.edu/catalog/12951/new-worlds-new-horizons-in-astronomy-and-astrophysics>.

National Radio Astronomy Observatory (NRAO). 2012. *National Radio Astronomy Observatory Response to the 2012 NSF Portfolio Review Committee Report*. NRAO Doc. #: PRC-2012.08. September 23. Available online: https://science.nrao.edu/index.html/NRAO_Response_23Sep12.pdf.

National Radio Astronomy Observatory (NRAO). 2016. "Metrology and Control of Large Telescopes." September 19–24, 2016. Conference held at the Green Bank Observatory, WV. Information available at: <http://go.nrao.edu/metconf>.

National Radio Astronomy Observatory (NRAO). 2016. *Previous NRAO Summer Students*. Available online: <http://www.nrao.edu/php/students/archive/archive.php>.

National Radio Astronomy Observatory (NRAO). 2016. *Discoveries with the Green Bank Telescope*. Available online: https://science.nrao.edu/GBT_DiscoveriesV4.pdf.

National Radio Astronomy Observatory (NRAO). 2016. *The Megamaser Cosmology Project (MCP)*. Available online: <https://safe.nrao.edu/wiki/bin/view/Main/MegamaserCosmologyProject>.

National Radio Astronomy Observatory (NRAO). 2017. *MUSTANG-2*. Available online: <http://www.gb.nrao.edu/mustang/>.

National Science Foundation (NSF). 2016. *Grant Proposal Guide*. Document ID: NSF 16-1. January 25. Available online: https://www.nsf.gov/pubs/policydocs/pappguide/nsf16001/gpg_index.jsp.

National Science Foundation (NSF). N.D. "10 Big Ideas for Future NSF Investments." Available at: https://www.nsf.gov/about/congress/reports/nsf_big_ideas.pdf.

Nikolic, B., R.M. Prestage, D.S. Balsler, C.J. Chandler, and R.E. Hills. 2007. "Out-of-focus holography at the Green Bank Telescope." *Astronomy & Astrophysics*. Vol. 465.2. January. pp. 685-693. Available at: <https://www.mrao.cam.ac.uk/~bn204/publications/2006/OOFP2.pdf>.

Odekon, Mary Crone. 2015. "Harvesting ALFALFA." *Mercury*. Vol. 44, No. 3. Available online: <http://aparnavenkatesan1.wpengine.netdna-cdn.com/wp-content/uploads/sites/21/2014/06/Mercury.pdf>.

Papovich, Casey, Ivo Labbé, Karl Glazebrook, Ryan Quadri Georgios Bekiaris, Mark Dickinson, Steven Finkelstein, David Fisher, Hanae Inami, Rachael Livermore, Lee Spitler, Caroline Straatman, and Kim-Vy Tran. 2016. "Large Molecular Gas Reservoirs in Ancestors of Milky Way-Mass Galaxies 9 Billion Years Ago." *Nature*. October. Available online: <https://arxiv.org/pdf/1610.05313v1.pdf>.

Pineda, Jaime E., Alyssa A. Goodman, Héctor G. Arce, Paola Caselli, Jonathan B. Foster, Phillip C. Myers, and Erik W. Rosolowsky. 2010. "Direct Observation of a Sharp Transition to Coherence in Dense Cores." *The Astrophysical Journal Letters*. Vol. 712, Issue 1. February. pp. L116-L121. Available online: <https://arxiv.org/pdf/1002.2946v1.pdf>.

Prestage, R.M., K.T. Constantikes, T.R. Hunter, L.J. King, R.J. Lacasse, F.J. Lockman, and R.D. Norrod. 2009. "The Green Bank Telescope." *Proceedings of the IEEE*. Volume 97, Issue 8. August. pp. 1382–1390.

Pulsar Search Collaboratory (PSC). 2016. "The Green Bank Telescope and the PSC." Available at: <http://pulsarsearchcollaboratory.com/>.

Ransom, Scott (National Radio Astronomy Observatory [NRAO]). 2016. *Consequences of replacing the GBT and/or Arecibo with the Jansky VLA for NANOGrav*. Prepared on behalf of the North American NanoHertz Observatory for Gravitational Waves (NANOGrav). September 13. Available online: https://library.nrao.edu/public/memos/gbt/GBT_294.pdf.

Ransom, S.M., I.H. Stairs, A.M. Archibald, J.W.T. Hessels, D.L. Kaplan, M.H. van Kerkwijk, J. Boyles, A.T. Deller, S. Chatterjee, A. Schechtman-Rook, A. Berndsen, R.S. Lynch, D.R. Lorimer, C. Karako-Argaman, V.M. Kaspi, V.I. Kondratiev, M.A. McLaughlin, J. van Leeuwen, R. Rosen, M.S.E. Roberts, and K. Stovall. 2014. "A millisecond pulsar in a stellar triple system." *Nature*. Vol. 505. January 23. pp. 520–524. Available online: <http://www.nature.com/nature/journal/v505/n7484/abs/nature12917.html>.

Reichart, Daniel. 2011. *About ERIRA*. January. Available online: <http://skynet.unc.edu/erira/>.

"RESOLVE Online Searchable Database." 2016. Available online: <http://resolve.astro.unc.edu/pages/database.php>.

Rosen, R., S. Heatherly, M.A. McLaughlin, R. Lynch, V.I. Kondratiev, J.R. Boyles, M. Wilson, D.R. Lorimer, and S. Ransom. "The Pulsar Search Collaboratory." *Astronomy Education Review*. Vol. 9, Issue 1. p. 010106. Available online: <http://adsabs.harvard.edu/abs/2010AEdRv...9a0106R>.

Rosen, R., J. Swiggum, M.A. McLaughlin, D.R. Lorimer, M. Yun, S.A. Heatherly, J. Boyles, R. Lynch, V.I. Kondratiev, S. Scoles, S.M. Ransom, M.L. Moniot, A. Cottrill, M. Weaver, A. Snider, C. Thompson, M. Raycraft, J. Dudenhofer, L. Allphin, J. Thorley, B. Meadows, G. Marchiny, A. Liska, A.M. O'Dwyer, B. Butler, S. Bloxton, H. Mabry, H. Abate, J. Boothe, S. Pritt, J. Alberth, A. Green, R.J. Crowley, A. Agee, S. Nagley, N. Sargent, E. Hinson, K. Smith, R. McNeely, H. Quigley, A. Pennington, S. Chen, T. Maynard, L. Loope, N. Bielski, J.R. McGough, J.C. Gural, S. Colvin, S. Tso, Z. Ewen, M. Zhang, N. Ciccarella, B. Bukowski, C.B. Novotny, J. Gore, K. Sarver, S. Johnson, H. Cunningham, D. Collins, D. Gardner, A. Monteleone, J. Hall, R. Schweinhagen, J. Ayers, S. Jay, B. Uosseph, D. Dunkum, J. Pal, S. Dydiw, M. Sterling, and E. Phan. 2013. "The Pulsar Search Collaboratory: Discovery and Timing of Five New Pulsars." *The Astrophysical Journal*. Vol. 768, Issue 1. May. pp. 85-95. Available online: <http://iopscience.iop.org/article/10.1088/0004-637X/768/1/85/pdf>.

Siemens, Xavier, Justin Ellis, Frederick Jenet, and Joseph D. Romano. 2013. "The stochastic background: scaling laws and time to detection for pulsar timing arrays." *Classical and Quantum Gravity*. Vol. 30, Issue 22. November. Available online: <https://arxiv.org/pdf/1305.3196v1.pdf>.

Spekkens, Kristine, Natasha Urbancic, Brian S. Mason, Beth Willman, and James E. Aguirre. 2014. *The Dearth of Neutral Hydrogen in Galactic Dwarf Spheroidal Galaxies*. October 2. Available online: <https://arxiv.org/pdf/1410.0028.pdf>.

Stark, David V., Sheila J. Kannappan, Kathleen D. Eckert, Jonathan Florez, Kirsten R. Hall, Linda C. Watson, Erik A. Hoversten, Joseph N. Burchett, David T. Guynn, Ashley D. Baker, Amanda J. Moffett, Andreas A. Berlind, Mark A. Norris, Martha P. Haynes, Riccardo Giovanelli, Adam K. Leroy, D.J. Pisano,

Lisa H. Wei, Roberto E. Gonzalez, and Victor F. Calderon. 2016. "The RESOLVE Survey Atomic Gas Census and Environmental Influences on Galaxy Gas Reservoirs." November. Available online: <https://arxiv.org/pdf/1610.06932v2.pdf>.

Svoboda B.E., Y.L. Shirley, C. Battersby, E.W. Rosolowsky, A.G. Ginsburg, T.P. Ellsworth-Bowers, M.R. Pestalozzi, M.K. Dunham, N.J. Evans II, J. Bally, and J. Glenn. 2016. "The Bolocam Galactic Plane Survey. XIV. Physical properties of massive starless and star-forming clumps." *The Astrophysical Journal*. Vol. 822, No. 2. May 5. Available at: <http://iopscience.iop.org/article/10.3847/0004-637X/822/2/59>.

Swiggum, Joseph Karl. 2015. "Pulsar population synthesis using palfa detections and pulsar search collaboratory discoveries including a wide DNS system and a nearby MSP". Available online: <http://adsabs.harvard.edu/abs/2015PhDT.....397S>

Taylor, S.R., M. Vallisneri, J.A. Ellis, C.M.F. Mingarelli, T.J.W. Lazio, and R. van Haasteren. 2016. "Are We There Yet? Time to Detection of Nanohertz Gravitational Waves Based on Pulsar-timing Array Limits." *The Astrophysical Journal Letters*. Vol. 819, Issue 1. March. 6 pp. Available online: <https://arxiv.org/pdf/1511.05564v2.pdf>.

Troischt Parker, Rebecca Koopmann, Aileen O'Donoghue, Mary Crone Odekon, and Martha Haynes. 2016. "The Undergraduate ALFALFA Team: A Collaborative Model for Undergraduate Research in Major Long-term Astronomy Projects." *2016 CUR Quarterly on Undergraduate Research Collaborations: Partnering for High(er) Impact*. Summer Issue. Vol. 36, No. 4. Available online: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0ahUKEwipqbbfn_TQAHVqIIQKHSd-DzIQFggqMAI&url=http%3A%2F%2Fwww.cur.org%2Fdownload.aspx%3Fid%3D3252&usg=AFQjCNHxoM62O2jH0rJBN1pnt2CMkxsupg.

Von Hoerner, Sebastian. 1967. "Design of large steerable antennas." *The Astronomical Journal*. Vol. 72(1). February. p. 35. Available at: <http://adsabs.harvard.edu/full/1967AJ.....72...35V>.

Walsh, Aron, Juarez L. F. Da Silva, Su-Huai Wei, C. Körber, A. Klein, L. F. J. Piper, Alex DeMasi, Kevin E. Smith, G. Panaccione, P. Torelli, D. J. Payne, A. Bourlange, and R. G. Egdell. 2008. "Nature of the Band Gap of In₂O₃ Revealed by First-Principles Calculations and X-Ray Spectroscopy." *Physical Review Letters*. Vol. 100, Issue 16. April 25. Available at: <http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.100.167402>.

Wolfe, Spencer A., D.J. Pisano, Felix J. Lockman, Stacy S. McGaugh, and Edward J. Shaya. 2013. "Discrete clouds of neutral gas between the galaxies M31 and M33." *Nature*. Vol. 497. May 9. pp. 224–226.

Appendix 5F

DEIS Public Meeting Materials



National Science Foundation



National Science
Foundation

Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

Overview:

The National Environmental Policy Act (NEPA) requires federal agencies to conduct an environmental review to assess the potential environmental impacts of federal actions that could significantly affect the environment.

Section 106 of the National Historic Preservation Act requires federal agencies to consult with interested parties and the State Historic Preservation Officer regarding potential effects of their proposed actions on significant historic properties.

The purpose of this public meeting is to obtain comments on the Draft Environmental Impact Statement (DEIS) and gain insight on public concerns regarding historic properties.

Timeline for Public Involvement:

- **Scoping Comment Period (completed):** October 18 – November 25, 2016
- **DEIS Published:** November 9, 2017
- **DEIS Comment Period:**
 - 60-Day Comment Period ends January 8, 2018
 - Public meeting on Draft EIS: Green Bank Science Center, November 30, 2017; 5:00 to 8:30 pm
- **Final EIS target:** Summer/Fall 2018
- **Record of Decision target:** Late 2018

Submit Comments:

You may submit written comments on or before January 8, 2018 by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov, with subject line "Green Bank Observatory"

Mail to: Ms. Elizabeth Pentecost,
RE: Green Bank Observatory
National Science Foundation,
2415 Eisenhower Ave, Suite W9152,
Alexandria, VA 22314

Project information will be posted, throughout the EIS process, at www.nsf.gov/AST.



Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

Alternatives evaluated in the DEIS include the following:

- Collaboration with interested parties for continued science- and education-focused operations with reduced NSF funding (Agency-preferred Alternative)
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date)
 - Demolition and site restoration
 - Continued NSF investment for science-focused operations (No-Action Alternative)



Environmental Resources Considered

An impact is a change or consequence that results from a proposed activity; it can be positive, negative or both. It may be mitigated to lessen or remove the impact.

- visual resources*
- biological resources*
- environmental justice*
- health and safety*
- traffic and transportation*
- hazardous materials*
- geological resources*
- water resources*
- cultural resources*
- solid waste*
- socioeconomics*

Section 106 Process for the Green Bank Observatory:

In coordination with the DEIS, NSF is consulting with the State Historic Preservation Officer (SHPO) and other consulting parties on potential effects to historic properties located within the Area of Potential Effects (APE).

- The APE has been defined as the boundary of the existing Green Bank Observatory property, through consultation with the SHPO
- NSF is actively working with the SHPO and consulting parties to determine the appropriate mitigation for potential effects to cultural resources

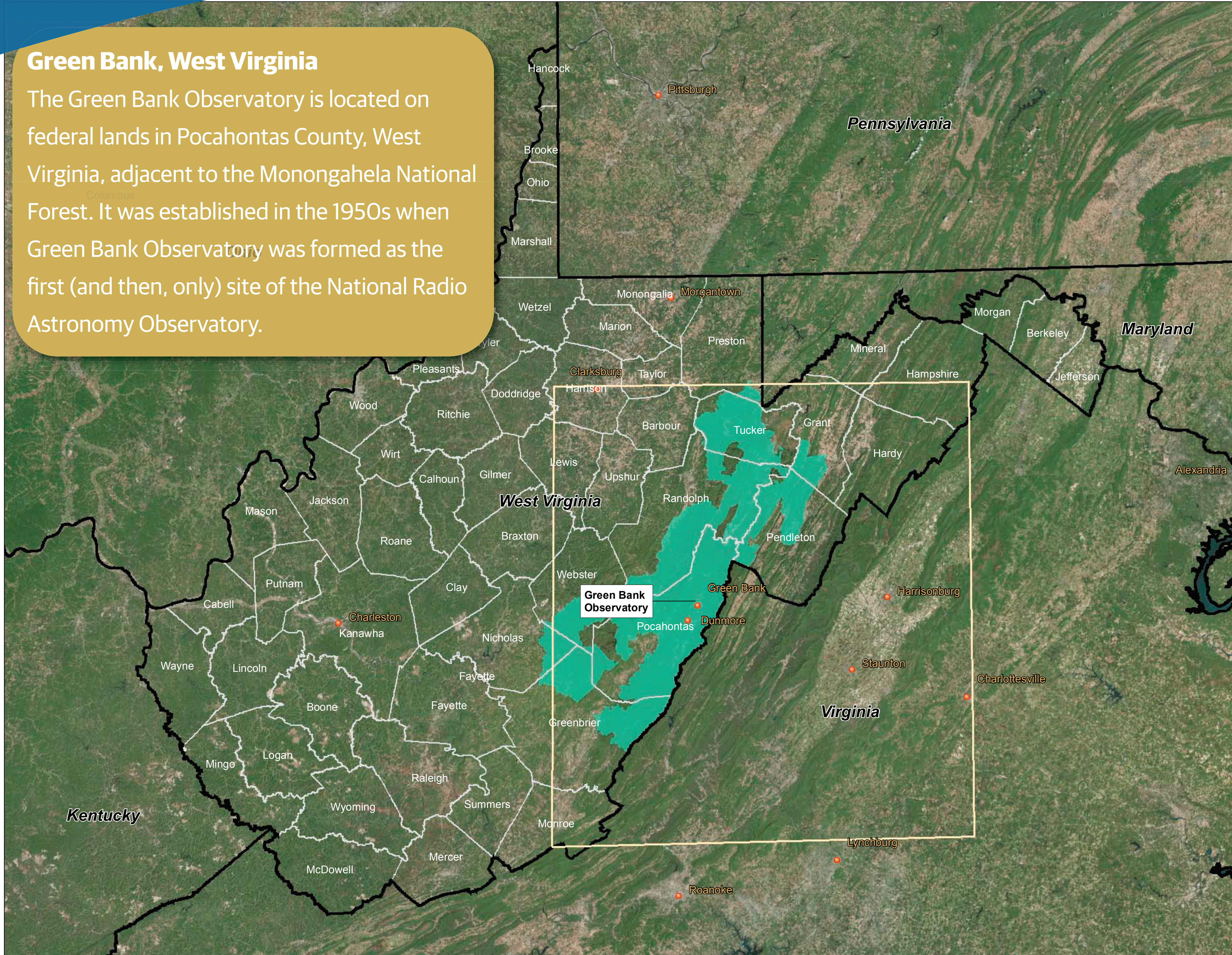


National Science
Foundation

Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

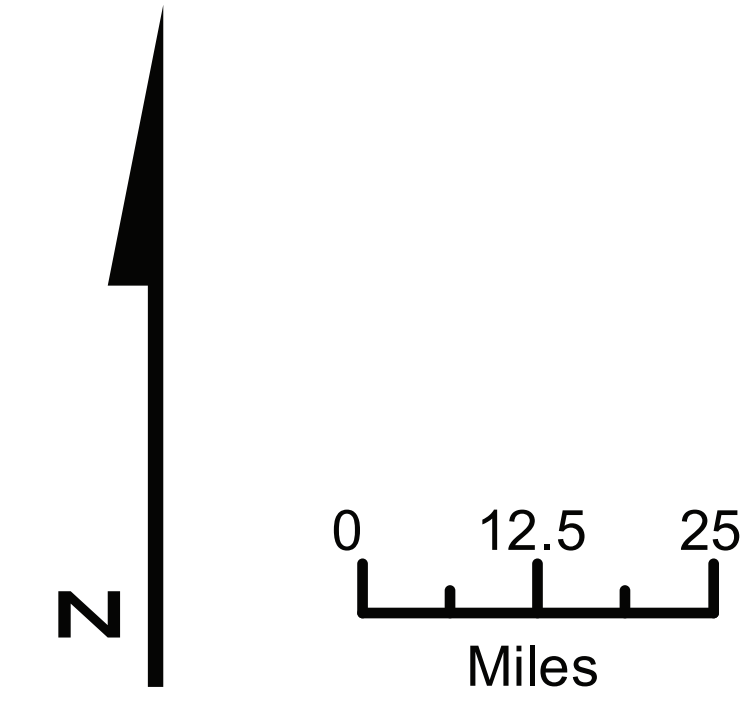
Green Bank, West Virginia

The Green Bank Observatory is located on federal lands in Pocahontas County, West Virginia, adjacent to the Monongahela National Forest. It was established in the 1950s when Green Bank Observatory was formed as the first (and then, only) site of the National Radio Astronomy Observatory.

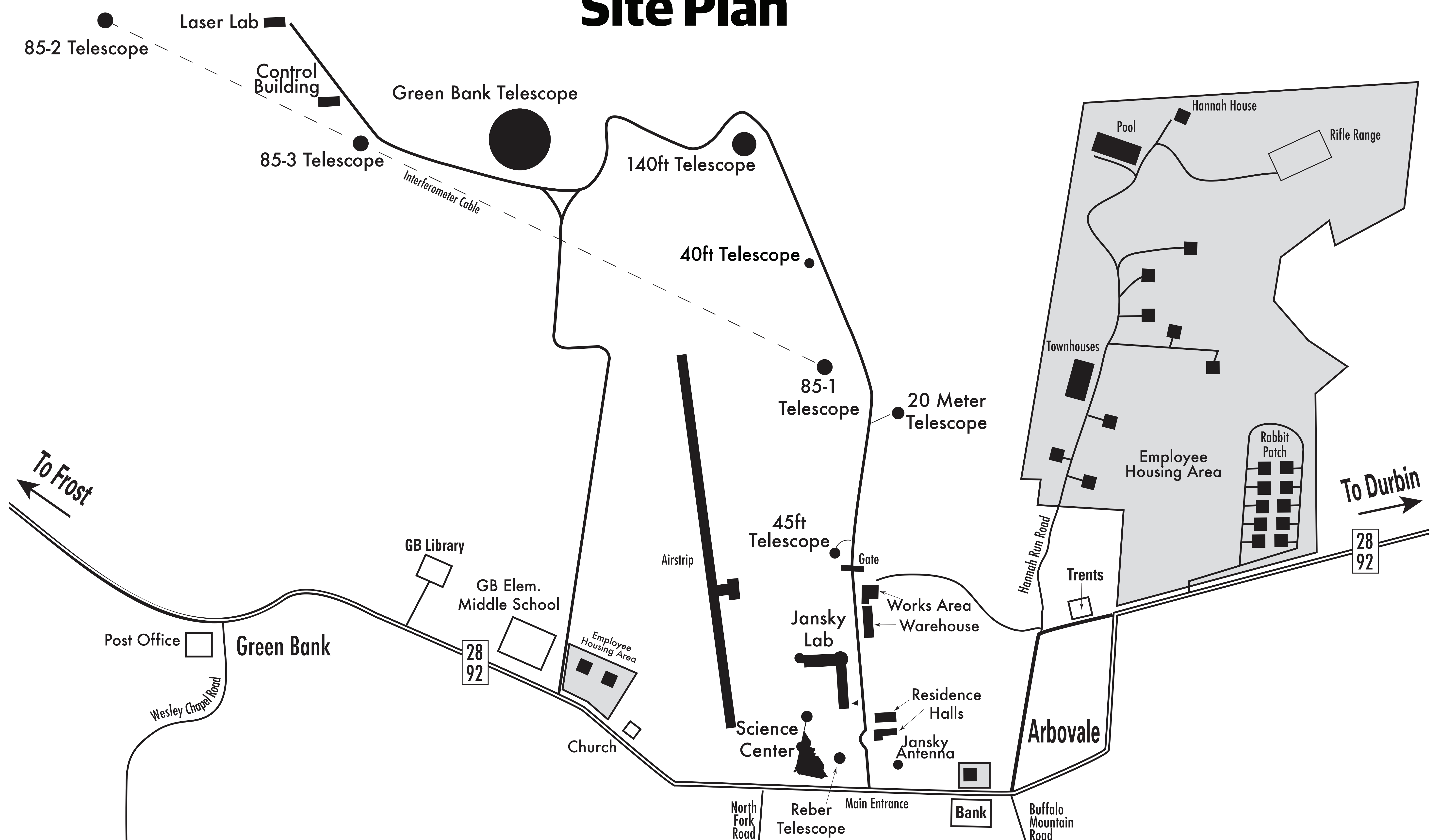


LEGEND

- City/Town
- National Radio Quiet Zone (NRQZ)
- State Boundary
- County Boundary
- Monongahela National Forest



Site Plan





Major Components of the Draft Environmental Impact Statement

Executive Summary

Purpose and Need

Description of Proposed Action and Alternatives

Affected Environment

Provides an overview of the existing physical, biological, economic, and social conditions at Green Bank Observatory.

Environmental Consequences

Provides an evaluation of the potential environmental impacts of the Proposed Action under the four proposed action Alternatives and the No-Action Alternative; the impacts of each alternative's implementation and operations phase are assessed. Impacts, which can be direct, indirect, or cumulative, are identified and their duration (short-term or long-term), intensity (negligible, minor, moderate, or major), and scale (local or regional) are provided where possible.

In addition, mitigation measures to reduce the duration, intensity or scale of the impacts are identified within the resource evaluations. Resource areas evaluated include: biological, cultural, visual, geology and soils, water resources, hazardous materials, solid waste, noise, health and safety, traffic and transportation, socioeconomics, and environmental justice. Methodology for assessing impacts is provided for each resource area.

Notifications, Public Involvement, and Consulted Parties





National Science Foundation

GREEN BANK
OBSERVATORY



GREEN BANK
OBSERVATORY

Public Meeting on the Draft Environmental Impact Statement

Green Bank Science Center
2017 November 30, 5:00—8:30 pm



Public Meeting Overview

- Introduction of team members and description of materials and transcript
- Science background
- Purpose of the meeting
- Draft Environmental Impact Statement (DEIS) summary
- Public comments



Introductions

Representative	Role
National Science Foundation: Federal Agency	
<i>Edward Ajhar</i>	Program Director for Green Bank Obs.
<i>Elizabeth Pentecost</i>	Project Management Administrator
<i>Matthew Viau</i>	Program Specialist
<i>Caroline Blanco</i>	Assistant General Counsel
<i>Kristen Hamilton</i>	Environmental Compliance Officer
<i>Karen Pearce</i>	Senior Legislative Affairs Specialist
<i>Sarah Bates</i>	Public Affairs Specialist
CH2M HILL: Environmental Contractor	
<i>Michelle Rau</i>	Project Manager
<i>Valerie Ross</i>	Senior Technologist

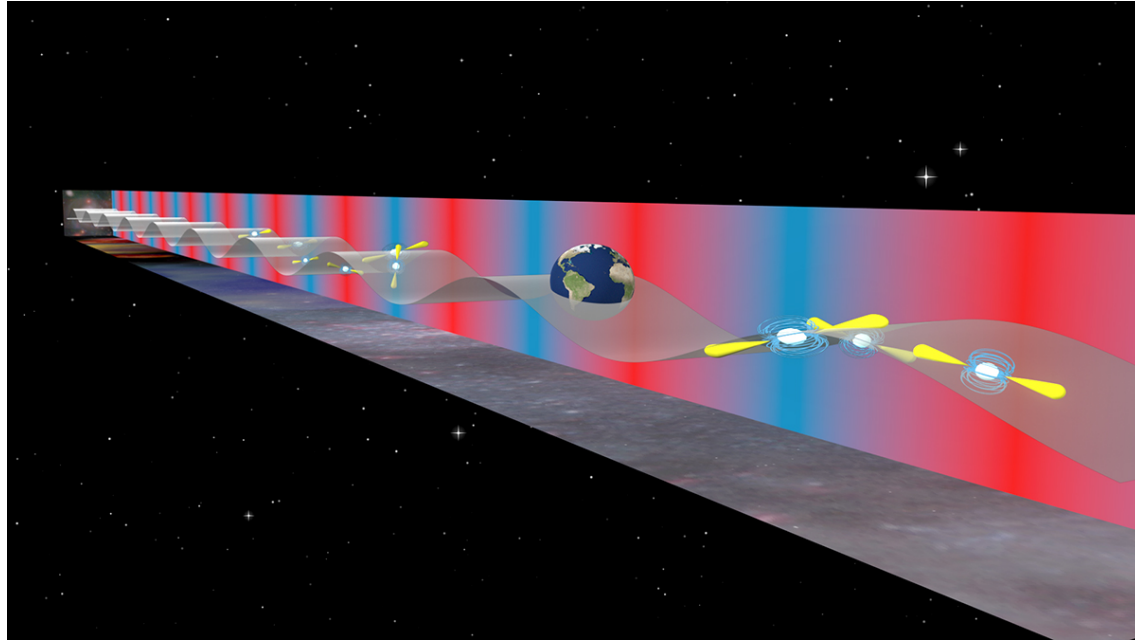


Materials

- Fact sheet and information boards
- This presentation, electronic versions of the fact sheet and information boards will be posted on the web following the public meetings at: www.nsf.gov/ast (click on Environmental Studies)



Science at GBO: Pulsars

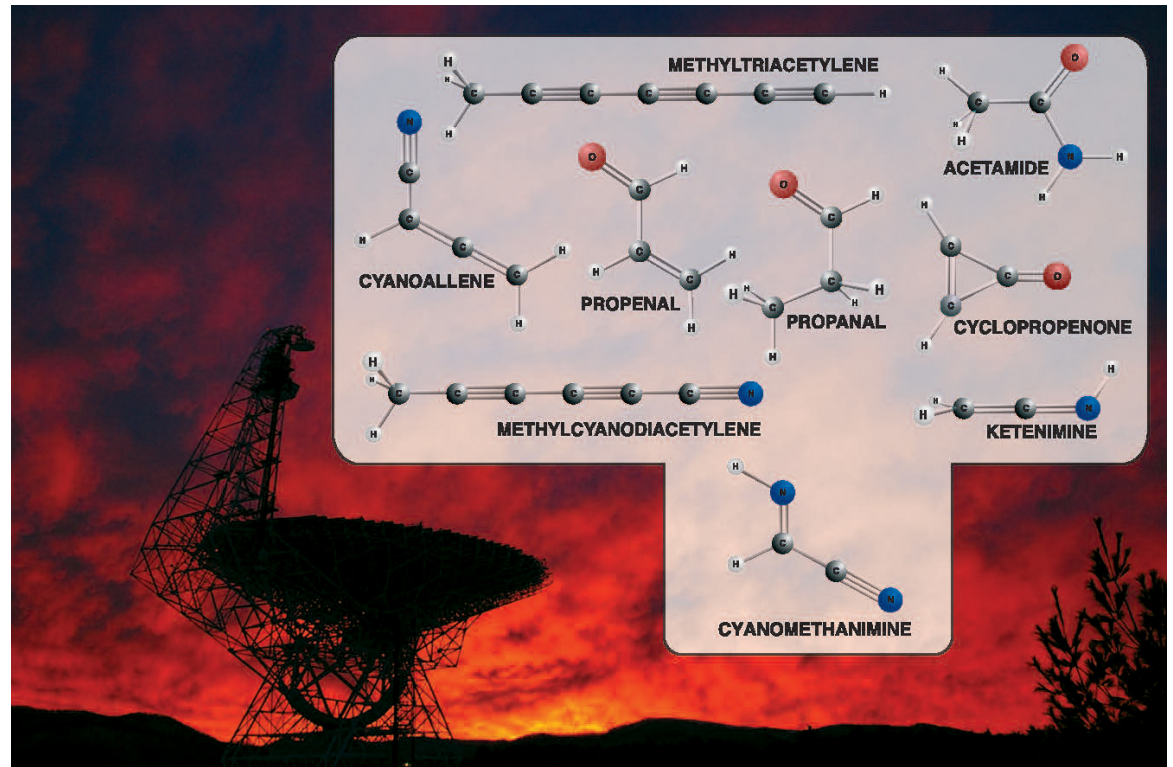


Credit :NRAO/AUI/NSF

- Rapidly rotating neutron stars
- Incredibly accurate clocks!
- Pulsar timing can detect gravitational waves
- GBT important facility for NANOGrav consortium



Science at GBO: Astrochemistry



Credit: Bill Saxton, NRAO/AUI/NSF

- Origins of life
- Emerging field
- Leader in new detections of organic molecules in the Universe
- Part of puzzle of star and planet formation



Science at GBO: Search for Life

- Breakthrough Listen: about 20% of GBT time
- Survey of a million closest stars
- Sensitive enough to detect aircraft radar from 1000 nearest stars



Credit: Jiuguang Wang



Purpose of This Meeting

- In compliance with the National Environmental Policy Act (NEPA), a Draft Environmental Impact Statement (DEIS) has been prepared to evaluate potential environmental impacts of proposed operational changes due to funding constraints for the Green Bank Observatory.
- The purpose of this meeting is to allow for public comments on the DEIS, which will help inform the Final EIS,
- And to allow public input on historic properties under Section 106 of the National Historic Preservation Act.



Purpose of the Proposed Action

- The purpose of the Proposed Action is to substantially reduce NSF's contribution to the funding of Green Bank Observatory (GBO).



Need for the Proposed Action

- NSF is responsible for maintaining a balanced research portfolio, and the scientific community, through reviews and surveys, has indicated that the scientific capabilities of GBO are lower in priority than other scientific capabilities that NSF funds.



Panel/Committee Reports

- A review of the NSF Astronomical Sciences portfolio was completed in 2012: *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*
- Regarding the Green Bank Telescope (GBT), the 2012 review recommended divestment and stated the following:

“The GBT is the world’s most sensitive single-dish radio telescope at wavelengths shorter than 10 cm; however, its capabilities are not as critical to *NWNH* [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities.”



Panel/Committee Reports

- The 2016 March 15 report of the *Astronomy and Astrophysics Advisory Committee* stated the following:
“Strong efforts by NSF for facility divestment should continue as fast as is practical. Efforts to explore partnerships, interagency cooperation and private resources to maintain some access to facilities for the US community that may mitigate the loss of open access should continue. Transferring the cost of operating a facility outside of the NSF/AST budget is preferable to complete loss of a capability from the suite of capabilities used by US researchers.”



Panel/Committee Reports

- In August 2016, the *National Academies of Sciences, Engineering, and Medicine* published their *Midterm Assessment* of the 2010 decadal survey and reaffirmed the 2012 Portfolio Review's recommendations for divestment of these AST facilities:

“The NSF should proceed with divestment from ground-based facilities that have a lower scientific impact, implementing the recommendations of the NSF Portfolio Review, which is essential to sustaining the scientific vitality of the U.S. ground-based astronomy program as new facilities come into operation.”



Alternatives Evaluated in the DEIS

Preferred Alternative

A. Collaboration with interested parties for continued science- and education-focused operations with reduced NSF funding

B. Collaboration with interested parties for operation as a technology and education park

C. Mothballing of facilities

D. Demolition and site restoration

No-Action: Continued NSF investment for science-focused operations



Alternatives Evaluated in the DEIS

Note that for each proposed Action Alternative NSF has identified which buildings and infrastructure **could be** retained, demolished, mothballed, or safe-abandoned (see Table 2.6-1 in the DEIS).

Importantly, these alternatives do not mandate the demolition of any buildings; this level of detail in the DEIS is helpful in ensuring that the environmental impact analysis adequately addresses each proposed Action Alternative.



Public Scoping

- Public scoping conducted 2016 October 19 to November 25.
 - Scoping meetings and 30-day (minimum) comment period
- Comments incorporated in the DEIS



DEIS Contents

- Executive Summary
- Purpose and Need
- Description of Proposed Action and Alternatives
- Affected Environment
- Environmental Consequences
- Notifications, Public Involvement, and Consulted Parties



DEIS Resource Areas Considered

- Biological Resources
- Cultural Resources
- Visual Resources
- Geology and Soils
- Water Resources
- Hazardous Materials
- Solid Waste
- Health and Safety
- Noise
- Traffic and Transportation
- Socioeconomics
- Environmental Justice



Section 106 of the National Historic Preservation Act

- The Section 106 consultation process requires federal agencies to consult with interested parties and the State Historic Preservation Officer regarding potential effects of their proposed actions on nationally significant historic properties. There are four basic steps:
 1. Initiate Section 106 consultation
 2. Identify Area of Potential Effects (APE) and nationally-significant historic properties within the APE
 3. Assess whether there are adverse effects
 4. Resolve any adverse effects



DEIS Availability

- www.nsf.gov/AST (“AST Facilities-Environmental Reviews”, “Green Bank Observatory”)
- Local libraries:
 - Green Bank Public Library, 5683 Potomac Highlands Trail, Green Bank, WV 24944
 - Durbin Community Library, 4361 Staunton Parkersburg Turnpike, Durbin, WV 26264



How to submit comments on the DEIS

- Provide verbal comments today
- Submit written comments today
- Mail or email comments to NSF by January 8, 2018

envcomp-AST-greenbank@nsf.gov

Ms. Elizabeth Pentecost
Division of Astronomical Sciences
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314



Target Dates & Opportunities to Comment



National Historic Preservation Act Compliance

Endangered Species Act Compliance (completed March 2017)

** The viability of the Preferred Alternative is dependent on the availability of qualified collaborations determined through a parallel NSF process.*



Record of Decision

Discussion of all the factors, including

- Science priorities
- Feasibility
- Environmental considerations and mitigation
- Budget



What's Next?

- 60-day public comment period (through Jan 8th)
- NSF to address comments in a Final EIS
- NSF to issue Record of Decision selecting which Alternative to implement



Your verbal comments are now welcome.

- One speaker at a time; may require time limit.
- Please state & spell your name for the court reporter, and speak slowly and clearly.
- Direct your comments/questions to the contents of the DEIS; NSF will not address comments at this time. They will be addressed in the Final EIS.
- Will take a planned break.



Thank you for your
participation!



Information and materials are posted at

www.nsf.gov/AST

NSF Point of Contact:

Ms. Elizabeth Pentecost, (703) 292-4907, epenteco@nsf.gov.



GREEN BANK OBSERVATORY

Appendix 5G

**DEIS Public Meeting Transcripts and Section 106
Meeting Minutes**

NATIONAL SCIENCE FOUNDATION (NSF)
PUBLIC MEETING ON THE DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR GREEN BANK OBSERVATORY

HELD AT:

GREEN BANK SCIENCE CENTER
155 Observatory Road
Green Bank, West Virginia 24915

NOVEMBER 30, 2017

5:30 P.M.

Reported by: Kristina Guthrie

1 P R O C E E D I N G S

2 * * *

3 MR. AJHAR: Hello and welcome to the public
4 meeting on the Draft Environmental Impact Statement for
5 Green Bank Observatory. I'm going to just go over what
6 we're going to do today in our public meeting. We're
7 just going to start by introducing the team and describe
8 the materials that we have with us today.

9 And then I'm going to take a side track with a
10 little bit of science background on Green Bank, because
11 I hope to indulge that. We won't spend too much time on
12 that because we have to really get to the purpose of our
13 meeting and talk about the, give a summary of the Draft
14 Environmental Impact Statement. And our focus today is
15 all going to be in getting your public comments on that
16 draft.

17 So first, I'm Edward Ajhar. I am the program
18 officer for Green Bank Observatory in the National
19 Science Foundation in the Division of Astronomical
20 Sciences. And joining me from our Division of
21 Astronomical Sciences is Liz Pentecost. Liz is over
22 here. And we have Matt Viau right there. And we also
23 have with us from our Office of General Counsel,
24 Caroline Blanco and Kristen Hamilton.

1 And from our office of Legislative and Public
2 Affairs we have Karen Pearce and Sarah Bates. And we
3 also have with us today CH2M Hill who is providing
4 contractor support to NSF in the preparation of our
5 environmental impact statement and we have Michelle Rau
6 and Valerie Ross with us. They're out front so if you
7 want to know who they are, that's who we have with us.

8 And I also want to acknowledge our court
9 reporter who will be taking notes and transcribing
10 everything that we say today for our record.

11 We have fact sheets available and we have
12 information boards out there so you know what this
13 meeting is about and the context of why we are here
14 today. And this presentation, an electronic version of
15 the fact sheet and information boards will be posted on
16 our Website following the public meetings at
17 www.nsf.gov/ast and click on environmental studies. So
18 everything is there.

19 So now my brief indulgence into the exciting
20 science that goes on at Green Bank Observatory. So I'm
21 only, I can only pick a few things because of the
22 limited time that we have. And I just want to mention
23 pulsars a little bit. This is a really fascinating
24 topic of -- these are special stars and, typically,

1 they're rapidly rotating neutron stars. And you wonder
2 what the heck is a neutron star. Well they are, as
3 they're described, they are made up purely of neutrons
4 and those neutrons are the same things we find in the
5 nucleus of atoms.

6 And if you imagine taking our sun and
7 collapsing it down to the size of a city, that would be
8 about the size of a neutron star. It is incredibly
9 dense. And in that process, that star ends up spinning
10 up really fast and rotating really fast and creating a
11 really powerful magnetic field. And some of those
12 rapidly rotating neutron stars will point radio energy
13 toward the earth and it will give this pulse.

14 And that's what we can measure with telescopes
15 like Green Bank Telescope. And it's something that can
16 be used in many ways. In fact, they are incredibly
17 accurate clocks. But one the things that's really
18 interesting that's happening lately is you may have
19 heard about NSF's LIGO which is a gravational wave
20 observatory and this was a big part of the recent Noble
21 Prize in Physics and there's been some very interesting
22 discoveries that happened recently where they detected,
23 you know, neutron stars coalescing in that moment when
24 it happened. It make a ripple of gravitational waves

1 which were detected by this LIGO observatory.

2 And they also detected, last year, block holes
3 coalescing. Well, the thing that we can do with pulsars
4 is use a distribution of pulsars spread throughout our
5 galaxy and by measuring very carefully the timing and
6 doing this over a number of years, it's possible to
7 detect the coalescence of super massive black holes.
8 And that happens when galaxies in our universe form.
9 When they form they, we have galaxies that merge and
10 believe that every galaxy has a massive black hole in
11 its center.

12 So in this process of this merging, there will
13 be a point where super massive black holes are orbiting
14 each other and then they merge. And when that happens,
15 they can create a ripple of gravitational waves that
16 goes across the galaxy. And with pulsars and careful
17 measurements made at Green Bank and other telescopes,
18 those things are possible to be measured and that will
19 allow us to look at another part of what Einstein
20 predicted many years ago.

21 So that's something that's very exciting and
22 it's work that's going on at Green Bank and the Green
23 Bank Telescope is an important facility for the NANOGrav
24 consortium as you might be aware of and that's the North

1 American Nanohertz Observatory for Gravitational Waves.
2 So I want to mention that. We could spend a long, a
3 whole day talking about it and we have experts in the
4 audience for sure and I'm very happy that they're here
5 and I'm glad that I could mention this.

6 I'm going to mention a couple of more things
7 but, again, I'm not going to spend too much time. I
8 want to talk about Astrochemistry but for a few seconds.
9 You know, maybe you've heard about Astronomy and
10 Astrophysics, very closely related things. Well,
11 Astrochemistry is kind of a newer field and it's kind of
12 an exciting thing because to understand how life started
13 in our universe, we have to really understand how
14 chemistry works.

15 So we are -- there's really important work
16 being done at Green Bank Observatory, and in this
17 emerging field it turns out that Green Bank has been one
18 of the leaders in new detections of organic molecules in
19 our universe. And all of those detections and studying
20 and understanding how Chemistry works in the universe,
21 we can do some of that in the laboratory and we have to
22 help compliment that. But, you know, it's really, a
23 really fascinating thing to learn about Chemistry in the
24 universe and it helps us to understand how stars and

1 planets are formed.

2 And on the little diagram here, it's actually
3 not up-to-date. It's an older one, but all of the
4 molecules that we have modeled here are ones that were
5 first detected in space by Green Bank Telescope. And
6 the list is bigger now and we'll have to get an update
7 one of these days on that.

8 So I'm going to mention one last thing.
9 Again, this is a very brief list of the science that
10 goes on at Green Bank, and that's the search for
11 extraterrestrial intelligence. And you've probably have
12 heard about Breakthrough Listen which is an important
13 funding partner for Green Bank Telescope and they're
14 spending about 20 percent of the Green Bank Telescope
15 time looking for signals from possible extraterrestrial
16 life.

17 And they're surveying a million stars, a
18 million of the closest stars to the earth, and the Green
19 Bank Telescope is actually sensitive enough to detect
20 aircraft radar from the thousand of the nearest stars to
21 our planet.

22 So that ends our indulgence in the science
23 and, again, I wish we could spend a whole day talking
24 about science. That's a lot of fun. But the purpose of

1 our meeting now is what I want to focus on.

2 So our purpose, again, is not to talk about
3 science but it is that in compliance with the National
4 Environmental Policy Act, also called NEPA, a Draft
5 Environmental Impact Statement, DEIS, you're going to
6 hear that a lot today, has been prepared to evaluate the
7 potential environmental effects of proposed operational
8 changes due to funding constraints for the Green Bank
9 Observatory.

10 The DEIS was noticed in the Federal Register
11 and emailed to our full stakeholder list and posted to
12 our Website on November 8th. And the purpose of this
13 meeting is to allow for public comments and, on the
14 DEIS, which will help inform the final draft of the
15 Environmental Impact Statement.

16 So this is a really great moment because this
17 is a case where what we really, the public really plays
18 a very important and vital role in the development of
19 this Environmental Impact Statement and we'll go over
20 this a little more later. But I'm very happy that
21 we're, have you here and we have a large participation.
22 This is a very important part of our process.

23 And we're also going to -- this also allows
24 today public input on historic properties under Section

1 106 of the National Historic Preservation Act.

2 The purpose of the proposed action is to
3 substantially reduce NSF's contribution to the funding
4 of the Green Bank Observatory. And there's a need for
5 that and this is kind of complicated and it's all laid
6 out in the Draft EIS.

7 And NSF is responsible for maintaining a
8 balanced research portfolio, and the scientific
9 community through reviews and surveys, has indicated
10 that the scientific capabilities of Green Bank are lower
11 in priority than other scientific capabilities that NSF
12 funds.

13 And we've -- and so to summarize some of that
14 input that got us to that point, is the Astronomy
15 portfolio, that Astronomical Sciences portfolio at NSF,
16 put together a portfolio review committee and it was
17 formed as a subcommittee of the Math and Physical
18 Sciences Advisory Committee at NSF. And it is subject
19 to all of the Federal Advisories Committee Act and it
20 was charged to provide their report on the astronomy
21 portfolio to the Math and Physical Sciences Advisory
22 Committee.

23 And this report came out in 2012, and it was
24 titled Advancing Astronomy in the Coming Decade:

1 Opportunities and Challenges. And regarding Green Bank
2 telescope, the 2012 review recommended divestment of the
3 Green Bank Telescope, among others, and it stated the
4 following, "The GBT is the world's most sensitive
5 single-dish radio telescope at wavelengths shorter than
6 10 cm; however, its capabilities are not as critical to
7 the Astronomy and Astrophysics the decadal survey New
8 World New Horizons science goals as the higher-ranked
9 facilities."

10 We have further advice in 2016, from the
11 Astronomy and Astrophysics Advisory Committee, and that
12 is a panel that reviews NSF, NASA, and the Department of
13 Energy Astronomy and Astrophysics programs and reports
14 directly to Congress and they stated the following:

15 "Strong efforts by NSF for facility divestment
16 should continue as fast as practical. Efforts to
17 explore partnerships, interagency cooperation, and
18 private resources to maintain some access to facilities
19 for the U.S. community that may mitigate the loss of
20 open access should continue.

21 "Transferring the cost of operating a facility
22 outside of the NSF/Astronomy budget is preferable to
23 complete loss of the capability from the suite of
24 capabilities used by U.S. researchers."

1 And in August of last year, the final report
2 that I'm going to mention, was the National Academies of
3 Sciences Report, they published a Midterm Assessment of
4 the 2010 decadal survey and reaffirmed the 2012
5 Portfolio Review's recommendations for divestment for
6 these yet AST facilities.

7 And their quote is, "The NSF should proceed
8 with divestment from ground-based facilities that have a
9 lower scientific impact implementing the recommendations
10 of the NSF Portfolio Review, which is essential to
11 sustaining the scientific vitality of the U.S. ground-
12 based Astronomy program as new facilities come into
13 operation."

14 So that's how we've gotten here and so that's
15 why this draft Environment Impact Statement has been
16 made. And I would like to now go on to the alternatives
17 that, for possible operations, future operations of
18 Green Bank Observatory as published in our Draft
19 Environmental Impact Statement.

20 So the National Environmental Policy Act
21 requires Federal agencies to consider a range of
22 alternatives that meet the purpose and need for the
23 proposed action, which I've just described to you, and
24 as we presented during the scoping period last year,

1 several alternatives were identified that could meet the
2 purpose of substantially reducing NSF funding.

3 And these were evaluated in the DEIS and
4 include the following, which I have up here. And so the
5 Action Alternative A is our agency, the NSF's preferred
6 alternative. So this is the one that we are identifying
7 as our preferred alternative.

8 And it is described as collaboration with
9 interested parties for continued science and education
10 focused operations with reduced NSF funding. So that's
11 one alternative we looked at and the other are: B,
12 collaboration with interested parties for operation as a
13 technology and education park; C, mothballing of
14 facilities; and D, demolition and site restoration. And
15 finally, we always look at the no-action alternative
16 which is continued NSF investment for science-focused
17 operations.

18 And I just make one other note to this, is
19 that we've identified A as our preferred alternative and
20 that can only be implemented if collaborating parties
21 come forward with viable plans to provide additional
22 non-NSF funding and support of their science and
23 education focused operations.

24 So we note that for each of the proposed

1 action alternatives, A, B, C, and D, as given there, but
2 especially for A and B, we have identified in the draft
3 which buildings and infrastructure could be retained,
4 demolished, mothballed, or safe abandoned, and you can
5 see the appropriate table and in the draft. It's Table
6 2.6-1.

7 But importantly, these alternatives do not
8 mandate the demolition of any buildings. So it's
9 important to understand that, though this level of
10 detail in the DEIS is helpful in ensuring that the
11 environmental impact analysis adequately addresses each
12 proposed action alternative.

13 So we put in the draft the most drastic thing
14 that might happen but we won't really know what that's
15 going to look like until we, you know, finish this
16 process and we know where we're going.

17 And it could be that nothing changes here. So
18 we just want to make sure because sometimes that's very
19 confusing in the draft. So there's nothing mandated in
20 the draft that would have to happen but we analyze sort
21 of a worst case scenario.

22 So at this point, I'm ready to turn this over
23 to my colleague, Kristen Hamilton, who will continue
24 talking about the process and Kristen, Thanks.

1 MS. HAMILTON: Thank you and good evening.

2 So as Dr. Ajhar said, this meeting today is a
3 continuation of the National Environmental Policy Act, a
4 process that began last Fall. So I'm here to give an
5 overview of where we're at with that process. I'll try
6 to be brief so we can get to the most important part of
7 this meeting which is hearing your comments today.

8 So as Dr. Ajhar said, NEPA requires Federal
9 agencies to consider the potential environmental
10 consequences of their proposed actions before making a
11 decision and to collect public input on that review.

12 Because of the potential for significant
13 environmental impacts for this proposed action, we are
14 complying with NEPA by preparing an Environmental Impact
15 Statement.

16 We issued a notice of intent to prepare an
17 Environmental Impact Statement, or EIS as we call it,
18 last October, a little over a year ago, and we held
19 public scoping meetings in this room on November 9th.

20 We had a phenomenal showing of civic
21 engagement. Last year we had over 300 registered
22 participants at those two meetings, over 50 verbal
23 comments were provided. We had a written comment
24 period. We collected over 800 written letters and

1 emails during that scoping comment period.

2 So comments and how they went into the
3 preparation of our Draft Environmental Impact Statement
4 are discussed in Section 5 of the EIS. I hope that you
5 see that many of the findings in our DEIS do reflect
6 what we heard during public scoping.

7 This is the Draft Environmental Impact
8 Statement. You've all read it from cover to cover, I'm
9 sure. It contains an Executive Summary that is
10 particularly helpful. It's about 18 pages of the 263,
11 but it provides a concise summary of the DEIS including
12 all the findings.

13 The Purpose and Need section provides the
14 rationale for NSF's proposed action. The next section
15 provides a full description of each of those four action
16 alternatives and the no-action alternative.

17 What we call the Affected Environmental,
18 Section 3, is essentially the baseline. It says what
19 the existing conditions are here at Green Bank
20 Observatory.

21 The Environmental Consequences section is
22 really the meat of the environmental analysis, so that's
23 where you'll see an evaluation of the potential
24 environmental impacts of the proposed action under the

1 four action alternatives and the no-action alternative.

2 Because the action alternatives would have an
3 implementation phase and then a longer-term operations
4 phase, we identified the impacts for both of those
5 phases for each of the alternatives and we identified
6 whether the impacts are direct, indirect, or cumulative.

7 In addition, you'll see that mitigation
8 measures to address those impacts are identified where
9 appropriate. That's all in that Section 4,
10 Environmental Consequences section.

11 And the final sections of the DEIS provide
12 information on the process thus far and a summary of the
13 consultation that has occurred to inform that Draft
14 Environmental Impact Statement.

15 These are the resource areas that are
16 evaluated in the draft EIS. You'll see that they
17 encompass many aspects of what we call the human
18 environment from biological resources to traffic and
19 transportation.

20 Most of these are very typical of what you
21 would see in an impact statement. But I did want to
22 note that based on what we heard from the community last
23 year during scoping, we did work with our consultant and
24 the economist on socio-economic section at add a

1 sub-topic called community cohesion which gets a
2 community features in there and how they are
3 interconnected. So that's a little bit unique to this
4 review.

5 You'll also see that we addressed cultural
6 resources in the NEPA document and that is typical. I'm
7 highlighting it now to note that we're also evaluating
8 cultural resources particularly historic properties
9 during an ongoing consultation under the National
10 Historic Preservation Act.

11 So that's a separate statute from NEPA that's
12 going on sort of in parallel. And since you might hear
13 about it from time to time, I just wanted to briefly go
14 over the National Historic Preservation Act as well.

15 Section 106 of this act requires Federal
16 agencies to consult with interested parties and the
17 State historic preservation officer, which we call the
18 SHPO, regarding potential effects of proposed actions on
19 nationally significant and historic properties.

20 So here's the four basic steps of an NHPA
21 process and we're currently at step 3 which jives well
22 with where we're at currently with the NEPA process in
23 terms of analyzing impacts.

24 So last year we initiated Section 106

1 consultation with the West Virginia State Historic
2 Preservation Officer and we identified a number of both
3 individuals and organizations that have historic
4 preservation interests and are interested in consulting
5 through this process. We've also contacted tribes that
6 might have interests in this area.

7 For step 2, we conducted evaluations of the
8 buildings and structures here at Green Bank Observatory
9 to identify which might be historic properties. Those
10 are properties that are listed on our eligible for
11 listing on the National Register of Historic Places.

12 And there are historic properties here and I
13 recommend you check out, Section 3 provides a
14 description of what they are in the DEIS. There's also
15 a cultural resources evaluation, a separate report, by a
16 qualified consultant. That's the second appendix in the
17 DEIS and that's a great read on the history of radio
18 astronomy and the Green Bank Observatory.

19 So we have concurrence from the West Virginia
20 SHPO on our findings of which are historic. So that led
21 us to step 3, assessing what the impacts of the various
22 alternatives would be, could be on historic properties.

23 So we've shared an assessment of the facts
24 with the SHPO. Section 4 of the DEIS summarizes the

1 same findings so they are consistent with each other.

2 The next step is to hear back feedback from
3 the SHPO and consulting parties on the assessment. We
4 also are listening today, and during this written and
5 comment period coming up, to hear if you have any
6 thoughts on historic properties. If you do, we will
7 address them both in the final EIS but will also
8 incorporate those comments into our section 106
9 discussion in terms of impacts to historic properties.

10 Because the final step will then be the
11 resolution of adverse affects, that's when NSF will work
12 with consulting parties and the SHPO to identify
13 measures to avoid, minimize, and mitigate adverse
14 effects to historic properties.

15 So any one of six materials and documents are
16 currently up on our Website and we'll continue to post
17 them. The DEIS and all the appendices are also
18 available on our Website. This is the easiest link to
19 jot down. You do then have to click on AST facilities
20 and then you'll see a list of observatories and you
21 click on Green Bank. That will take you to all the
22 public documents.

23 We also have hard copies available for review
24 at two local libraries, Green Bank Public Library, and

1 the Durbin Community Library.

2 There's a number of ways to submit comments on
3 the Draft Environmental Impact Statement. You can
4 provide verbal comments today. You can submit written
5 comments today. We have comment sheets that you can
6 give to one of us or you can mail later, and you can
7 snail mail or email comments to us by January 8th, by
8 the end of the day January 8th. And this address and
9 Website are on the fact sheet that you picked up at the
10 front desk.

11 I'd like to go over the time line for the
12 environmental review process. As I mentioned, we
13 conducted scoping in October and November of 2016.
14 We're currently at the Draft EIS review phase. We'll
15 have a 60-day public comment period. Once we have your
16 comments, we'll take them in, we will review them, and
17 process them, and we will use them to help inform any
18 updates that are needed in order to prepare a Final
19 Environmental Impact Statement, which we expect to
20 publish in the Fall of 2018.

21 Following the Final EIS, NSF will issue a
22 record of decision. That's the agency decision on which
23 alternative to move forward with, and we expect to
24 release that by early 2019.

1 As I mentioned, we'll also be consulting under
2 the National Historic Preservation Act along the same
3 time line. We would have to have resolution of adverse
4 affect, usually done via an agreement document, executed
5 before we could have a record of decision under NEPA.

6 I also wanted to briefly mention that we have
7 completed our required consultation under the Endangered
8 Species act as of March of this past year. And if
9 you're curious about that, there's a summary of that
10 consultation in the Biological Resources section of the
11 DEIS.

12 So you'll see we have, our FEIS has an
13 asterisk. This says, "The viability of the preferred
14 alternative is dependant on the availability of
15 qualified collaborations determined through a parallel
16 NSF process."

17 Dr. Ajhar mentioned this briefly. What does
18 this mean? NSF is actively exploring potential
19 collaborators and they have been, we have been for some
20 time. This is a separate process, separate from NEPA
21 and the Environment Review Process, but it will inform
22 whether the preferred alternative continues to be
23 considered viable as we move forward.

24 The record of decision will state the agency's

1 chosen path, which of these concepts level alternative
2 to move forward with. It will identify all the
3 alternatives that were considered and discuss how the
4 selection was made based on relative factors. So at
5 this point, yes, we consider the environmental impacts
6 that we developed through the DEIS and the FEIS, but we
7 also consider other factors that are relevant including
8 science priorities and the NSF mission, feasibility and
9 budgetary considerations.

10 In summary, we have this 60-day public comment
11 period that goes through January 8th. We encourage you
12 to take a look at the DEIS if you haven't yet and send
13 us any comments. The regs required a 45-day comment
14 period, and we realize that would have comments due
15 December 24th, and we thought that was not the nicest
16 thing to do, so we'll get through the holidays. The
17 deadline we be January 8th. Again, we will address the
18 comments in the Final EIS and NSF will issue a record of
19 decisions selecting which alternative to implement.

20 So we're now going to open up the floor to
21 your comments, move from the presentation portion to the
22 public comments portion. I wanted to just go through a
23 few ground rules because we have quite a few people who
24 would like to speak today, last count about 50 people.

1 So we're going to have about one speaker at a time and
2 because of the number of people, to make sure that
3 everybody has a chance to speak, we're going to have to
4 limit as least the first round of comments, limit them
5 to three minutes. If at the end there's time and you
6 wanted to come back and finish a statement, we could do
7 it at that time.

8 What we're going to do is have people come to
9 this microphone. Please state and spell your name for
10 the court reporter because these comments do go on the
11 record. Try to speak slowly and clearly, and direct
12 your comments or questions to the contents of the DEIS.
13 NSF will not address comments at this time. We're here
14 to hear from you, but they will be addressed and
15 discussed in the Final Environmental Impact Statement.

16 And we're going to take a planned break
17 sometime around 7:00-ish when there's a good time to
18 take a break, for about ten minutes. Okay. So with
19 that, I'm going to start the public comment period. And
20 we do have this row here. What I'm going to do is I'm
21 going to call there or four people at a time just so you
22 know to get ready. If you are sort of buried in one of
23 the rows, feel free to come and use one of the seats up
24 here if you want, sort of make your way; otherwise, just

1 come up in the order that I'm calling you.

2 So the first three we have today is will be
3 Peggy Hause, Mary Eckerson, and Jordan Maynor.

4 Oh, I'm sorry, I should say how I'm going to
5 let you know about the timing. So I will be sitting
6 right here and just so that you have a little hint that
7 you hit the two minute and you have one minute left,
8 I'll just sort of raise my hand.

9 PEGGY HAWSE: Good evening. I'm Peggy Hawse
10 and that's P-e-g-g-y, H-a-w-s (as in Sam)-e, and I'm a
11 regional coordinator for US Senator Joe Manchin. The
12 Senator had a meeting scheduled today with Dr. Cordova,
13 the Executive Director of the National Science
14 Foundation. It was canceled due to the vote on the tax
15 bill. All of the amendments were being voted on today.

16 That has been rescheduled for Tuesday and the
17 Senator would like to take comments with him and hand
18 deliver them to the director. So I'm going to give you
19 my email address right now for you to write down and
20 email me. I will send them to Washington. They're
21 going to print them out and he's going to take them on
22 Tuesday. And I want to give this first in case I run
23 out of time. It's Peggy, P-e-g-g-y and then there's an
24 underscore, just one little underscore, not a dot, but

1 one underscore, and then Hawse, H-a-w-s, as in Sam,
2 e@manchin.senate.gov. (peggy_hawse@manchin.senate.gov).

3 I do have comments from Senator Manchin that I
4 want to share with you.

5 "It is a pleasure to welcome each of you to
6 one our beautiful State's most impressive and nationally
7 significant landmarks, the Green Bank Telescope
8 Observatory. For sixty years, the Foundation,
9 Pocahontas County, and the State of West Virginia have
10 supported the ability of enumerable national and
11 international scientists to make discoveries about our
12 universe using the capabilities located at the
13 observatory within the National Radio Quiet Zone.

14 "During this time, the local communities have
15 made sacrifices to keep the surrounding area radio
16 silent to ensure that the activities at the observatory
17 can continue without interference. As we look to the
18 future, I believe that the observatory's contributions
19 to national and international science and the West
20 Virginia commitment to this work justifies the
21 Foundation's strong, continued full-time support and
22 presence at the observatory.

23 "I strongly oppose the proposed arbitrary
24 21-week implementation period for demolition,

1 mothballing, and/or self abandonment, and I believe that
2 the Foundation has a responsibility to identify and
3 secure additional partners before affecting any change
4 to the infrastructure or funding support at the
5 observatory.

6 "We owe it to our children, our future
7 leaders, to uphold the integrity that this facility has
8 provided in regard to STEM programs and community
9 efforts. By continuing to integrate these skills
10 throughout our communities and in our schools, we are
11 showing our future leaders that we are investing in them
12 and that their statewide community wants them to be
13 succeed in return.

14 "Green Bank is a vital link to the future of
15 our home state and entire nation and we simply can not
16 turn our backs on this world class facility."

17 Am I out of time? Okay.

18 I just want to say that the Green Bank
19 Telescope, or as I affectionately call it The Great Big
20 Thing, is a friend and I don't want to lose my friend.

21 Thank you.

22 MARY ELIZABETH ECKERSON: I'm Mary Elizabeth
23 Eckerson. I'm with U.S. Senator Shelly Moore Capito.
24 My name is M-a-r-y, E-l-i-z-a-b-e-t-h, Eckerson,

1 E-c-k-e-r-s-o-n, and I'm happy to represent Senator
2 Capito today regarding our crown jewel which is the
3 Green Bank Telescope and this entire facility.

4 "Thank you for including me today for your
5 discussion regarding the National Science Foundations's
6 Draft Environmental Impact Study for Green Bank
7 Observatory. I regret that my obligations in the Senate
8 prevent me from joining you in person.

9 "If there is a word to describe the Draft EIS
10 I would use the word "exhaustive." I commend those who
11 took the time and effort to compile this report. Though
12 I'm not able to attend this meeting, if they are
13 anything like those in the past to discuss the future of
14 Green Bank, I know there are First Responders standing
15 next to researchers and school children sitting near
16 their teachers along with current small business owners
17 and maybe more than a few future scientists. This
18 represents the impact and the opportunity that Green
19 Bank embodies.

20 "When I submitted a letter in November of
21 2016, I asked NSF to not overlook the less easily
22 measured impacts which, among soil and climate impact,
23 hit home to me as I read through your report.

24 "We have talked about how Green Bank is the

1 potential portal for history-making research, but let's
2 not overlook that the Green Bank Observatory is a
3 certified Red Cross shelter for this area, that the
4 water tower is used by several fire stations, and that
5 the GBO staff, in addition to their daily work, serve as
6 the backbone to this area through their work in
7 community organizations and emergency service crews.

8 "In addition to monitoring potential life in
9 the solar system, these men and women are playing a huge
10 role in improving life for those in Pocahontas County.
11 I have long advocated the partnership model for Green
12 Bank. In this time of limited financial resources from
13 the Federal government, maximizing partnerships, whether
14 with universities, other government agencies, or private
15 industry, is something we should always be pursuing.

16 "I have been and will continue to be an
17 advocate for the potential that exists at Green Bank.
18 That potential rests in its facilities, its community
19 and in the men and women who work here. Let's work
20 together to fulfill that potential for it holds exciting
21 promise for all of us. It is truly an honor to serve
22 you in the United States Senate. Sincerely, Shelly
23 Moore Capito." Thank you.

24 JORDAN MAYNOR: My name is Jordan Manor and

1 I'm here on behalf of Congressman Evan Jenkins.
2 J-o-r-d-a-n, M-a-y-n-o-r. I also brought a letter to
3 read tonight and I'll be as quick as possible.

4 "Dear friends, I regret that I cannot be here
5 today because of scheduled votes in Washington, DC;
6 however, I do want to express my strongest possible
7 support for the Green Bank Observatory.

8 Green Bank is truly a gem in the mountains of
9 our state and it must be fully funded and preserved. We
10 know the incredible work that takes place here, the
11 undeniable influence this facility has on scientific
12 research and the irreplaceable impact it has on our
13 community and on our State. This facility must remain
14 open and fully operational.

15 "Just yesterday I met with top NSF officials
16 to discuss the future of Green Bank, the Draft EIS, and
17 the work being done to identify new strategic partners
18 to work with NSF here at Green Bank.

19 "I have also had multiple conversations with
20 NSF Director Cordova and the Foundation over the past
21 few years in an effort to make the strongest case
22 possible for a strong, secure future for Green Bank.

23 "I am encouraged and very optimistic that the
24 commitment from NSF is sincere and the future funding

1 possibilities are real. As your Representative in
2 Congress, I am pledging my full, active support to
3 facilitate contacts and build relationships with other
4 Federal agencies to secure a new strategic partner.

5 "We must preserve this world-class telescope
6 and research facility. As potential partners come
7 forward, the focus will always remain in ensuring that
8 Green Bank is able to continue its ground-breaking
9 research and that West Virginia is still able to bring
10 in top scientists and researchers.

11 "We must also preserve the exceptional
12 educational resource the Green Bank Observatory gives
13 students, a truly unique opportunity for hands-on
14 experience.

15 "For many of the students who come to Green
16 Bank, this visit will shape their future career
17 aspirations in science, technology, engineering, and
18 mathematics. The lessons learned at Green Bank will
19 stay with these students for a life time.

20 "The Green Bank Observatory affords incredible
21 job opportunities for the people of West Virginia and
22 those who are here are a true asset to our state. The
23 employees here not only dedicate their time to
24 researching life's great mysteries but they also give so

1 much back to the community by helping students learn and
2 prepare for a successful future.

3 "We have a world-class observatory and world-
4 class employees. The call I make to the NSF and the
5 call I ask you to make here today is that we are here
6 ready to work with you to make sure that Green Bank
7 stays open and fully operational. And we also call on
8 NSF to make sure that the core mission of Green Bank is
9 not lost, the mission of discovering what makes our
10 universe work, discovering how stars and planets form,
11 and how they can support life, and discovering the
12 fundamentals of life.

13 The Green Bank Observatory is important to
14 West Virginia and is important to the world. Thank you
15 for being here and making your voices heard. This is
16 another opportunity for all of us to show the value of
17 Green Bank and what West Virginia has to offer. Keep
18 Green Bank here and keep Green Bank open.

19 Sincerely, Congressman Evan Jenkins."

20 Thank you.

21 KRISTEN HAMILTON: Next up we have Jack Tade,
22 John Taylor, and Jim King. Is Jack Tade here?

23 JACK TADE: Good evening, my name is Jack
24 Tate, that's J-a-c-k, T-a-d-e. I'm the corporate

1 controller for Associated Universities, Incorporated,
2 I'm here to represent the corporate office. AUI is the
3 organization that manages or is responsible for managing
4 the NSF Green Bank Observatory and it's operations. On
5 behalf of AUI I'd like to strongly express that we
6 support the outstanding scientific research performed
7 here at this facility and value the deep involvement
8 with Pocahontas County and their communities. We look
9 forward to working with the National Science Foundation
10 throughout the process and hope to continue our support
11 for and service to the local communities. Thank you.

12 JOHN TAYLOR: My name is John Taylor, J-o-h-n,
13 T-a-y-l-o-r. I am the vice president of the Central
14 Appalachian Astronomy Club, and our club, and I don't
15 know how I got to go right after those high powered
16 speakers, but our Astronomy club annually, for the last
17 14 years, in cooperation with the Kanawha Valley
18 Astronomy Club and with the collaboration, of course, of
19 the Green Bank Observatory has held an affair here,
20 called a star party called Star Quest.

21 Star Quest is billed as the only optical and
22 radio astronomy star party. We get to operate the
23 40-foot telescope as well as look, it's a great dark sky
24 site for a star party. Most star parties are held in

1 tents, we've got this nice facility at our keynote
2 speakers.

3 We have four keynote speakers. It's basically
4 a four-day event. In the past, we've had Alan Bean who
5 is the fourth man to walk on the moon. We've had
6 Carolyn Shoemaker. We've had Seth Shostak. So we've
7 had some really high powered folks to come in to our
8 Green Bank star quest.

9 This is a unique facility to hold a star party
10 in. Like I said, most of them are held in tents. We've
11 got a great facility to do this in. And as an
12 educational facility and -- this is just one of many
13 things that Green Bank Observatory does.

14 I'm a retired school teacher. Some 25 years
15 ago, I participated in a two-week National Science
16 Foundation teachers affair that we had a workshop
17 basically. Then we had a number of speakers in and
18 learned a lot of Astronomy.

19 And basically, I went back to my high school
20 and started an Astronomy class based on that. And I
21 had, for several years, a number of students pass
22 through my classroom taking Astronomy and it was all
23 inspired by Green Bank Observatory.

24 So Green Bank Observatory as an educational

1 facility is unmatched, and it would not exist as an
2 educational facility without the observatory being here
3 and the work that the observatory does. So, you know,
4 we are very grateful.

5 I can't speak to the science as well as a lot
6 of the people, but, you know, this is a facility, it's
7 probably the only observatory, radio observatory that's
8 in a radio quiet zone. There's got to be something to
9 be said to keep that operating.

10 So by all means, I think the Green Bank
11 Observatory should be as fully funded by the National
12 Science Foundation as it can be and collaborators should
13 be found to keep it working. Thank you, very much.

14 JIM KING: My name is Jim King. I'm the
15 co-founder of the Central Appalachian Astronomy Club.
16 And I've been with John here for several years in
17 regards with the Star Quest. He's pretty well told you
18 about that event.

19 Some of the other things that have happened as
20 regards to the star quest is that we have children's
21 events and the children come here with their families
22 and attend star quest and, hopefully, they're inspired
23 to pursue science, and we need scientists.

24 In our own club, we have several of the club

1 members who have gone on after being in the club to be
2 Physicists and Geologists, et cetera. And that -- so
3 it's all from a spark of a place like this, you know.
4 We come here and we learn things and we try, you know,
5 as we come here trying to teach some things, you always
6 learn some things.

7 So it's really a win-win situation for us that
8 Green Bank is here. And it would be a devastating blow
9 to our club if we could not have this facility to
10 present our star party. There is no other facility in
11 the state that we could go to that we would have this
12 kind of infrastructure.

13 The other thing is like Green Bank, if you
14 close your eyes and you can't see anything; right?
15 Well, Green Bank is an eye with a telescope to the sky.
16 It sees things that optical telescopes cannot see.
17 There's, you know, like pictures out in the 00 and
18 they're showing like galaxies. Well, this little
19 picture in the middle, that's what we could see with an
20 optical telescope. With a radio telescope, we saw all
21 these clouds of hydrogen gas all around it. So it's
22 important that we have this kind of equipment
23 infrastructure to see the universe.

24 We are like a small speck in the universe, the

1 whole planet. But if we, you know, can't see and don't
2 understand what's going in the universe then our ability
3 as a race, society, whatever, is limited. We need to
4 understand what's going on out in the universe and this
5 is a, one of the most finest places I've ever been that
6 you can learn and have a lot of real science going on.

7 One other thing here, when we were here, one
8 of the star parties that we had, they had the deep
9 impact where they shot the missile to the comet. And we
10 were the first people -- the head astronomer that was
11 doing this came in here, we were having a meeting that
12 night like this, he came in and told us they had
13 discovered water. They had it had always been
14 hypothesized, but it had never been proven. Am I done?

15 KRISTEN HAMILTON: Complete your thought.

16 MR. KING: Okay. Anyway, but I mean,
17 basically, that's what I wanted to say. I mean, this is
18 a really important place. The people here are top
19 notch. I would hate for them to have to go out and look
20 for other jobs, because, and I'd hate to lose a lot of
21 friends because there's a lot of friends I have here.

22 So thank you, very much.

23 KRISTEN HAMILTON: David Wilfong, I believe, I
24 apologize. I can't tell if that's a U or a W. It says

1 this gentleman is identified as a farmer. Then we have
2 Diane Schou and Sue Ann Heatherly. Is David here?

3 Okay, great.

4 DAVID UMLING: Good evening, I'm sorry, my
5 actual name is David Umling, D-a-v-i-d, U-m-l-i-n-g. I
6 was raised on a small family dairy farm and I, after a
7 30-year career have retired to try to survive on a
8 homestead farm here in West Virginia.

9 And I guess, I haven't read this report. I
10 apologize to anybody for that, but if I had, I'd
11 probably be up here talking about a bunch of acronyms
12 and technical terms that nobody's going to understand
13 and I'd rather just speak plainly to you.

14 But basically, what I'm concerned about is
15 having seen that there are only four options that this
16 National Science Foundation has come up with to evaluate
17 in it's report, I'm quite dismayed that we have here a
18 body that represents the scientists and the intellect
19 that we depend on to try to answer some of the most
20 difficult, perplexing, and complex questions about our
21 existence in the universe that we have to face today.

22 And the best that they can do is come up with
23 four alternatives, two of which is shutting this thing
24 down. This facility has a 50-year life span. Over that

1 time it's had some important discoveries. And now they
2 say there are other facilities that make it obsolete,
3 basically.

4 Well, I would have to ask, you know, if we're
5 not really seeing here the unintended final results from
6 long deferred maintenance and upgrade of our facility,
7 when things could have been made more relevant or kept
8 up to the highest technology that exists today, but I
9 understand this facility still makes important
10 discoveries.

11 So I question, you know, whether we're seeing
12 a self-fulfilling prophecy here and the expectation that
13 NSF is going to divest it's investment in our community.
14 I think the State has done a lot for the National
15 Science Foundation, and for this facility as well as it
16 did for Sugar Grove. I live in Pendleton County and the
17 Sugar Grove facility in our county is in the National
18 Quiet Zone. It was set up for it originally as well.

19 And if the National Science Foundation wants ,
20 is appreciative of the investment that was made on their
21 behalf to make this facility something important, then
22 they should have put money into it while they had it
23 instead of waiting until they get to the point where
24 they don't have money and then saying they need to close

1 it down.

2 Well, I don't think that's a good decision, I
3 don't think it represents perhaps a policy that was
4 sustainable or good to begin with. But I would like to
5 remind them of a scene from the movie, Carl Sagan movie,
6 Carl Sagan's movie Contact, where the star of that
7 particular story Ellen Arroway, has made this discovery
8 of other civilizations and picked up this signal from
9 some other society, extraterrestrial out there in the
10 vicinity of Vega.

11 And she had a person that she worked for by
12 the name of David Drumlin who was very much against
13 everything she did, and wanted to shut it down many
14 times and worked to defeat her efforts to try to fund
15 her program that resulted in this discovery.

16 And of course when the discovery is made,
17 these people from somewhere else has sent us plans for,
18 design plans for transport that will take one astronaut
19 to go and visit them and make the first contact. And
20 Ellen decides she wants to go on this trip. And, but so
21 does David Drumlin and when the two of them compete,
22 she's asked some very difficult questions by a committee
23 that makes it hard for her to tell, to be honest and to
24 be able to earn the committee's support for her

1 candidacy to be the astronaut.

2 But David Drumlin, he goes ahead and tells
3 them whatever they want to hear and he's the one who
4 wins. And later on when he meets up with her he says,
5 Ellen, I'm sorry. I wish this was the kind of world
6 where the integrity and honesty that you showed before
7 the committee in trying to answer those difficult
8 questions were rewarded instead of taken advantage of.
9 And her one line response was, Funny, I thought the
10 world was what we make of it.

11 And I want to ask the National Science
12 Foundation: What do you think you're going to be making
13 of our world when you make this decision?

14 I reject the idea that this facility need to
15 closed down and shuttered. I know what happened to our
16 community in Pendleton County when Sugar Grove was
17 eliminated, and I don't believe that anything good has
18 ever come to West Virginia when outside interests have
19 divested themselves of their obligations to our state.
20 And I would question seriously whether you're just going
21 to do the same thing to us. Thank you.

22 DIANE SCHOU: Hello. My name is Diane Schou,
23 and that's spelled S-c-h-o-u. I am here in Green Bank
24 because of a special environmental -- oh, Dear I lost

1 the word -- but because of the environment here. I was
2 injured by over exposure, from over exposure to
3 emissions from a cell phone tower. There are a number
4 of other people here who are also harmed by
5 electromagnetic radiation.

6 There was one day that several of us reacted.
7 We didn't know why, but there are 82 different symptoms
8 and out of eight people, six of us reacted at the same
9 time. This was about 3:00 o'clock in the morning. We
10 don't know what happened. It woke me up. It woke up
11 six other people.

12 I contacted the government to find out what
13 was it that occurred at 3:00 o'clock in the morning,
14 that we woke up, we got out of bed, we did stuff, we
15 lived miles apart, what happened?

16 And this is why I am here at Green Bank
17 because there are less electromagnetic radiation
18 emissions. It's safer here. And a number of people are
19 here because they have less symptoms by being here.

20 There are many, many emissions that are
21 invisible. Some of them may be legitimate, such as
22 emissions from cell phone towers, fortunately not here
23 in Green Bank. But there are also emissions, they may
24 be illegal. And one emission, I contacted a person when

1 several of us were detecting it, and I was told that it
2 was, they could not tell what that emission was. They
3 were prohibited from doing that. And if they did they
4 could be, I don't know what the consequences were.

5 I guess that's about the summary of this.
6 This is why I'm here in Green Bank, and why the
7 observatory is essential, and it's essential for people
8 around the world, not just for West Virginia but this is
9 the safest place and a safe place to live.

10 SUE ANN HEATHERLY: I'm Sue Ann Heatherly,
11 S-u-e, A-n-n, H-e-a-t-h-e-r-l-y. And I'm the education
12 officer here at the Green Bank Observatory.

13 I didn't read the Draft EIS from cover to
14 cover, but I did do some searching on it and would like
15 to bring up a few points that I think were either
16 understated or need further investigation before final
17 draft or before the Final EIS is produced.

18 And one them is, of course being the education
19 officer, is the impact of the observatory's educational
20 programs which really do depend on having a vibrant
21 scientific operation here. It's just not possible to
22 have the alternative happen where we give tours of, you
23 know, decaying facilities out there in the field and
24 trying to operate an educational program without a

1 scientific program happening here.

2 On page 3-59, the Green Bank Observatory's
3 education programs are listed there and then they're
4 referred to several times throughout the whole document,
5 but they are completely under reported.

6 And when comments were sent in last time
7 around, I sent them a seven page detailed description of
8 numbers, all the educational programs that we do that
9 you can find in the comments from last time. I think
10 they need to be addressed in the final report because
11 it's a lot bigger than was stated.

12 Regarding that the 20-meter telescope was not
13 mentioned very often at all and kind of slated to either
14 be mothballed or a potential telescope to be removed
15 from the site, but it is our robotic telescope that
16 allows students all the way up through undergraduate and
17 even graduate school, to use a regular telescope no
18 matter where they are. And so the impact of the loss of
19 that reaches far beyond our community and our state. So
20 I want that to be addressed also.

21 With regard, regarding historic properties,
22 the 43-meter was listed as one that should be kept, but
23 yet the table telescope was listed as one that could be
24 potentially demolished and I thought that was odd.

1 That's the first one here. That's the one that Frank
2 Drake used, so I don't know what, you know, what
3 rationale went into that but I'd like to see a response
4 to that.

5 And finally, I searched for West Virginia
6 University, I'm an alum, and a lot of the educational
7 programs that I do are in partnership with WVU and we
8 make use of a very vibrant astronomical staff and it's
9 just faculty that are there. And they are there because
10 of the GBT and because of this observatory.

11 Yet that environmental impact, that socio-
12 economic impact which goes far down to our county wasn't
13 really addressed, I didn't see in the Draft EIS as far
14 as the loss of this place for West Virginia University's
15 Astronomy department and what that would do.

16 They have garnered over \$13 million in grants
17 since 2012, when this whole nightmare began. So and
18 that's for research using the GBT. So I think that
19 needs to be brought out as a big environmental impact.

20 Thank you, very much.

21 KRISTEN HAMILTON: Next we have Micky Holcomb,
22 Becky Rabel, Blake Humphrey.

23 MICKY HOLCOMB: Hi, my name is Micky Holcomb,
24 that's M-i-c-k-y, H-o-l-c-o-m-b. I'm a faculty member in

1 the Physics and Astronomy department at West Virginia
2 University. I am not an astronomer. I'm a materials
3 physicists. As far as I know, my research field has
4 absolutely nothing to do with anything going on here.
5 In fact, this is my first time coming. It's very nice.

6 I wanted to take time away from my own work
7 today because in the eight and a half years I've been at
8 WVU, I've seen the incredible impact that the Green Bank
9 Observatory has had on our department's research
10 program. Since 2006, our Astrophysics faculty has grown
11 from one to six, and that group brings in more research
12 dollars per capita than any other in our department.

13 The Physics Frontier Center Award, which are
14 very competitive, shows that they are not just one of
15 the flagship research programs at WVU, but thought to be
16 one of the most transformative science programs of the
17 broader Physics community.

18 There are currently 15 graduate students
19 working with the group and the majority of which are
20 involved in research with the Green Bank Observatory.
21 An even greater number of undergraduates are involved
22 with researches for pulsars with the GBT and many of
23 these students got started as high school students in
24 the Pulsar Search Collaboratory Outreach program.

1 Let me do something that's a little unusual
2 and be brutally honest about my own field. Most
3 physicists and maybe even most scientists aren't the
4 best at communicating the importance of their work to
5 young generations; however, this program has been really
6 important, almost like a gateway drug, for bringing
7 awareness to STEM fields in the state and beyond, and in
8 particular, has been critical for increasing the number
9 of West Virginia girls going into these fields.

10 In fact, the fraction of female physicists,
11 Physics majors has increased from 10 percent a decade
12 ago to 30 percent now. And a good fraction of those
13 girls joined because of the Physics Frontier Center.

14 Every once in a while, one of those excellent
15 young women or men will switch to my field and I'm so
16 happy that this program has encouraged them to pursue a
17 career in science, which is so critical for our
18 country's future, not just West Virginia.

19 So the Green Bank Observatory is the premier
20 science facility in the state and is critical for both
21 WVU's research profile and the education that remains
22 open at current funding levels.

23 KRISTEN HAMILTON: Is Becky here, Becky Rabel?

24 UNIDENTIFIED SPEAKER: She was.

1 KRISTEN HAMILTON: Well, if she shows up, she
2 can speak at that time. Blake Humphrey.

3 BLAKE HUMPHREY: Well, good evening. My name
4 is Blake Humphrey, that's spelled B-l-a-k-e,
5 H-u-m-p-h-r-e-y, and I am the student body president at
6 West Virginia University.

7 And less than 48 hours ago I would have never
8 expected that I'd be at the Green Bank Telescope today
9 with you all. But after hearing about this hearing, I
10 wanted to speak on the importance of this to young
11 people, not only at West Virginia University but in the
12 State of West Virginia. And I look here and I see two
13 young people and I think about them all across the
14 state. And I'm from West Virginia and I think of them
15 and the impact that this would have on the future of our
16 young people.

17 But to speak of the student impact, and my
18 friend from WVU just touched on that, not only do we
19 have undergraduate and graduate students here at the
20 Green Bank Telescope and working in partnership with
21 Green Bank, but we also have research, exploration,
22 innovation, education, training, and life changing
23 experiences that can change someone's trajectory.

24 Now, I'm going to talk very briefly about the

1 fact that recently, WVU obtained an R-1 research
2 classification and we have a world-class student body
3 and world-class students who do amazing things each and
4 every day, including in partnership here with the Green
5 Bank Telescope.

6 And my own unique experience here today, and I
7 want to underline that word "unique," I think emphasizes
8 the importance of the Green Bank Telescope for the State
9 of West Virginia. You know, before we started all of
10 this, I had the chance to take -- I just turned off the
11 lights. Only I could do that. I'll keep talking.
12 Maybe it wasn't me.

13 KAREN O'NEIL: I believe someone might be
14 leaning on the light switch in the back. It will wake
15 us up.

16 BLAKE HUMPHREY: I'll reclaim a little bit of
17 my time. But my experience today taking a quick walk
18 out over to the telescope and taking a peek at it only
19 emphasizes to me the importance of it's uniqueness in
20 West Virginia.

21 And the activities that are undergoing here at
22 the Green Bank Telescope can continue to inspire
23 research because of the fact that as it says -- I did it
24 again -- as it says, outside on the wall entering, "The

1 universe is whispering to us," and no doubt, the Green
2 Bank Telescope is listening.

3 In Morgantown, we say at West Virginia
4 University that Mountaineers go first. Mountaineers go
5 first. And today I think that we should all say as West
6 Virginians, as a science community and beyond, that the
7 Green Bank Telescope has gone first and by gosh, the
8 Green Bank Telescope must continue to go first.

9 Thank you, very much.

10 MS. HAMILTON: Next is Mayuresh Surmis, Sheena
11 Murphy, and Paul T. Baker.

12 MAYURESH SURMIS: Okay. Good timing, right?
13 Okay. My name is M-a-y-u-r-e-s-h, S-u-r-m-i-s. I'm a
14 post-doc at WVU and I actually work on some of these
15 things like pulsars, for example. I have no written
16 statement with me but people have talked about how
17 science is important so I won't want to go into that.

18 But the first real experience at the GBT which
19 I had after joining here as a post-doc, is the PSE,
20 which is where school kids actually get involved in
21 active research with us people and, I mean, I have seen
22 how people's faces light up when they see something
23 which only scientists are suppose to see so --

24 I mean, as a scientist, I would really like

1 this facility to be open but just from a perspective of
2 a layman, in order to understand what people in science
3 are doing and getting inspired by that and, you know,
4 you don't have to necessarily end up being a scientist
5 yourself. But even if you are not ending up as a
6 scientist, you see these people doing those
7 extraordinary things.

8 Being able to be one of them for some time and
9 understand how things work, that's something which I
10 think should not be taken away from school kids. So I
11 guess from that standpoint, I would rather like to have
12 facilities like this open.

13 To add to that, I come from India where
14 there's an another observatory called the GMRT, where I
15 actually wasn't in charge of -- there's something called
16 a science day where about 20,000 people visit the
17 facility in two days. And I have seen the wonder on
18 people's faces when you explain to them what we are
19 doing here so --

20 And I would really like people to still have
21 that sense, you know, adventures, you know, just looking
22 at the sky and, you know, knowing that place in the
23 universe, knowing how things work so such things are
24 real important for that. Thank you.

1 SHEENA MURPHY: So I'm Sheena Murphy,
2 S-h-e-e-n-a, M-u-r-p-h-y, and I'm the Associate Vice
3 President for Research Development at WVU. Thank you
4 for coming to Green Bank and thank you for the
5 opportunity for us to provide input into this important
6 process.

7 I have taken the time to read the draft
8 environmental report. It covers biology, water,
9 geology, culture, visual aspects, but no where in the
10 report, anywhere, does the word "pride" or "proud"
11 appear and that is an oversight.

12 The Green Bank Telescope is one of the premier
13 facilities of which West Virginia is proud and we have
14 every right to be. Indeed, any state would be proud to
15 have this facility and we're just fortunate enough to
16 have it in our backyard. As well as being a linchpin of
17 the community, is it of vital importance to outstanding
18 science at WVU as well as graduate and undergraduate
19 student training.

20 I'm now going to quote from an NSF report that
21 was issued earlier this week which was a review of the
22 Physics Frontier Center, NANOGrav, which is one of the
23 principal users of this facility. It is an exhaustive
24 review. I'm just taking little pieces from it.

1 "NANOGrav is making great scientific progress
2 and has an excellent chance of detecting gravity waves
3 within the award period. The team has an extremely
4 strong publication record resulting from these many
5 research accomplishments. As a result, NANOGrav is a
6 clear and visible leader in the field and well ahead of
7 once comparable efforts based in Europe, South Africa
8 and Australia. The detection of Nanohertz Gravity Waves
9 is probably not far off and will reveal a completely new
10 aspect of the universe."

11 These are directly from a NSF report on the
12 NANOGrav center issued this week. So what isn't there
13 to be proud of.

14 And so when you turn to the environmental
15 impact survey, it's very thorough but the devil is in
16 the details and we don't know what those details are in
17 moving forward.

18 The preferred agency alternative is for
19 continued operation but with reduced funding. What
20 reduction is planned? There are no numbers in the
21 report. If we use what happened to Arecibo as
22 representative of what might happen here, it frightens
23 me because there the funding falls right off the cliff
24 and we don't know what to anticipate here.

1 Likewise, there's a statement that
2 collaborators are being sought and new partnerships.
3 Who are these collaborators? How aggressive is your
4 search for these collaborators?

5 So in closing, the absence of hard numbers and
6 identified collaborators in this preferred action plan
7 A, only offers a false sense of security. We are proud
8 of the GBO and I ask that the NSF keeps it a facility
9 that we in West Virginia and the nation can continue to
10 be proud of. Thank you.

11 PAUL BAKER: Hello. I'm Paul Baker, spelled
12 as you would expect. I'm a post-doctoral fellow at West
13 Virginia University. I work in the Center for
14 Gravitational Waves and Cosmology, NANOGrav, which we've
15 heard about a little bit.

16 And I will say that the socio-economic impact
17 on the facility goes well beyond just the local
18 community but extends across the entire state. My job
19 wouldn't exist without the Green Bank Observatory so
20 that's a reason.

21 But just WVU in general is drawing lots and
22 lots of research money from research at the Green Bank
23 Observatory and the strength of the astrophysics group
24 there is dependent upon the Green Bank Observatory. So

1 any reduction in scientific operations will have and
2 economic impact that extends far beyond the local
3 community, throughout the entire state. Thanks.

4 KRISTEN HAMILTON: Next up is Carla Beaudet,
5 Kaitlyn Witt, Rodney Elliott.

6 CARLA BEAUDET: Carla Beaudet, C-a-r-l-a,
7 B-e-a-u-d-e-t, I'm an engineer here at Green Bank.

8 I know that there's going to be more brought
9 out about the socio-economic impact and my focus is just
10 on that segment of the EIS. And it's the only part that
11 I read so here we go.

12 I'd like to thank the members of the EIS
13 committee for doing a great job on the socio-economic
14 impact section of the Green Bank draft EIS. When I
15 addressed this committee last year, I was afraid that in
16 a cut-and-past world that section of the report would
17 come out looking like the socio-economic impact section
18 of the Arecibo EIS which listed minimal impacts.

19 I'm very happy to say it's clear that you
20 listened to the outpouring of concern and disbelief from
21 this community. That which is at stake is well
22 reflected in the Draft EIS both in detail and also in
23 the executive summary by considering the impacts to West
24 Virginia, Pocahontas County, and Arbovale-Green Bank

1 area separately. We did not sweep the worst of impacts
2 under the rug as would have happened if only West
3 Virginia were considered as a whole.

4 By listing to the many ways the Green Bank
5 facility serves the community and by pointing out that
6 alternative services are non-existence in this area, you
7 make it clear what vital resources would be lost if
8 Green Bank Observatory folded.

9 By detailing the numerous capacities in which
10 Green Bank employees participated in and support the
11 local community, you plainly illustrate what's at stake
12 here so thank you, again, for listening to us.

13 KAITLYN WITT: My name is Kaitlyn Witt,
14 K-a-i-t-l-y-n, W-i-t-t, and one of the things I just
15 wanted to point out was that, as some people have said
16 before, Green Bank's impact goes much farther than just
17 the local community or even just the state.

18 I'm a member of NANOGrav which some people
19 have spoke about before, which is a national
20 collaboration and we also collaborate internationally.
21 So Green Bank's data affects not just our country and
22 our state but also research worldwide.

23 And it's not just graduate students or faculty
24 and high-level scientists that benefit from the use of

1 the facility. I teach an undergraduate lab where
2 students are able to use the 20-meter telescope and
3 without that, they would have no way to do that. Many
4 of them have heard of Green Bank before they took the
5 class. A lot of them are from West Virginia and that
6 spurred their interest to pursue Astronomy even though
7 most of them are not Physics or Astronomy majors.

8 So it's been a wonderful opportunity for them
9 and those students will spread nationwide and hopefully
10 spread their interest and knowledge of what they've
11 learned. So it's a great interest-building and
12 inspiration to a lot of people that should stay around.

13 RODNEY ELLIOTT: My name is Rodney Elliott.
14 That's R-o-d-n-e-y, E-l-l-i-o-t-t. I'm a Physics student
15 at WVU as well. I participate in research that relies
16 heavily on observations from GBO, but I'm also the
17 president of the WVU Astronomy Club. And one of the
18 things I get to do in that capacity, I consider a
19 privilege, actually, is a couple of times a month I get
20 to interact with the public and share the night sky with
21 them from our rooftop observatory in Morgantown.

22 I can't tell you how many kids I've met that
23 have been inspired by this facility, inspired to pursue
24 a career in science and I'm concerned that any loss of

1 funding to this facility or others like it will be
2 effectively shutting a door to an entire generation of
3 future American scientists. That's all I have.

4 KRISTEN HAMILTON: Next up is Olivia Young,
5 Bob Sheets and Kathryn Williamson.

6 OLIVIA YOUNG: Hello, my name is Olivia Young,
7 spelled, O-l-i-v-i-a, Y-o-u-n-g.

8 My first actual experience with Green Bank was
9 the week and a half I spent here when I was in tenth
10 grade during West Virginia Youth Science Camp. During
11 that time, the seeds were sewn for this farm girl from a
12 small tiny roadside town in the eastern panhandle of
13 West Virginia, to one day realize that she wanted to be
14 an astrophysicist.

15 Now, that brings me to where I am at this
16 current moment. I am an undergraduate, a sophomore, at
17 WVU studying Physics. I'm involved in the pulsar
18 research with Dr. Maura McLaughlin and we use the GBT to
19 discover and study these fascinating stars that act as
20 laboratories in the sky for some of the most amazing
21 physical processes in the entire universe, including
22 research on detection of gravitational waves.

23 However, my fellow undergraduates, professors,
24 and graduate students and I aren't the only ones that

1 are having this once-in-a-lifetime opportunities and
2 experiences that the GBT offers, presented to us.

3 Through groups like SPOT, which is the
4 Scientific Public Outreach Team and the PSC which is
5 Public Search Collaboratory, Pulsar Search
6 Collaboratory, pardon, we go to elementary, middle and
7 high schools throughout the state and bring them wonders
8 of the universe and a passion of scientific discovery to
9 young, brilliant minds of our state.

10 The impact of the Green Bank Telescope is far
11 reaching and vitally important to not only the
12 progression of scientific research but also to the
13 development of the youth of our state.

14 I can say with absolute confidence that
15 because I'm a West Virginian, I am a scientist. And I'm
16 a scientist because of the GBT. So I implore you on the
17 grounds of our youth, of our state, and of humanity as a
18 whole, please continue to fund with the utmost of your
19 ability the wonders and opportunities the GBT brings to
20 our tiny planet from beyond the reaches of our solar
21 system and our galaxy. Thank you.

22 BOB SHEETS: My name is Bob Sheets. B-o-b,
23 S-h-e-e-t-s. I'm here representing the Pocahontas County
24 Historical Landmark Commission. I'm the liaison with

1 that particular organization and the group that is
2 making this assessment. Our president is here and he
3 will speak to you later.

4 The thing I would like to say is I would like
5 to commend the group, as Carla did earlier, for the work
6 they did in the historical section with at least one
7 thing that Sue Ann brought up earlier, the 85-1 Tatel
8 telescope should definitely be on there as an historical
9 landmark. It was the first dish here and it's where
10 Frank Drake went first here in West Virginia in his
11 search for extraterrestrial signals and I think that's
12 something that should be upgraded in the report. I'll
13 address it in written comments later on.

14 The other thing I would like to do in this
15 period as I'm talking to you is encourage those of you
16 that are local and have been here for a while, like
17 Mr. Harold Crist, and have knowledge that we may not
18 have -- and these folks may not have. As I said, they
19 did a good job with the history -- but there are some
20 things out there that we may not be aware; for instance,
21 on the original encouraged action, the Hannah House is
22 preserved but in the next, it is demolished.

23 And that house was the home to George Burner,
24 and Mike Holstein and I serve on the bicentennial

1 commission here and George Burner was one of our first
2 county commissioners. He was a delegate to the Virginia
3 legislature for two terms back in the 1820s, and we
4 would hate to see that historical landmark go away.

5 He took up arms at one point, that was called
6 the Civil War. His father took up arms at one point, it
7 was called the Revolution and he was at Valley Forge
8 with George Washington.

9 So there are some historical components here
10 that these folks may not know about. I think they've
11 done a good job with what they had to work with. But
12 those of you in the community, if you have stories, if
13 you have knowledge, if you have information, please
14 convey them in the written comment period, get in
15 contact with me, Jason Bauserman, we need to add the
16 rich historical legacy that we do have here and make it
17 part of the ongoing record. Thank you.

18 KATHRYN WILLIAMSON: Hey there. My name is
19 Kathryn Williamson, K-a-t-h-r-y-n, W-i-l-l-i-a-m-s-o-n.

20 I'm an Astronomy professor at WVU but I used
21 to work here as the education specialist. I arrived
22 here in 2013, with a big, bad Ph.D. and no practical
23 skills at all. And so thanks to Sue Ann Heatherly and
24 all the staff here in Green Bank, I gained really all of

1 my inspiration to, and all of my purpose, honestly, in
2 giving back to students and giving back to West
3 Virginia.

4 I'm not from West Virginia. I'm from Georgia,
5 but I feel like West Virginia is my state now. I see
6 there's so much potential, there's so much pain, there's
7 so much hardship, but I believe that West Virginia has
8 so much potential. And the Green Bank Observatory is
9 part of that potential.

10 Every semester, over 200 of my Astronomy 106
11 students use the 20-meter telescope through the Sky
12 Night Robotic Telescope Network. So I want to
13 underscore what Sue Ann said, that needs to be included
14 and emphasized in the report.

15 Through using the telescope, my students are
16 able to determine our direction of rotation around the
17 center of the Milky Way, that we live in a spiraling
18 galaxy, and we find evidence of dark matter.

19 Now, most of my students aren't going to be
20 scientists and most of them aren't ever going to need to
21 really talk about dark matter, but it gives them that
22 sense of pride and it gives them the skills to think
23 critically and that's what our nation needs. That's
24 what West Virginia needs.

1 So Green bank Observatory is basically why I'm
2 at WVU. There's no way that I would have the skills in
3 order to give back to the students at WVU and the
4 students in our state without Green Bank Observatory.

5 While I was here, we also started the Science
6 Public Outreach Team which Olivia mentioned. We trained
7 dozens of college students around the state, all
8 operated out of Green Bank. So we're giving back.
9 We're inspiring over 4,000 students every year in K
10 through 12 audiences.

11 But the biggest impact is on the college
12 students. Without any prompting, our ambassadors, our
13 future -- they're education majors. They're our future
14 educators. They have just said on their own volition, I
15 was afraid to teach science and now because of coming to
16 Green Bank, because of participating in SPOT, I'm not --
17 they're excited to teach science now. That's one of the
18 greatest investments we can make in this state.

19 And SPOT is just one of the amazing programs.
20 People have mentioned the pulsar search laboratory. No
21 one has mentioned the First-To Network which is about
22 training first generation college students. And there's
23 also PING, Physicists Inspiring the Next Generation,
24 which is a completely, fully diverse camp of students

1 from all over amazing socio-economic brackets, all
2 different races, all different -- rich, poor, there's
3 all types. And I've just never seen that kind of
4 education anywhere else. And it's what inspires me. So
5 I truly believe that my whole purpose was shaped by my
6 experience here, so thank you.

7 KRISTEN HAMILTON: Next up we have Paul
8 Marganian, followed by Brent Shapiro Albert, and Marty
9 Bloss.

10 PAUL MARGANIAN: My name is Paul Marganian.
11 P-a-u-l, M-a-r-g-a-n-i-a-n.

12 Thank you for giving me the chance to talk.
13 I'm a little bit unprepared because I was busy coaching
14 my kids' robotics team, and we made it into the State so
15 we're getting ready for Saturday's competition. So that
16 wasn't the, you know, shameless plug for the robotics
17 team. We're going to get back to that.

18 So right. So my role, I'm a software engineer
19 here at the Green Bank Observatory so, of course, if we
20 shut down, that would affect me. But I'd like to talk
21 about how this would affect not just me, not just the
22 town of Green Bank, not just Pocahontas County, not even
23 just West Virginia, but how this affects our nation.

24 So let me just tell a little story. So my

1 father is an immigrant. He came to this country back in
2 the '50s. And he came here to get a top-notch education
3 because back then, this is where you went to get a
4 top-notch education, especially in the STEM fields.

5 And that has remained true for decades. But
6 there are certain trends that are visible now and it's
7 not quite clear whether that's going to remain true or
8 not.

9 So an example that I gave when I talked here
10 last year was we've been doing work with the Chinese.
11 The Chinese government is dumping money into basic
12 research. They're not trying to play catch-up. They're
13 trying to pass us. Okay. I was there two years ago and
14 I remember working in their facility and seeing this
15 huge construction right next door and I'm like, what is
16 all of that?

17 Oh, that's our lab.

18 And I come back here back here, you know, to
19 look at Options A, B, C and D and talking about shutting
20 us. So what the hell; right? Sorry. You can scratch
21 the hell part.

22 So -- all right. So where was I.

23 I said I'd get back to the whole robotics
24 thing. Well, I'm teaching robotics because my kids are

1 interested in STEM subjects. If this continues, when
2 they get to college age, when they get to grad school
3 age, where are they going to go for a top-notch
4 education. Where will the center of that be on this
5 planet? Where is it going to be?

6 Part of that answer is right now, right here.
7 Are we going to stop investing or are we going to
8 abdicate our leadership role in the world?

9 Okay. So let's keep America great and let's
10 keep investing in the future. Thank you.

11 BRENT SHAPIRO ALBERT: Hi, everybody. My name
12 is Brent Shapiro Albert. That's B-r-e-n-t,
13 S-h-a-p-i-r-o, A-l-b-e-r-t. That's great, filling out
14 standardized test forms.

15 I'm a graduate student in the department of
16 Physics and Astronomy at West Virginia University, and
17 I'm also the president of the Physics and Astronomy
18 graduate student organization there. I think -- and a
19 lot of my work is in pulsars and some of it's with
20 NANOGrav. And pretty much all of my research is only
21 possible because of this facility. And I know that
22 there are also a lot of other graduate students at WVU.

23 I think there let's 15 or so others in
24 Astronomy, some of who can't be here tonight. They're

1 graduating soon and are filling out job applications and
2 have based their entire career off of observations and
3 research they've done here at Green Bank. And whether
4 that's at WVU or coming down here over the Summer for
5 weeks or months at a time.

6 This place is incredibly important, for them
7 and for building careers and myself, hopefully,
8 included. And just from a personal note, grad school is
9 sometimes rewarding and often very, very grueling and
10 the first time I came down here actually was for this
11 public meeting last year and it was dark by the time we
12 got here and all I got to see of the telescope was this
13 blinking headlight.

14 But I got to come down in May for the
15 observatory training workshop here which was a fantastic
16 workshop, but being able to see the telescope in person
17 is really, really inspiring. It's an incredible
18 facility, this whole place is just an incredible
19 facility and sometimes that really helps to motivate you
20 and to keep doing the research that we're doing.

21 And I really hope that the NSF will continue
22 to fund this facility to the best of their ability in
23 the future. Thank you.

24 MARTY BLOSS: Good evening. My name is Marty

1 Bloss, M-a-r-t-y, B-l-o-s-s. I'm a resident of
2 Pocahontas County and a staff member here at the
3 observatory.

4 My comments are going to be to look beyond the
5 EIS Draft document into the future. I was struck by a
6 very complete document that addressed many issues and
7 leaves many very big issues completely un-addressed, and
8 I'd like to speak to some of those if I may.

9 In particular, there's discussions about
10 potential removal of facilities, modification of
11 facilities, but there are no budget numbers given for
12 any of these things. And I think in a view of
13 transparency, when decision making is happening
14 concerning facilities versus cost of operations, there
15 needs to be some transparency into how those numbers are
16 derived, the assumptions behind them, and how they play
17 out going forward.

18 You can infer a budget, sort of, if you look
19 at the economic impacts and we're talked \$3, \$4,
20 million, \$5 million, potentially from some of these
21 impacts and there's mention of how that is to be funded.
22 And one would assume that had nothing to do with our
23 operational funding but when, in an atmosphere of
24 silence, it's an unknown and I think that needs to be

1 shared more broadly.

2 I would like to speak also to site expansion.
3 So one of our charges has always been, since this
4 process started, is to expand our opportunities, both in
5 the science and commercial endeavors; however, the EIS
6 has actually constrained us greatly in being able to do
7 any changes to the site. Essentially, we were frozen in
8 place for the last couple of years and not able to make
9 an substantial changes because that would upset the
10 baseline, as I understand it, of this report.

11 Well, as we go forward, it's been my
12 experience that once a report exists that people keep
13 coming back to that and back to that and back to that
14 and if the agency preferred approach is followed, we
15 must have relief to be able to do the kinds of things
16 that new endeavors the observatory require with a
17 minimum of obstruction and problems, because it can be a
18 real problem as we go forward.

19 And then lastly, I'd just like to comment that
20 part of this needs to talk about what is considered
21 success criteria for any of these options, and most
22 importantly, the agency preferred option. And right
23 now, everything is about revenue and finances. They're
24 very important. They're what keeps the lights on. But

1 science is what drives the site and there needs to be a
2 metric as we go forward that also looks at the changes
3 in the science community and our contribution to those
4 changes as another metric into the success of the
5 observatory in whichever of these forms that it takes.
6 Thank you.

7 KRISTEN HAMILTON: We're going to take one
8 more round and then we're going to take a brief break.
9 So we'll have Anthony Minter, Sarah B. Spolaor, and Mali
10 Minter. And I'd like to give Becky Rabel the
11 opportunity if you're back in the auditorium, you can
12 come down after Molly.

13 ANTHONY MINTOR: Hi, I'm Anthony Mintor. You
14 can spell that however you wish.

15 In page 4-108, it states that in the worse
16 case scenarios that the loss of STEM education here
17 would be adverse to the county. This is really an
18 understatement. If you look of the number of
19 astronomers in the United States, you can estimate that
20 it's about one out of every hundred thousand people in
21 the United States are actively in astronomy working on
22 advance degrees or with an advanced degree. Of that,
23 only a quarter of those are women. So it's something
24 like one out of 200,000 are women in astronomy.

1 But from Pocahontas County alone, I can think
2 off the top of my head of two women who have gone
3 through the program since I've started working here that
4 have gone on and are seeking an advanced degree or do
5 have an advanced degree working in Astronomy.

6 Our county only has about 8,000 people.
7 That's one out of every 4,000, 50 times my guess at the
8 national average. That's what the STEM education
9 program is doing, amazingly, beyond anything you can
10 imagine in the national average in a state that has
11 historically been at the bottom.

12 So this is a real treasure having the STEM
13 programs here which rely on the science being here and
14 we need to keep that alive because we're doing amazing
15 things, not only locally but within the state and within
16 the region. So I just want to really share that
17 "adverse" is an understatement for catastrophic if we
18 lose these programs. Thank you.

19 SARAH BURKE-SPOLAOR: Hello. My name is my
20 Sarah S-a-r-a-h, B-u-r-k-e--S-p-o-l-a-o-r. Brent and I
21 are friends.

22 So I'm speaking today as a member of both of
23 the West Virginia University Physics and Astronomy
24 department. The department has been a long supporter of

1 Green Bank Telescope and Green Bank Observatory,
2 facilities both in the science and in the outreaches as
3 you've heard a lot of today. I'll highlight that again.

4 I'm also here speaking as a collaborator in
5 the NANOGrav project. I currently lead the Gravitational
6 Wave Astrophysics working group. And NANOGrav is, of
7 course, very generously funded by the NSF through the
8 Physics Frontier Center.

9 I know it's really interesting for me to read,
10 at least, the first 20 pages of the DEIS and select
11 other pages and I stumbled upon the phrase where we are
12 meant to consider GBO as a cultural resource. And it
13 struck me that there was a phrase that this is defined
14 as a current historical, cultural and natural aspect,
15 what makes a cultural resource.

16 And it occurs to me that GBT is right now
17 making history through NANOGrav. We are just now in the
18 past two years, LIGO was able to discover gravitational
19 waves, just two years ago in 2015, reported just last
20 year in 2016. And really, the ramp up of this science
21 and cultural awareness in humanity has just come about
22 in the past two years. And it has been after the
23 assessment that was done of the importance of the
24 science that's now being discussed in the context of

1 Green Bank.

2 So these developments have all been very rapid
3 and really, you know, NANOGrav is now leading
4 gravitational wave science. It will be, in the next few
5 years, expected to really open the gravitational wave
6 spectrum and change the world in the way we can perform
7 astronomy and explore the universe, explore the
8 structuring of the universe, through it's studies of
9 black holes.

10 And this is really a change that fundamentally
11 develops us in a way that hasn't been changed since,
12 basically, Galileo started observing Astronomy and
13 electromagnetic emission. We're now using gravitational
14 waves.

15 This is a fundamental capability of humanity.
16 GBT gives half the sensitivity to NANOGrav and NANOGrav
17 will play, certainly, a historical role in the coming
18 decade, if no longer.

19 And I just wanted to add to that our continued
20 success with NANOGrav, at least over the next few years,
21 really relies on GBT being available to us to continue
22 this NANOGrav effort.

23 The other main thought I wanted to add to this
24 is that we just want to simply support, express support

1 for either the no-action alternative or the agency
2 preferred alternative, in that first, we really want to
3 continue NANOGrav science. We want to bridge the gap
4 until alternative facilities can come available to
5 support this really historical effort that we are now
6 performing.

7 At WVU itself, the department, you've heard a
8 lot about the really fantastic education programs that
9 have been happening. We use the 20-meter in our intro
10 Astronomy classes. That's about 200 students per
11 semester. We have two semesters a year. Over a couple
12 of years, that accesses thousands of students, brings
13 science directly to them, puts science in their hands
14 and makes them perform research. And that's a really
15 unique thing to be able to do.

16 It's one thing to just have data presented to
17 you and say, hey, make a plot of this. That's science.
18 That's one aspect of science. But actually collecting
19 data, making that into some conclusion, that's very
20 fundamental and observe, something you, yourself,
21 observed about the universe, it's really amazing.

22 And just like through the Pulsar Search
23 Collaboratory, we have accessed hundreds and hundreds of
24 students that are in high school and are able to bring

1 literal Green Bank Telescope data to the computer, the
2 desktops of those students to actually look at the Green
3 Bank Telescope data, look at stuff that scientists have
4 not even looked at because they have been given the
5 responsibility to take a look at that data and make some
6 observation, have we've found a new star in the universe
7 or have we found a burst from a distant galaxy.

8 So I think, I just wanted to conclude that WVU
9 aims to continue to support and use Green Bank
10 facilities, not just GBT but also the 20-meter and other
11 ones on site and we hope to perform what science and
12 what outreach we can going into the future and we aim to
13 support that as much as we can. Thank you.

14 MALI MENTER: Hi. I'm Molly Menter, M-a-l-i,
15 M-e-n-t-e-r. And I just have a couple notes.

16 One is, the EIS draft mentions -- and I know
17 you can't answer this but I'm saying this so that maybe
18 someone will answer this -- it mentions that in 2006, an
19 NSF study was done and it said that the GBT was possibly
20 over-funded. My understanding is that the 2006 report
21 had incorrectly reported the construction cost by a lot.
22 And so a more extensive review was done.

23 However, I cannot find any more extensive
24 report anywhere so I really would like to know if a more

1 extensive report was actually done and what the results
2 were and where it would align with funding from that.

3 The other thing I just wanted to touch on, Sue
4 Ann touched on it, it was one of the main things I was
5 going to talk about, was if -- I mean, of course,
6 everyone is full funding and then we're really happy on
7 Option A; however, if it were to go on to a different
8 option, I think there are some fatal flaws in Option B.

9 It says that you'll go to a tourism education
10 facility. Then later, it says in your statement that
11 the amount of tourists that will come will go down by
12 half, at least, and the less, the less facilities that
13 are up kept as far as mothballing or destroying or
14 whatever you do to the telescopes, the less people that
15 are going to come here.

16 And so, basically, Option B is going to sink
17 further and further and further down where there's no
18 tourism coming and that will really impact our
19 community, and so I think you need to think about that.

20 The other thing is, and I think Sue Ann
21 touched on it, when you do these educational programs,
22 they are fantastic. We have some people here who have
23 bene parts of them; however, when you do them and you're
24 going to reduce the staff to just have education and the

1 science center, I don't know if you really understand
2 that when a group comes in, they call and say, hey Ron,
3 Hey Tony, Hey, Jay, or Hey, all you scientists, or hey
4 you computer engineer or hey you, you know, computer
5 scientist, can you come back talk to this group. We're
6 doing this and we really need someone to talk to them
7 about that. You're not going to do that when those 45
8 people aren't employed here. You're not going to have
9 the educational opportunities you think you're still
10 going to have because you're going to be missing a
11 generous part of your staff.

12 So that said, the only other thing I had, and
13 I know you all want to go on break, is and I'm sorry
14 because I meant to have it typed out, I think there are
15 some issues with -- as everyone said, you've done a
16 really good job putting it all together, but I still
17 think there are a few issues with the housing and the
18 socio-economic impact on the housing because you say,
19 well, you know, people will be moving off-site because
20 they won't be able to live on-site. So that will be
21 good for the housing so there won't be that bog of an
22 impact. But then there's not that many houses on-site
23 compared with how many people are going to be losing
24 their jobs, so there's a lot of people who are leaving.

1 And they can't -- the people that would be losing their
2 jobs if you went to B, C, D, would not be able to be
3 employed in the same manner here in Pocahontas County.

4 So I think some of your statistics may be a
5 little bit off in that but I didn't get it written up
6 nicely so I'm just going to say that in passing.

7 And that's it, thank you.

8 KRISTEN HAMILTON: Has Becky Rabel returned to
9 the auditorium? No? Okay.

10 Thank you all for giving concise and
11 meaningful comments thus far. I think we're on track in
12 terms of timing, so if we can take a brief break and
13 return, we'll get to the rest of you that have signed up
14 to speak, and perhaps those of you who didn't get a
15 chance to sign up, may also have the opportunity. So
16 return here at 7:30. Thank you.

17 (Short break.)

18 Welcome back. I know people are still
19 filtering in we're going to continue with the public
20 comment portion just to make sure everybody has a voice.

21 The next folks up to comment are Charles
22 Sheets, Burt Schou, and Ryan Lynch.

23 CHARLES SHEETS: Thank you. My name is
24 Charles Sheets, C-h-a-r-l-e-s, like sheets of paper.

1 As a resident of Green Bank, West Virginia,
2 and also a member of the Greenbrier Valley Economic
3 Development Corporation which represents Pocahontas
4 County, I'm on record of writing a letter in support of
5 the Green Bank Observatory last November when many of
6 you were here. But I want to thank the National Science
7 Foundation returning to Green Bank Observatory and
8 inviting the public to comment on their draft
9 environmental statement, DEIS.

10 Anyway, I'm happy that the National Science
11 Foundation has acknowledged the importance of the
12 scientific community of Green Bank Observatory and its
13 scientific discoveries over the past 60 years. And in
14 light of the constrained budgetary environment, the
15 National Science Foundation says it must provide a
16 balanced research portfolio with the largest scientific
17 return for taxpayer dollar.

18 In looking up the National Science
19 Foundation's 2018 budget request to Congress in its
20 continued long-standing commitment to support basic
21 research and education across all fields of science and
22 engineering, the budget request is \$6.653 billion, which
23 is a decrease from 2016, by the way.

24 The total of the West Virginia government

1 budget, our state budget in West Virginia for 2017-2018
2 is only \$4.5 billion for a population of 1.8 million
3 people.

4 The National Science Foundation's only
5 research facility of this type in West Virginia and
6 Green Bank Observatory, working in conjunction with the
7 West Virginia University, is providing a scientific
8 curriculum for students to obtain their Doctorate in
9 Astronomy and that's the only curriculum in West
10 Virginia. And this was evidenced by the great students
11 that we have here. And I'm really inspired by those
12 students. I don't know if they have a class greater
13 back at WVU or not. But I was really inspired to hear
14 them.

15 I want to support Senator Manchin's offer to
16 the National Science Foundation director to have a
17 public hearing with the scientific community of the
18 importance of continuing funding to maintain the Green
19 Bank Observatory scientific facility.

20 I support the DEIS finding in its preferred
21 alternative which keeps Green Bank Observatory open with
22 reduced National Science Foundation funding. Since the
23 agency has acknowledged the importance of Green Bank
24 Observatory to the scientific community, I trust that

1 the funding will continue at GBO at the current level
2 and not engage in a slow strangulation of funding so
3 that Green Bank can no longer exist.

4 Once again, I thank you very much for this
5 opportunity.

6 BERT SCHOU: My name is Bert Schou and that's
7 spelled B-e-r-t, S-c-h-o-u. I'd like to thank the
8 National Science Foundation for the opportunity to
9 respond today and the importance of science and
10 education is what my theme will be.

11 Just before I came to this meeting today I was
12 with a meeting called Sigma Xi. Sigma Xi as you well
13 know has 76,000 members. We have two chapters here in
14 the State of West Virginia; one is in Williamsburg at
15 the West Virginia School Osteopathic Medicine. And one
16 of the persons there asked me to ask why -- he had
17 written letters and had not gotten any response, even
18 that the letters had been responded to, Dr. Larry Davis,
19 our president -- we have an officer's meeting.

20 We have been up here to the Green Bank
21 facility with a whole busload of people and really
22 enjoyed bringing these scientists up here to study
23 what's going on here. In addition, the Green Bank or
24 the West Virginia or the Greenbrier Chapter of Sigma Xi

1 sponsors fairs, their science fairs, and there is a
2 science fair here at this part of Pocahontas and the
3 school here in Green Bank and they're very active.

4 We have four active schools or more that come to
5 the science fair that the Sigma Xi group in Green Bank
6 or down in Williamson or Lewisburg puts on. As you can
7 see, I didn't prepare this and I can write some thoughts
8 afterwards.

9 With this importance to science, I think that
10 we need to look at how important it reacts as well as
11 the students have indicated here. I also think it's
12 important, we have two national presidents, one of them
13 is still in our chapter. We've had one before and he
14 couldn't be here today. He's out in New Mexico or he
15 would have been here.

16 And so there's a great importance of it, of
17 coming here and I think the essence of all of this is
18 science is really important and these students are
19 picking it up here and they're getting enthused and
20 that's of great economic importance. So I wish that you
21 would evaluate that in your whole program. Thank you.

22 RYAN LYNCH: Hi. My name is Ryan Lynch,
23 R-y-a-n-, L-y-n-c-h. I am an astronomer here on staff.
24 I am also the coordinator for our Summer student

1 research programs so I'm going to focus my comments
2 primarily on education and research.

3 So first, I was a little disappointed to see
4 that the Draft EIS did not seem to mention our
5 observatory's long standing and outstanding REU Research
6 Experience for Undergraduates program, which is an NSF
7 funded program, as well as the Physicist Inspiring the
8 Next Generation program.

9 I might have missed it, but if I didn't, I put
10 some numbers and made reference to those in my public
11 oral comments last year, and I'd be happy to share those
12 with you again with you guys, any information that you
13 guys need to make sure that's corrected in the final
14 statement.

15 I also wanted to address the region of
16 influence and how that is defined for the education of
17 socio-economic impacts. So there are a lot of comments
18 already about the impacts of the Observatory, not just
19 within the local community and within the state but
20 really nationally and globally. So I just wanted to
21 share some numbers to kind of back that up.

22 So there were 32 states and territories of the
23 U.S. that were represented during the public scoping
24 period and 13 countries other than the U.S. Out of 201

1 commenters that provided and addressed on the written
2 comments, were from outside the State of West Virginia.
3 That's 44 percent; 61 commenters, 10 percent were
4 outside the U.S.; and 67 percent of all comments dealt
5 with either research or education.

6 So my understanding is that the region of
7 influence as it is defined narrowly as being the local
8 community and maybe extending out to the State. But I
9 think that demonstrates that Green Bank has an impact
10 that is national and really global. And if you really
11 want to assess the impact and education and on
12 employment, you need to include the entire country and
13 the entire world.

14 These are of researchers who depend upon the
15 observatory to further their educational career as well
16 as their professional careers.

17 There was a line in the draft EIS that the RY
18 was not officially widened to the state beyond the State
19 of West Virginia because it would dilute the economic
20 consequences of the proposed action alternative.

21 Those of you that were here last year would
22 remember a young woman, a high school student from West
23 Virginia who got up here and rocked it in her comments.
24 Anyone who listened to her talk cannot possibly say that

1 expanding the region of influence would dilute anything
2 and I think we've heard that from other people here as
3 well.

4 And the other thing I want to address is the
5 magnitude of the impasse under the Action A alternative.
6 There's a line that says that maintaining STEM related
7 training, the impasse would be minor, adverse, and
8 short-term under action alternative A.

9 But that really depends on the funding model
10 that we settle on with partners and whether or not those
11 partners take away from the open sky science time. If
12 the open sky science time really drops, and the research
13 funding also drops then the educational and research
14 opportunities drop as well. And it's not going to be
15 minor and short term. It's going to be severe and long
16 term. And I really encourage you guys to take a look at
17 that and fund the report. Thank you.

18 KRISTEN HAMILTON: Next up is Leslie Goodall,
19 followed by Jason Bauserman, and Ellie White.

20 UNKNOWN SPEAKER: Leslie had to leave. She'll
21 write.

22 KRISTEN HAMILTON: Is Jason Bauserman here?

23 JASON BAUSERMAN: I'm Jason Bauserman,
24 J-a-s-o-n, B-a-u-s-e-r-m-a-n. I am a resident just north

1 of here at Bartow, and I happened to move back here as a
2 back-to-the-lander out of Washington, DC in 1971. This
3 has just been a great place to come. And we've had
4 three sons and they're all living in West Virginia, a
5 couple of them living here still.

6 I just want to say what the observatory has
7 meant to our family. My wife, Julie, has been a piano
8 and voice teacher for 45 years. They -- well, even
9 today, the observatory lets her come down and do
10 rehearsals on the Baby Grand over here and sometimes
11 she's taught lessons here at the Observatory.

12 But I asked my wife before I came today, I
13 said, Julie, how many people, how many kids of
14 observatory people have you taught. And she said, you
15 know, I bet you 75 of my students have been observatory
16 kids. And that's really helped us to finance us and
17 helped us to stay here. So that's a real big thing.

18 Likewise, I was in charge of Green Bank soccer
19 for nine years and that meant finding 12 to 15 coaches
20 each year, finding referees for every game, finding some
21 grass mowers, and, of course, we were on Observatory
22 property for our soccer fields.

23 And I, too, can say probably that 75 percent
24 of my volunteers for the soccer league, and this was

1 through the mid-'80s through the mid-'90s, were
2 observatory personnel. I mean, it was just really
3 helpful and just really a great community thing for the
4 Observatory and for the local people here.

5 Last year, I was actually involved in planting
6 potatoes here on observatory property. I picked 30 tons
7 of rock out of my five acres behind the Green Bank
8 library and I got 15 tons of potatoes. Not a very good
9 conversion but I think we did better than anybody else.
10 Maybe it was those extra rocks that got picked.

11 My son, Jonah, who does work here at the
12 observatory, he happened to go -- well, he finished up
13 Pocahontas County High School and was in the
14 school-to-work program. He -- gee, my time is already
15 up.

16 KRISTEN HAMILTON: No. Just one more minute.

17 JASON BAUSERMAN: Oh, one more minute. Okay.
18 I thought that was going to be it.

19 He wanted to come here to the observatory to
20 do the school-to-work program and he did. And I guess
21 he did so well they asked him, could stay you on with
22 us? When he was here he was, you know, soldering as an
23 electronic technician under a microscope. They said,
24 you're just so nice and clean and do a great job.

1 So he was signed right out of high school in
2 1998. So it's just about been 20 years, it was, he was
3 here. But his first job was to run the stainless steel
4 cryogenics line all the way up the big scope. He had
5 never soldered or welded, whatever you do with stainless
6 steel. He soldered the whole thing from top to bottom,
7 didn't have one leak in it.

8 And then the other great thing, I'm just so
9 proud of him, I guess they had seven new receivers or 14
10 new receivers they needed for the big scope. He
11 actually put together seven of them and still maintains
12 those seven today.

13 But he does have a couple of extra jobs to show you
14 that they're really trying to save here. Not only is he
15 maintaining those seven receivers but he is also, goes
16 out and checks every cell phone tower within 100 miles
17 of here and he rides the little white truck with the
18 antennas to look for RF. So he's really doing what was
19 three jobs as one.

20 But, gee, my time is out. But here just three
21 or four weeks ago or maybe a month, five weeks ago, he,
22 Katie Couric came here -- and that is under-reported,
23 how many people are coming from all over. But he spent
24 five and a half hours running her around and showing her

1 for her National Geographic article. So I really cannot
2 imagine this community without the personnel and the
3 workers here at the Green Bank Observatory. Thank you.

4 ELLIE WHITE: All right. So I just want to
5 say thank you to NSF for giving us the opportunity to
6 speak today.

7 KRISTEN HAMILTON: Your name?

8 ELLIE WHITE: All right. So my name is Ellie
9 White. It's spelled pretty much how it sounds,
10 E-l-l-i-e, W-h-i-t-e, like the color. Okay.

11 So I just appreciate you all listening to all
12 of the comments you've received, both written and oral,
13 from all of the people who've been -- well, not all of
14 the people but only just a small fraction of the people
15 impacted by the observatory. I've received hundreds of
16 letters, outpouring of support. But I'd like to speak
17 about why I think the NSF should restore full, 100
18 percent funding to the Green Bank Observatory.

19 So I appreciate the fact that you've decided
20 to continue to provide partial funding. But I'd like to
21 bring up some concerns I have about this option.

22 First of all, a reduced, reduced funding by
23 the NSF means the observatory will have to seek outside
24 partnerships as mentioned in the DEIS. If the GBO

1 becomes beholden to institutions who do not uphold the
2 open skies program that you all make possible, the
3 outcome -- sorry, if you don't care -- this outcome
4 would ultimately --

5 So I'd just like to say that the open skies
6 program is extremely important to the observatory here.
7 If it were to disappear, it would ultimately reduce the
8 diversity of the research currently going on at the
9 observatory and would serve to cut off opportunities to
10 make the next great discoveries in Astrophysics but
11 couldn't do it because their institution couldn't get
12 time on GBT.

13 With the open skies program in place for the
14 GBO researchers and nearly every possible sub-field of
15 Astronomy, are making fantastic findings that bring us
16 closer to a full understanding of our universe. Many of
17 the research topics being investigated with the GBT are
18 in line with the NSF's own astronomical priorities as
19 identified in the New Worlds New Horizons study.

20 GBT is used for and has been used for studies
21 in the following Astrophysical topics that the NSF
22 decided was worthy of completed panels dedicated to in
23 WNH survey.

24 So the first topic would be Planetary System

1 and Star Formation. The GBT has performed several
2 observations concerning astrochemistry, as you covered
3 earlier, in star forming regions and receivers can
4 continue to be developed and proved for high frequency
5 observations of such topics.

6 Also, two other topics, the Galactic
7 Neighborhood and Galaxies Across Cosmic Time, the GBT is
8 used frequently for neutral hydrogen and other frequency
9 studies in the Milky Way and surrounding galaxies. This
10 is something I think really needs to be emphasized. The
11 Green Bank telescope has contributed tremendously to
12 neutral hydrogen studies.

13 In fact, they just implemented a new phaser
14 ray feed on the scope this summer that will basically --
15 it's like a giant camera. Instead of having one pixel
16 it's like seven. So the GBT is constantly being
17 upgraded, it's constantly being given more capability so
18 there's really no way it can go out of date because it's
19 constantly being recycled and reused with relatively a
20 small amount of money.

21 Another topic that I identified was Cosmology
22 and Fundamental Physics. Green Bank has made tremendous
23 contributions there as well. Many dark matter and dark
24 energy experiments have been undertaken with GBT. One

1 particularly notable cosmology project that was
2 undertaken in the past is the Megamaser, and is
3 currently going on, is the Megamaser cosmology project,
4 basically to determine how fast the universe is
5 expanding.

6 So first, NSF has also identified other areas
7 of interest including education and I'd like to just
8 touch on that as well because that's such an important
9 part of what's being done here. So demographics is one
10 area of interest.

11 So as was touched on earlier by so many
12 people, many of the educational programs at the GBO are
13 aimed at growing diversity in the astronomy community by
14 giving under represented minorities and female students
15 a two-week Summer camp experience introducing them to
16 real high level science.

17 In addition to this, the first two programs
18 encourages STEMing involvement among first-generation
19 college students, education, and public outreach. So
20 the number of students impacted in positive ways is
21 absolutely tremendous.

22 From the Hands-On Radio Astronomer for a Day
23 program which goes out almost constantly involving so
24 many students, to the research experience for

1 undergraduate students, to Sky Net Junior Scholars, so
2 many other programs including just casual mentorships.

3 I'm a high school student from Barboursville,
4 so about four hours away from here, and just from a
5 chance encounter a couple of years ago, I've been able
6 to do actual research on radio frequency interference,
7 telescope pointing, and I will be doing some hydrogen
8 research soon.

9 So from my own perspective as well as so many
10 other students, many of whom are from under represented
11 backgrounds, our lives and career paths have been
12 changed by the mentorship experience we've had here at
13 the observatory.

14 For these reasons among so many others, I feel
15 the NSF would reap large benefits and make great strides
16 toward achieving their goals for science and education
17 by continuing to provide 100 percent funding for the
18 GBO.

19 The continuation of the open skies policy is
20 crucial to keeping up the pace of ground breaking
21 science and student opportunities that move us toward
22 great discovery and more inclusive and diverse future
23 for STEM fields everywhere, so thank you.

24 KRISTEN HAMILTON: Next up we have Deana

1 White, and then Nathan Tehrani.

2 DEANA WHITE: Hello, everyone. I'm Deana
3 White. I'm her mom. D-e-a-n-a, W-h-i-t-e.

4 Thank you guys for letting us speak. I'll try
5 and make the time. I think it's evident to anyone who's
6 read the comments from last year that the NSF has had a
7 great return on their investment at Green Bank
8 Observatory. We're here to urge you to choose the
9 no-action alternative, continued NSF investment for
10 science focused operations and restore full funding for
11 the observatory so we can all continue to reap the
12 benefits of this fantastic investment.

13 We know you need the support of many allies to
14 justify this decision in these very competitive times
15 for budget allocations so hopefully all of us here can
16 help with that. As you review the comments made last
17 round, and as I said in my own comment last year, this
18 place is magical. It turns busy, ordinary people into
19 dreamers of what we can achieve just from looking at the
20 feat of human architecture, engineering results that the
21 GBT exemplifies.

22 You can participate in a Radio Astronomer For
23 A Day program and see high school students challenged to
24 learn high level concepts, struggle at first and then

1 step up their game, rise to the challenge and make
2 meaningful discoveries about what they themselves can do
3 in just a 24-hour period.

4 You can witness a young, curious but tentative
5 student growing in meaningful ways from opportunities
6 provided by the amazing astronomers, engineers, and
7 education staff here. The Green Bank Observatory is
8 magic.

9 Your continued investment in the observatory
10 returns exponential benefits to society as we stand now
11 and as we move towards our future. We all eagerly watch
12 and anticipate what question will the Green Bank
13 Observatory answer next.

14 We all know instinctively from each of our own
15 gatherings, of stories and experiences with education in
16 its many forms, that the staff here, the resources here
17 and the Green Bank learning philosophy of open skies
18 open minds, open hearts is a model that should be
19 studied and implemented across our nation.

20 We know it's not just individually but as
21 evidenced by the footprint the Green Bank Observatory
22 has made since its inception to this very day, expressed
23 over and over in the letters you've received. We've
24 read at least 600 of these letters. We noted that

1 people from over 30 states, as mentioned before, and
2 territories, and 13 countries. People from numerous
3 institutions and organizations sent you their unanimous
4 support along with their reasons and unique stories.

5 Each letter was moving, informative, and
6 inspiring. Many cited multiple reasons why this
7 facility should be continued to be funded at the highest
8 level, from cultural to historic, economic to health and
9 safety and so on. But the most often cited reasons were
10 education and research and the two cannot be separated.

11 So many of the letters expressed the
12 importance of the observatory to their research and the
13 ground breaking discoveries that they've made or are on
14 the verge of making and how important and unique the
15 learning opportunities that accompany the research are
16 to so many students ranging from kindergarten to post-
17 doctoral studies.

18 What corporation in America wouldn't leap to
19 be able to write the mission statement that the
20 observatory breathes every day and then reap the
21 enormous returns on investment that the observatory
22 achieves for our future.

23 There's also a more traditional measure of
24 return on investment that's evident. I believe the

1 annual operating budget here is \$8 to \$10 million and
2 the observatory generates close to \$30 million for the
3 thriving Green Bank community, Pocahontas County, and
4 the State of West Virginia. The NSF can post that in
5 their earnings report to taxpayers.

6 So as you can tell, I could go on and on and
7 on and on, but let me just finish by saying that we want
8 to help you, the NSF, to communicate your return on
9 investment in earnings to all that we can to help you
10 garner the support you need to restore full funding to
11 the Green Bank Observatory, an outstanding performer and
12 inspiring treasure in your portfolio. Thank you.

13 KRISTEN HAMILTON: Is Nathan here?

14 NATHAN TEHRANI: Oh, yes.

15 KRISTEN HAMILTON: Come on up.

16 NATHAN TEHRANI: All right. John Mather,
17 Nobel laureate once said, "That to look through a
18 telescope whether it's for work or for pleasure is
19 always a cool experience but it pales in comparison to
20 watching the look on someone else's face when they look
21 through the eye piece."

22 And even though that's a quote from an
23 infrared astronomer about optical astronomy, I think it
24 absolutely holds true for radio astronomy as well, lack

1 of eye pieces not withstanding.

2 I've had the amazing opportunity to be
3 involved in a few educational programs here in a very
4 small way for each of them, but I've had that experience
5 to see hundreds of students gain a confidence in
6 themselves, and in some case, watched students in high
7 school who had very little interest in science chose to
8 study, or other STEM fields, in their college careers
9 and they're now beginning their careers in STEM.

10 Now, that's not all of them, but each and
11 every one of the students who did an educational
12 experience here that I got to see, whether they were
13 working on the 40-foot telescope or the GBT, they
14 discovered something in themselves that they could do
15 science. And, you know, if you can map the galaxy,
16 there really isn't a whole lot that you can't do. And
17 each and every one of them discovered that, you know,
18 out there and they discovered that in themselves.

19 So, yes. This is absolutely an amazing place
20 for science but this place, as was just said, is
21 absolutely magical and I hope that magic never leaves.

22 KRISTEN HAMILTON: Is there anyone else who
23 signed up that they'd like to give verbal comment today
24 that I have missed? That's my first question. I want

1 to make sure I didn't miss anybody.

2 So my next question, is there anybody who did
3 not sign up to give verbal comments but would like to
4 come on up? And you are very welcome to. We have
5 plenty --

6 UNIDENTIFIED SPEAKER: Can I add something?
7 Is that allowed?

8 KRISTEN HAMILTON: Yes. But let me first see
9 if there's anybody who didn't speak and then move on to
10 that. Thanks. Anybody? Okay. We have one.

11 Come on up, please.

12 MICHAEL HOLSTINE: So my name is Michael
13 Holstine, M-i-c-h-a-e-l, H-o-l-s-t-i-n-e.

14 And I think most of you know me. I'm the
15 business manager here at the observatory, and I just
16 wanted to speak to a few details about this. I will be
17 submitting in the written comment period.

18 But, you know, as you and I discussed today
19 that this is a cooperative effort between us and the
20 NSF. And I think we've worked well together on this
21 program and I want everyone here to know that we've been
22 working well together on this. And I said earlier
23 today, you have your job to do and I have mine to do.
24 And so now it's my turn to talk a little bit.

1 In the Draft EIS, I do want to say that it was
2 a very thorough job. I was impressed by the amount of
3 detail they went into. Like some of the other
4 commenters, though, I am concerned that there was a lack
5 of specificity to some of the vaguer options and ideas
6 that were in place.

7 And it concerned me a little bit when I read
8 some of the statistics that are fairly based to the
9 organization that were wrong. And it concerns me that
10 if those comments or those statistics are wrong, what
11 else might be wrong since the site is stated as having
12 2200 acres. Well, it's not. It's 2,654.37 acres. I
13 gave them those figures and why that's not reflected,
14 I'm not sure. And I think that's right. It's 45.37 or
15 54.3, anyway. They'll figure that out.

16 The information on the reports of which this
17 whole EIS, sort of, is based, I was a participant in
18 those review committees. I'm a little concerned that
19 the actual summaries given by those review committees is
20 not truly reflective of what was stated on the Green
21 Bank operations at the time; however, those reports are
22 not available that I can find.

23 So I will be either happy to speak to you
24 later about trying to get those summary reports or I

1 will reflect my personal observations of what was truly
2 said as a result of those reviews.

3 I will state for the record that in no review
4 that I have ever participated in, by either NSF or
5 operating in AUI or any thrid-party consultant, has
6 Green Bank ever come out to be too expensive, and, in
7 general, has been stipulated that we needed more funding
8 and we were operating too lean. So I'd really like to
9 figure out where that came from.

10 And lastly, without going into too much detail
11 about other things that, you know, that statistically I
12 can comment on, I'm concerned about the, even option
13 alternative A and the fact that any of the options would
14 have anything to do with the demolition of our housing.

15 If you go through the socio-economic part of
16 this, it mentions that there is a 50 percent vacancy
17 rate in the housing in Pocahontas County, and,
18 therefore, housing is freely available off site and,
19 therefore, housing is not necessary on site.

20 And I kept thinking, there is no where in this
21 county that I think of that has a 50 percent housing
22 vacancy. Then it occurred to me as I read through, I
23 think, part of the appendices, as to where those numbers
24 came from. They're talking about hunting camps.

1 And there are structures, tons of hunting
2 camps but those are not houses. The assessor does
3 include them as either a second home or whatever it
4 might be. Right now, in this last two weeks, I would
5 guess that there is probably a 10 percent vacancy
6 because it's hunting season and in the Summer you'll
7 probably have a 50 percent vacancy because nobody is
8 using them.

9 Any rate, those are the kinds of things that I
10 think need a little bit more massaging and explanation,
11 and I do appreciate the opportunity to speak to you and
12 to have you let all of these people speak to this as
13 well. Thank you.

14 KRISTEN HAMILTON: Thank you. Anybody else
15 who has not yet spoken but who would like to?

16 SUZANNE STEWART: Hi. I'm Suzanne Stewart,
17 S-u-z-a-n-n-e, S-t-e-w-a-r-t.

18 And I'd like to talk about a couple of things
19 that were mentioned tonight. One was pride. Other than
20 the first couple days of my life and nine years for
21 college and work, I have been a resident of Green Bank.
22 And I am proud to say that I was raised and live today
23 in Green Bank.

24 And when I travel around and talk to people

1 and I say I'm from Green Bank, West Virginia, they say,
2 oh, where is that? And I get to say, have you ever
3 heard of the Green Bank Observatory, the GBT, and
4 they're like -- a lot of people says, oh, yeah. I have
5 heard of that.

6 And there is a sense of pride to say I am from
7 this place where this facility is and where, it is a
8 unique place to live and be, and our lives would be
9 vastly different if we didn't have this facility
10 anymore.

11 And the other thing I wanted to talk about was
12 the national impact. And my cousin, Stephanie Stewart,
13 is a middle school English teacher in Tennessee and
14 you're thinking, English, how is that connected to the
15 observatory. Well, she is, you know, a rock star for
16 starters for teaching middle school, but she always
17 tells me that every semester she has a section where she
18 talks to her students about utopian places.

19 And there are tons of young adult books with
20 utopian stories. And she always uses Green Bank as an
21 example because of the quiet zone and how we don't have
22 cell phone towers and we can't use cell phones and her
23 students are fascinated by that because they can't live
24 without their cell phones.

1 But I think it's amazing that, you know, she
2 is just one person who has found a way to take what the
3 observatory is and to take what the quiet zone is and to
4 turn it into something that isn't necessarily the first
5 thing you think of when you think of this place.

6 And you know, she, to call it utopia and to
7 compare it to some of the utopian places that they
8 study, I think is fantastic. And just think about all
9 the other things that could be covered if we continue to
10 have this facility here and I have invited her up with
11 her students. I hope one day she gets to bring them so
12 they can experience it for themselves. So that's all I
13 had to say. Thank you.

14 KRISTEN HAMILTON: Any other new speakers?

15 UNIDENTIFIED SPEAKER: I'll go.

16 JOSH WHITE: Hello. My name is James
17 Espillita, J-a-m-e-s -- that's not my real name. My
18 name is Josh White.

19 So last year or was it this -- realized that
20 they were going to -- Green Bank Observatory here was
21 going to separate from the NARO and become the Green
22 Bank Observatory which was its own thing. And so I,
23 that was pretty cool.

24 And there is a video contest to show what does

1 the Green Bank Observatory mean to you. And so my
2 sister, Ellie White, and I both submitted contest
3 entries, a video. Each of us sent in a video, of
4 course. So we both ran and I think hers should have
5 gotten first place. Sadly, I did. So she got second
6 place, I got first, and what happened was I decided, you
7 know, hey, I'm just going to make a video for the Green
8 Bank Observatory. And it was fun.

9 I took, I went and I made an animation with a
10 type of animation software I had never used before and I
11 had just a great time with it and if it wasn't for this
12 observatory, I wouldn't have had that sort of experience
13 but that doesn't have anything to do with the
14 observatory at all much.

15 Something else that happened this year,
16 actually, that I had an absolute blast with, was that
17 I'm a home-schooled kid so, you know, I'm not around a
18 bunch of other kids all the time. So there was this
19 group, I'm in this group called Leo Club which is a
20 non-profit sort of, you know, like you go to the mission
21 and you make Thanksgiving dinner and you do, you know,
22 charity stuff.

23 And we decided, Hey, let's come to the Green
24 Bank Observatory, and I'm like, okay. Let's go to the

1 Green Bank Observatory. So we came to the Green Bank
2 Observatory, whoa, and so then all of them came and just
3 had a blast. We went down to the 40-foot and learned
4 how to operate that and that was fun.

5 I mean, my sister has done this before because
6 she has all of these opportunities here. She's done the
7 40-foot telescope, Radio Astronomer for a Day, Skynet
8 Junior Scholars. She has a mentor named Dr. Richard
9 Prestage. She's doing all kinds of funky stuff with
10 him. I don't understand any of it when she explains it
11 to me, but, you know, pulsars and stuff. And so we came
12 -- where was I -- so we were talking about the Leo Club;
13 right?

14 UNIDENTIFIED SPEAKER: Yes.

15 JOSH WHITE: So we were at the Leo Club and we
16 came and we had a blast with the 40-foot. And I had
17 been there before and then suddenly, I know how to use
18 the 40-foot. Whoa, but not, I mean, I knew how to do it
19 but basically I just hit a button.

20 And so then that was a fun time. I got to
21 hang out with kids and we all played Frisbee and there's
22 a Frisbee on top of the guest house. I don't think
23 anyone has gotten it off yet. And so we just had the
24 best time and we, the next day we went through our data,

1 you know, all of these little pin marks, you know, and
2 so then -- that was fun.

3 And I think we should have full funding.
4 Thank you.

5 KRISTEN HAMILTON: Any other new speakers?
6 It's hard to top that. Don't be shy.

7 EVAN SMITH: My name is Evan Smith, E-v-a-n,
8 S-m-i-t-h. So here's my two cents.

9 Two years ago I was about to leave
10 undergraduate education without a job and without
11 acceptance to graduate school even though Astronomy was
12 what I really wanted to do. By a stroke of luck, I
13 ended up getting a job here at the last minute as a tour
14 guide, right in this building. I worked in this room
15 for about a Summer and I was really lucky. And
16 eventually, I got in touch with Richard Prestage, a
17 staff scientist here. He talked me up to three West
18 Virginia University professors who do an extensive
19 amount of work here. It's Loren Anderson, Maura
20 McLaughlin, and D.J. Pisano, and that last guy is now my
21 advisor at WVU.

22 And so I spent about 15 months here working on
23 my radio astronomy skills and building up my resume and
24 eventually, I got into West Virginia University, which

1 is the only graduate school I got into but good enough.

2 And so now I'm a Ph.D. student and I just
3 wanted to say I owe my career to Green Bank Observatory
4 because before GBO my life was like this, and in 15
5 months, you know, the universe is the limit, not just
6 the sky.

7 So obviously, I'm not just talking about
8 myself here. Ryan Lynch runs a very robust Summer
9 student program and I just, there's probably many other
10 kids that owe their future careers to Green Bank
11 Observatory just like me so -- that's it.

12 KRISTEN HAMILTON: Any additional new
13 speakers? About how many people are planning on
14 speaking who have not spoken, just so that I can get a
15 sense? Okay.

16 STSHIDIG AGGARWAL: Hi, everyone. It's
17 spelled S-t-s-h-i-d-i-g, A-g-g-a-r-w-a-l, a very hard
18 name. I'm a first year Ph.D student at WVU in the
19 Department of Physics and Astronomy. And I'm basically
20 from India so this is my first time at the Green Bank
21 Observatory. And I wanted to see the 100 meter dish
22 although it was dark and I wasn't able to.

23 But, yeah. I was there at a smaller
24 observatory in India, which is GMRT which is a

1 significant diameter dish, and the first time I saw it I
2 was still in my sophomore year and it was so awe
3 inspiring. I was like, oh, God, like such things exist
4 and you can do such wonders with these things.

5 And I wonder how lucky those high schoolers
6 are who can actually visit Green Bank Observatory and
7 see that kind 100-meter dish working. And then more so,
8 you can actually, on a push of a button you can actually
9 make that thing go there, make that thing (inaudible) --
10 look at pulsars or other galaxies, hydrogen and stuff
11 like that and analyze the data.

12 For a high schooler, for a person -- I was
13 from a very small town in Indian that was, that these
14 facilities were not there. But for a person who has
15 access to these resources, it's actually a really
16 valuable thing and it actually inspires a lot of people.
17 And I can understand that, to go into STEM fields, so
18 it's not going to science but actually having solving
19 skills right from the start.

20 And another important factor which I want to
21 point out here is that the radio quiet zone here in this
22 area is a very important factor which radio astronomers
23 appreciate. Because I have experience in radio
24 frequency (inaudible), so I know how noise looks in the

1 radio frequency data. And the radio quiet zone is like
2 a dream come true for astronomers. There is very, very
3 less noise in the data. And this kind of thing is not
4 everywhere. I don't anywhere else apart from Australia
5 in the world.

6 So this thing should be appreciated and I
7 believe, and I hope NSF will continue it's full funding
8 for the Green Bank Observatory. Thank you.

9 PRANAV SANGANVI: My name is Pranav Sanganvi,
10 P-r-a-n-a-v, P as in potato.

11 I don't really like speaking much but this
12 seems to be quite important. So anyway, this thing has
13 been very informative for everyone that has spoken over
14 here, be it the community or grad students, the staff
15 and the staff scientists. It has been informative for
16 all my mentors.

17 And it's kind of a legacy that should, I
18 believe, continue. That -- I worked on a project over
19 the Summer called the Research Experience for Teachers,
20 also an NSF funded program, and high school teachers
21 from all over West Virginia, from all over the country,
22 had the chance to come down -- well, we have done the
23 telescopes down at WVU and they were able to get their
24 own scopes built from scratch and use that to observe

1 the night sky in the radio quiet zone.

2 And it's kind of an opportunity that they
3 wouldn't get otherwise because it's quite noisy in the
4 radio frequencies. And they will use whatever they
5 learned, the experience they had. They even got to use
6 the GBT itself. And these high school teachers, some of
7 them taught middle school, and they can go and share
8 this experience with hundreds of students they will be
9 teaching over all.

10 My research is mostly in instrumentation. I'm
11 an engineer. And again, the staff and the facilities
12 over here would make all of my research work possible.
13 Basically my thesis would depend on Green Bank
14 Observatory existing, and that's all I have to say about
15 that.

16 KRISTEN HAMILTON: Is there anyone else that
17 has not spoken but would like the opportunity?

18 Okay. For those who have already spoken, how
19 many of you would like to have perhaps a couple more
20 minutes, just so I can get a feel for that? We have
21 one, two, three. Anybody else?

22 UNIDENTIFIED SPEAKER: I think there's four.

23 KRISTEN HAMILTON: Is there four, four.

24 So if my colleagues can humor extending the

1 meeting by a few minutes we can perhaps allow about two
2 minutes supplement to your prior statements.

3 And I'm going in the order that I saw the
4 hands so if you can come up.

5 MICKY HOLCOMB: I'll be real quick. Again, my
6 name is Micky Holcomb, M-i-c-k-y, H-o-l-c-o-m-b.

7 I'm a Materials Physicist. In my work I've
8 had the privilege to work at a lot of different national
9 laboratories around the United States and globally,
10 Lawrence Berkeley, Argonne, NEST, for example, and it's
11 possible that those facilities might be able to boast
12 more tours to students but I highly doubt more tours per
13 person or more tours per dollar funded. And what I've
14 observed is that this place does way more than just
15 tours.

16 I've observed the tours that have been given
17 to students at other national facilities and never do
18 they get to have hands-on activities that I've heard
19 about today and that I've heard about in the past. So I
20 think that's a really amazing and unique thing that is
21 done here.

22 And I just want to state that as a professor,
23 I hope anyone who's ever tried to teach a child can
24 related to this. There is a huge difference between

1 giving a lecture and letting a person actually get their
2 hands dirty and make mistakes and learn from those
3 mistakes. So this is really a unique capability and it
4 is clear that there's a huge trickle-down effect on
5 state and globally and this impact will not be the same
6 if research were to leave. Thank you.

7 KATHRYN WILLIAMSON: I'll be fast. My name is
8 Kathryn Williamson. I used to work here. I'm of staff
9 at WVU.

10 I would like to see the educational theories
11 that are driving the alternative option B, if this is
12 just going to become an educational facility, because
13 all of the educational theories that I use in my
14 publications and in my NSF funded proposals state that
15 an authentic community of practice is necessary for the
16 highest learning gains. So I don't understand why NSF
17 would chose an option that it's own NSF educational
18 research funded initiatives show is not ideal.

19 That's all I have to say.

20 KRISTEN HAMILTON: I think we had a couple
21 more in the second row.

22 ELLIE WHITE: So my name is Ellie White,
23 again. So I'd like to just get up one more time and say
24 one other thing. Last time I talked about the research

1 and why this was a good investment for the NSF based on
2 their previous studies. But this time I'd like to talk
3 about something a little bit more specific to the
4 Environmental Impact Statement, and that's the community
5 and environmental impact, basically.

6 So I say that one of the things that has made
7 the biggest impression on me since I first came here is
8 just this overwhelming sense of community and
9 togetherness that just permeates this place. It isn't
10 just a world-class research and education facilities,
11 it's also the heart of a vibrant community that
12 exemplifies what's best about West Virginia, our ability
13 to come together for the common good.

14 This place acts as an emergency care center, a
15 gathering place for local events, and an economic
16 revenue generator that puts millions of dollars back
17 into the small economy it's compassed by every year.

18 More broadly speaking, it makes a huge impact
19 on the rest of the State and the U.S as a whole, but the
20 far-reaching unrivaled educational opportunities it
21 offers. Students across West Virginia who might
22 otherwise may not have any other exposure to real STEM
23 research and technical work are given a chance to learn
24 about science and technology through programs such as

1 Radio Astronomer for a Day, Skynet Junior Scholars,
2 Pulsar Search Collaboratory, research Inspiring the Next
3 Generation, RAU, RET, First To, and on and on and on.

4 But -- and as I sort of mentioned before, I've
5 benefited from these programs myself. I basically was
6 just here volunteering for an open house. I ran into
7 Astronomer Dr. Richard Prestage and that's led to a
8 mentorship experience that has helped me find my
9 passions along a program developing radio frequencies
10 interference visualization tools. I like to analyze
11 data and look for trends by working a project to
12 characterize GBT pointings they may result in a
13 published paper, and I've learned to think like engineer
14 from building a small loop antenna to detect solar
15 flares.

16 If I wasn't convinced before, there is no
17 question in my mind I will now be pursuing a career in
18 STEM. In a state like West Virginia, in increasing
19 number of STEM graduates, as a result of these programs,
20 will have a tremendously positive impact on the State
21 economy, not to mention giving a morale boost in the
22 face of the current opioid crisis and the dying coal
23 industry.

24 However, if the NSF reduces its Funding of the

1 Observatory, it's possible that the efficacy of these
2 fantastic program could be diminished greatly.

3 The open skies science with full NSF funding
4 ensuring it's irreplaceable for enabling students from
5 all backgrounds to expand their horizons by pursuing
6 research with the GBT. Students who can't afford to go
7 to an Ivy league or another fancy, expensive school with
8 great research capabilities can have an equal chance to
9 pursue a science or technology career if they have
10 access to an open facility like Green Bank.

11 And that's just one of the many zones from
12 where full funding from NSF is absolutely imperative to
13 the future of the observatory and the many people and
14 communities it impacts every day. So thank.

15 KRISTEN HAMILTON: Was there somebody else --
16 come on up, and then you will be next.

17 DEANA WHITE: I'm Deana White again, Mom of
18 those two, her over there.

19 So a lot of this has been covered but I just
20 want to summarize it really quickly, that open skies
21 policy allows anyone with a merit-based proposal to gain
22 observing time which means real ground-breaking
23 scientific research can be done by anyone from a student
24 at a small college to a world renowned scientist

1 studying gravational waves to a high school student with
2 a great idea, and all of those have happened here.

3 There are many small colleges. When we read
4 those letters, there are many small colleges that don't
5 have the resources or the abilities to do this and they
6 can apply for time and they can give their students
7 opportunities that aren't available anywhere else in the
8 United States.

9 The thing that we need to emphasize, I think
10 people have covered it but I'm going to say it one more
11 time, we've got to remember that while like-minded
12 partnerships are beneficial, partnership reduce the
13 amount of observing time available because they're going
14 to want time. So the many different people institutions
15 that don't have these resources to have their
16 instrumentation in their facilities or to partner up
17 with the GBO would lose out.

18 Education opportunities and diverse research
19 subjects would be reduced. Further, per the Draft
20 report, the Section 106 Historic Assessment, that's
21 concurrently being conducted as we discussed, the
22 adverse impacts that have been identified for the
23 collaboration operation option includes removal of some
24 of the historical structures identified as part of the

1 GBO district, and that's potential, that it's any time
2 there's a potential, that's a problem.

3 It's imperative to the historic preservation
4 of the Green Bank Observatory, the United States birth
5 place of the National Radio Astronomy Observatory in
6 response to the space race with Russia and with a rich
7 history in world-leading research results that are
8 on-going today that the NSF provide full funding to
9 continue to operate this facility.

10 Additionally, reduced funding could impact
11 staffing levels. I know it says that Option A, that
12 reducing funding would not impact staffing levels, but
13 if we start partnering with potential NSA or other
14 agencies, the staff would reduce. I mean, it's a fact.
15 It would reduce and if the staff reduces, the economics
16 in this area go down, youth leadership, local education,
17 emergency response, support of the Arts, on and on, that
18 could be impacted.

19 So it's very important that we strongly
20 consider, doing we need partners other than the ones
21 we've already established, and if so, who they are. And
22 I think specifically that people have mentioned before
23 about partnerships needs to be addressed.

24 So that's all I have. Thank you.

1 JASON BAUSERMAN: Just two real quick
2 comments. One is, well, just a month ago, I had my 50th
3 college reunion at Bridgewater College in Bridgewater,
4 Virginia, and I met one fellow and he found out that I
5 lived close to Green Bank, and he said, Gee, yeah, 50
6 years ago he came over here to the observatory and he
7 was a Physics major and I think all Physics majors came
8 over here.

9 But when I found out what he did, he lives in
10 Nebraska now, he came up with a drill core that drills
11 into the polar ice caps and it was two miles deep that
12 he could go with that drill and come up with really, the
13 history of the earth in the polar ice caps. You know,
14 you can CO2 in those and volcanic ash, it's just
15 amazing, that gee, he kind of started out here in a way.

16 The other amazing thing is and what I'm so
17 excited about, so many young people here and your
18 excitement and enthusiasm is just great. I mean, my
19 faith in young people has increased. I've been down
20 here a couple of Summers walking around. To me, it's
21 just like a of the college campus down here. It's just
22 a lot of excitement and enthusiasm and that is just
23 great to see. I'd hate to see that go.

24 KRISTEN HAMILTON: Thank you for speaking,

1 Mr. Bauserman. It's been very inspirational hearing our
2 students speaking.

3 At this point, we don't want to over-stay our
4 welcome with our very generous hosts, so I'd like to say
5 I believe this is was a very successful public meeting
6 because of the thought that you put into your comments.
7 So thank you, very much.

8 We got through over 42 speakers in less than
9 three hours which is phenomenal and you gave us a lot to
10 consider. Please do consider submitting, if you have
11 any additional thoughts that you didn't get to speak
12 about today, please so send us your written comments via
13 email or mail. I also just wanted to put up a point of
14 contact. My colleague, Elizabeth Pentecosta, if you
15 have questions about the process, she can answer them or
16 connect you with the right person to answer your
17 questions, and all the information, all the documents
18 are available on our Website.

19 At this point, I would like bring Dr. Ajhar up
20 for closing remarks.

21 DR. EDWARD AJHAR: Thanks, Kristen, and I just
22 want to express my thanks to the whole public here that
23 was here today and those who have left.

24 These comments are very valuable to us. We --

1 as you know, this is the Draft Environmental Impact
2 Statement so all of these comments are really valuable
3 and you have, just what Kristen said, too, you know,
4 they were very important , they are very important for
5 us. It's very important for us to get the correct, the
6 facts corrected, and where there are deficiencies in the
7 documents, to replace that with things that are
8 appropriately addressed so when that when NSF is in a
9 position to make a decision, we have the right
10 information in this document.

11 So I appreciate, again, your participation.
12 And I especially want to thank the staff here at Green
13 Bank, Karen and Mine and anybody else who have supported
14 us in everything in putting all of this together and
15 helping the public and keeping everything going very
16 smoothly. It is a cooperative effort.

17 We don't operate this observatory under a
18 Federal contract. It's a cooperative agreement and
19 that's something that NSF invented and it is something
20 that we hold very dearly and that's how we make science
21 happen at our facilities. So, again, thank you to the
22 staff. We really appreciate your support, and thank you
23 to the public for being very helpful in making comments
24 and staying within the time limits so everyone has time.

1 And this is not it for comments. Right.
2 We're open until January, through January 8th and you
3 can submit comments through our procedures we've
4 outlined multiple times.

5 So thank you, very much again and we
6 appreciate you excellent cooperation.

7 (Hearing concluded at 8:42 p.m.)

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CERTIFICATE OF NOTARY

I, Kristina Guthrie, the officer before whom the foregoing hearing was taken, do hereby certify that the hearing was taken by me stenographically and thereafter reduced to typewriting by me; and that said hearing is a true record of the proceedings given at said hearing; that I am neither counsel for, related to, or employed by any of the parties to the action in which this hearing was taken and further that I am not a relative or employee of any attorney or counsel or employed by the parties thereto, nor financially or otherwise interested in the outcome of this action.

Kristina Guthrie

Notary Public, State of West Virginia

My Commission expires November 8th, 2020

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Section 106 Consulting Parties Meeting
Green Bank Observatory
Thursday, June 28, 2018
3:00 p.m. – 5:30 p.m. (EDT)

Attendees and Introductions

National Science Foundation (NSF): Caroline Blanco (Assistant General Counsel/Federal Preservation Officer, Office of the General Counsel), Karen Pearce (Senior Legislative Affairs Specialist, Office of Legislative and Public Affairs), Elizabeth Pentecost (Project Administrator, Division of Astronomical Sciences), Kristen Hamilton (Environmental Compliance Officer, Office of the General Counsel), Harshal Gupta (Green Bank Observatory Program Director, Division of Astronomical Sciences, Directorate for Mathematical and Physical Sciences)

CH2M HILL/Jacobs (Jacobs): Lori Price (Senior Cultural Resources Consultant), Jessica Wobig (Cultural Resources Specialist)

Advisory Council on Historic Preservation (ACHP): Charlene Vaughn (Assistant Director of Federal Permitting, Licensing, and Assistance Section, Office of Federal Agency Programs)

Green Bank Observatory (GBO): Dr. Karen O'Neil (Green Bank Site Director & Assistant Director for WW Operations), Mike Holstine (Business Manager), Frank Ghigo, Martin Chestat, Paulette and David Woody, Mary Meeks, Jon Cooper, Jason Pitzer, Galen Watts, Carla Beaudet, Dennis Egan

Division of Culture and History's State Historic Preservation Office: Susan Pierce (Deputy State Historic Preservation Officer), Benjamin Riggle, Sarah Hanna

National Park Service (NPS): Bonnie Halda (via telephone)

Pocahontas Landmarks Commission: Bob Sheets

Senator Manchin Representative: Zahava Urecki, Staff Assistant (via telephone)

Consulting Parties (CP): Deana White, Gray Ralphsnyder

Interested Members of the Public (Public): Ellie White, Sue Howard, Jennifer Wood, Carlos Sosa

The Pocahontas Times: Suzanne Stewart

Status/Process Update

Kristen/NSF provides an overview of the meeting purpose.

- Statement of Intent.
- Introduction of the environmental review process (beginning in 2016).
 - Included 2 different public scoping meetings, public comment period, and issuance of a Draft EIS (published in November 2017), followed by a 60-day public comment period and public meeting.
 - Completed Endangered Species Act.
- **Charlene/ACHP** asks if the received public comments could be summarized. **Kristen/NSF** clarified the received public comments during the NEPA process on cultural resources and noted that all public comments were considered by NSF during the Section 106 process as well:
 - 6 comments received:
 - Comments (noted below) were received from 3 persons in attendance at today's meeting
 - Overall interest in additional research (including the 20-meter Telescope, the Hannah House, and Tatel Telescope)

- EPA asked how TCPs were identified.
- **Kristen/NSF** continues by providing an overview of the Section 106 process, which includes four main steps: initiation, identification of potential historic properties, assessment of effects, and development of a document to address adverse effects to historic properties

Summary of Historic Properties at GBO

Lori/Jacobs provides overview of identification and assessment process to date

- Survey efforts in 2014 led to a NRHP Historic District (GBO Historic District) found eligible by NSF (the federal agency) under Criteria A and C. Also, Criteria Consideration G is applicable to the GBO Historic District due to the presence of historic properties with exceptional significance that are less than 50-years of age
- Discussion of the Section 106 process for the GBO Historic District versus the Reber National Historic Landmark (NHL); the NPS is involved when there is a potential effect on an NHL
- **Bonnie/NPS** clarifies that the Secretary of the Interior (SOI) designates NHLs and the NPS provides comment on the potential to affect NHLs in addition to the Lead Federal Agency, the State Historic Preservation Officer (SHPO) and other Consulting Parties
- **Charlene/ACHP** is introduced because of the ACHP's involvement due to the potential adverse effect to a historic property. She clarifies that she is vested in today's meeting not only due to the role of the ACHP but also because of her previous experience and knowledge gained from the Section 106 efforts at the Arecibo Observatory.
- **Lori/Jacobs** continues with the explanation of the four individually NRHP-eligible historic properties (Interferometer Range, 40-foot Telescope, 43-meter Telescope, Green Bank Telescope or GBT). Some additional discussion between the Consulting Party attendees and Lori/Jacobs occurs to further clarify the difference between the individually NRHP-eligible historic properties and the GBO Historic District's contributing resources. SHPO concurred with the NRHP-eligibility determinations and assessment of adverse effect.
- **Charlene/ACHP** asks **Susan/SHPO** to explain SHPO's role in review and concurrence of the NRHP-eligibility assessment and potential adverse effect determination.
 - **Susan/SHPO** clarifies the review and concurrence of the NRHP-eligibility recommendations and states she would like to further discuss the telescope (Tatell) which was referenced in the received public comments.
- **Carla Beaudet, GBO staff**, interjects with a recommendation to include further discussion on the Drake Lounge, which is in the residents' hall above the cafeteria. Currently, the Drake Lounge has a commemorative plaque memorializing the site where a meeting occurred leading to the Drake equation, and Tully-Fischer relation (foundation of how dark matter was inferred, quantifies the mass of galaxies). Noted there is a book available, "But It Was Fun," for purchase at the GBO gift shop that further discusses the event.
- **Bob/Pocahontas Landmarks Commission** appreciates seeing the Hannah House featured in the presentation due to the anniversary of the county and his previous comment regarding the building's local significance.

Discussion of Draft Programmatic Agreement

Kristen/NSF discusses the Draft PA, which is a document that details how to resolve adverse effects on historic properties.

- **Charlene/ACHP** further describes how a PA is a program alternative, or a project-based programmatic agreement to address short/long term solutions that are aimed to include all Consulting Parties. The document lays out a road map for how a project's effects on historic properties will be addressed. The draft does not exactly detail the outcome.
- **Kristen/NSF** explains a comment period is open, and NSF will provide the weblink for submitting a comment.
- **Kristen/NSF** describes how a PA is set up, or the intent of each Section.

Kristen/NSF opens the floor for additional questions related to the Draft PA.

- **Deana White/CP** asks for a copy of a "2006 report" that recommended the need for de-funding the GBT.
 - **Caroline/NSF** and **Liz/NSF** clarify that the NSF AST completed a Senior Review in 2006. NSF-AST relies on its decadal surveys for setting science priorities for the agency. The 2010 Decadal Survey recommended that NSF conduct a "senior" review before the mid-decadal review, and the result was the 2012 Portfolio Review. The 2012 portfolio review did specifically mention the GBT. Both clarify that it is a publicly available document, and NSF will provide a link or copy.
 - **Charlene/ACHP** asks to clarify if the public was involved in the previously mentioned studies.
 - **Caroline/NSF** and **Liz/NSF** clarify that NSF AST utilized an external advisory group composed of experts in the field, not the public, who made the recommendations to NSF. The recommendations were developed to ensure NSF's portfolio is balanced and maximizes progress on the scientific priorities set by the 2010 Decadal Survey. While not everyone agrees with NSF's ultimate direction, the external review groups are essential to the overall mission.
 - **Ellie White/Public** asks how the advisory group is selected.
 - **Liz/NSF** states about 12-20 persons are selected by NSF to compose a multidisciplinary panel that makes the recommendations.
 - **Harshal/NSF** states the overall process is broader than the advisory group because it takes into account the recommendations of the 2010 Decadal Survey, which reflects the priorities of the greater astronomical science community.
 - **Karen/GBO** further explains how the 2006 review included operational costs. Financial reviews brought in by outside parties and internal audits created contradictions between the NSF audit review and the response that was received internally. As a result, scientists made financial recommendations that were audited by financial experts, which generated some irregularities. Overall, the outcome was based on a budgetary cap described in 2012 report.
- **Charlene/ACHP** asks about how the WV Senator legislative questions were answered.
 - **Karen/NSF** and **Caroline/NSF** state that periodic comments/concerns/questions presented to NSF have consistently been responded to by NSF; many of the comments/concerns/questions focused on the proposed Alternatives analyzed in the NEPA review and did not focus on the portfolio review. Karen states that NSF has been in close contact with the WV delegation throughout this process.

- **Mike/GBO** asks why the National Radio Quiet Zone (NRQZ) is not identified as an historic property (he mentioned it was first created by the State in 1967 followed by U.S. Congress)
 - **NSF/SHPO/Jacobs** explain that the NRQZ was discussed as part the NRHP-eligible Historic District.
 - **Bonnie/NPS** clarifies that the Reber Telescope NHL is not significant for its setting but, rather, for its technological significance. She then poses a question: should the GBO Historic District be considered an NHL?
 - **ACHP/NSF/SHPO/Jacobs** state that it would be difficult to list the NRQZ in the NRHP because it's not a site or object. But could evaluate it in more detail as a contributing factor to the setting of the historic district.
- **CP** asks about the potential for UNESCO World Heritage eligibility.
 - **ACHP/NSF/SHPO/Jacobs** Explain the process for consideration is different than determining eligibility for the NRHP and involves greater competition, globally.
 - **Karen/GBO** adds that, while the GBO was the first NRQZ in the US, it is not necessarily the best example. It is unique to the U.S., but not to the world.
- **GBO staff**, who has served as a custodian of the NRQZ for 12-years, emphasized that the technology wouldn't have importance without the NRQZ (setting).
 - **ACHP/NSF/SHPO/Jacobs** all agree that this impact of the NRQZ on the setting will need to be further evaluated.
- **Charlene/ACHP** asks whether mitigation could be included by incorporating a more full analysis of the importance of the NRQZ into any agreement document.
 - Notes that Section 110f *and* 106 should be noted in the "Whereas" section
- **Charlene/ACHP** asks how Tribal representatives were included.
 - **Kristen/NSF** states that the relevant tribes were notified and followed up with phone calls. Delaware Nation identified themselves as being an interested party. Cherokee replied with an "out of interest area" comment and recommended the Shawnee be contacted. The Delaware Nation has not submitted a comment on the Draft EIS, and likely only wish to be consulted if changes occur. No other tribes have responded or expressed interest.
 - **Caroline/NSF** clarifies the Delaware Nation sent a letter to NSF.
- **Kristen/NSF** explains adverse effects specific to transferring to non-federal entity, safe-abandonment, and demolition.
- **Kristen/NSF** explains the measures of avoidance, which encourages any new operators or non-federal owners to use as many of the resources as possible.
- **CP** suggests including the 20m in the "Whereas" clause addressing individually eligible resources.
- **Karen/GBO** requests clear guidelines on how GBO is supposed to keep using historic properties. For example, what is an adverse effect from modifications to contributing resources, or demolition of noncontributing resources.
 - **Lori/Jacobs** and **Susan/SHPO** agree that a focused review process should be defined for how these resources will be cared for moving forward.

- **Karen/GBO** points out the amount of time that has lapsed since the 2014 studies were conducted. She stressed the need to look at the present condition of resources when developing a preservation/maintenance plan. For example, weather, deterioration, etc.
- **Charlene/ACHP** asks to add a section addressing a process for handling effects on historic properties as a result of emergencies and natural disasters. She suggests making it a standalone provision among the “boilerplate” provisions explaining what the process will be and how it should work with the SHPO to streamline the review process.
- **Susan/SHPO** states that a separate consultation could occur now, outside of this current environmental review.
- **Mike/GBO** asks why the Reber and two other contributing (but not individually eligible) instruments were mentioned in the Draft PA in one stipulation.
 - **Kristen/NSF** states the resources were grouped because they are stand-alone display instruments.
 - **NPS** requests that the Reber be listed in the Draft PA as a stand-alone stipulation because it is an NHL, even if it is repetitive language for the other resources, due to potential for future confusion as to why they are discussed together. All agree.
 - **Kristen/NSF** suggests that the Reber should have a condition report every two years to monitor its condition, in response to comment received from SHPO.
 - **Mike/GBO** adds that the GBO uses a post-card image from 1970s to match the appropriate paint.
 - **Bob/Pocahontas Landmarks Commission** notes Grote Reber was here and the Reber was used here, and points to the control building that existed and is shown in the photo used in the presentation (Slide #8).
- **Karen/GBO** adds that the Calibration Horn (Little Big Horn) is a contributing resource, too. She follows up with additional information about the Replica Antenna, which is maintained and used once per year by amateur radio enthusiasts as an education tool and is functional.
 - **Frank/GBO** follows up that the Little Big Horn should be maintained.
 - **Ellie/Public** adds that the Little Big Horn was used in some of the earliest absolute flux measurements (brightest) of radio astronomy.
 - **Karen/GBO** confirms that Little Big Horn shouldn't be moved but it should be made more readily available for public access (i.e., add a path, etc.). The hillside is part of its structure. The angle of the hillside provided the necessary angle to observe the absolute center of the galaxy.
- All agree to make Section 1.A.4.b. a standalone provision applying to any situation in which there are historic properties that are not repurposed for further scientific use by NSF.
- **NPS** asks, not as a requirement but just as a consideration, for HAER documentation to be included for the Reber.
 - **Caroline/NSF** and **Charlene/ACHP** discuss the need for a consideration of HAER recordation or language that clarifies appropriate mitigation documentation and future potential changes (Potentially to be added into Section I.B.1).

- **Charlene/ACHP** and **Susan/SHPO** asks for additional language around modification (Section I.A.3.) that can occur without additional consultation, provided that there are no adverse effects on contributing resources. They ask for additional language to detail out exempt actions.
 - **Karen/GBO** uses an example of the interferometer needing an upgrade. For example, she asks whether consultation is still required if the replacement of the surface is carried out with a similar type of material.
 - **Charlene/ACHP** points to the Secretary of the Interior’s Treatment of Historic Properties
 - **Susan/SHPO** further discusses replacement in kind.
- **Lori/Jacobs** asks for **Karen/GBO** to create a list of the types of modifications GBO needs to do that may not be considered an adverse effect. Lori/Jacobs suggests that the list be added as an attachment to the PA.
- **Caroline/NSF** suggests that, if the list holds up the finalization of the PA, this approach can be continued outside of this environmental review/Section 106 process.
- **Kristen/NSF** introduces the intent to Mothball, which means operations may resume in the future. Also, **Kristen/NSF** asks about the potential to repurpose significant equipment and artifacts.
 - **Ben/SHPO** asks that a two-year monitoring reporting be put into place
 - **Karen/GBO** asks about what it means to mothball historically significant resources and artifacts.
 - **Lori/Jacobs** and **Kristen/NSF** clarify that this discussion requires additional clarification and may not be appropriate for inclusion in the Section.

Kristen/NSF introduces Section I.B.2.

- **Charlene/ACHP** requests further oral histories to be completed.
- **Susan/SHPO** states the need to include language around who is making the determination of reasonable documentation. **Susan/SHPO** goes on to speak to the potential to do more than what is in a National Register nomination. For example, she suggests an innovative approach that focuses on the living history of GBO staff and the people here.
- **Karen/GBO** states that Grote Reber saved everything, but it was mailed around the world.
- **Charlene/ACHP** and **Susan/SHPO** agree that the appropriate format for telling the story remains an open question.
- **Suzanne Stewart/Pocahontas Times** states that the Newspaper has an archive covering all 146 years of its operation for use in any potential research efforts.
- **Bob/Pocahontas Landmarks Commission** adds that the Commission has additional information to support such a project, also.
- **Susan/SHPO** wants to take an action item to work toward gathering recent histories.
- **Caroline/NSF** suggests that NSF develop an outline of a report and then consult with the SHPO on the contents of that outline. **Susan/SHPO** agrees.
- **Deanna White/CP** has a concern related to Section I.A.1 or I.B.2, which is specific to additional information regarding why resources were determined appropriate for demolition when they are significant. For example, what happens if a new operator comes in and views the Alternatives as options for demolition.

- **Charlene/ACHP** echoes concern by asking for further emphasis to be placed on coordination with SHPO.
- **Caroline/NSF** clarifies there is no intention to demolish but there is a practical reality of needing to plan for worst case scenarios. She suggests that a way to address this is to use a similar approach to what was used in the Arecibo PA: develop a management plan with a future collaborator(s) that addresses preservation strategies and includes training and SHPO consultation. Language will be included to encourage the preservation of historic properties. **Charlene/ACHP** agrees with that suggestion.
- **Mike/GBO** points out and asks for clarification on a statement in Part C regarding an every sixth-month reporting stipulation
 - **All** agree it is internally confusing and should be deleted.
- **Karen/GBO** and **Charlene/ACHP** discuss what happens if a new federal owner takes possession of the property. For example, can the PA be adopted by the new owner?
 - **Caroline/NSF** explains that the PA may be used as appropriate to the new owner's mission, either incorporated in whole or in part and at the discretion of the new owner. The PA will reflect NSF's encouragement of a new partner to use the document. However, NSF may not enter legally binding agreements on behalf of any unknown or future partner.

Kristen/NSF concludes the meeting and asks that any further comments for a revised Draft PA be sent to NSF. A revised copy of the Draft PA will be provided to CPs and agencies.

Next Steps

- NSF to provide a copy of the 2006 report. The 2012 report is already provided on the main NSF-AST web site.
- Following the close of comments on the Draft PA, a revised copy of the Draft PA will be provided to interested CPs and agencies.

Appendix 5H

DEIS Comment Matrix and Comment Responses

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
1	a	Joe	Manchin	U.S. Senator	<p>Letter read by Peggy Hawese, Regional Coordinator for US Senator Joe Manchin: "It is a pleasure to welcome each of you to one our beautiful State's most impressive and nationally significant landmarks, the Green Bank Telescope Observatory. For sixty years, the Foundation, Pocahontas County, and the State of West Virginia have supported the ability of enumerable national and international scientists to make discoveries about our universe using the capabilities located at the observatory within the National Radio Quiet Zone.</p> <p>"During this time, the local communities have made sacrifices to keep the surrounding area radio silent to ensure that the activities at the observatory can continue without interference. As we look to the future, I believe that the observatory's contributions to national and international science and the West Virginia commitment to this work justifies the Foundation's strong, continued full-time support and presence at the observatory.</p> <p>"I strongly oppose the proposed arbitrary 21-week implementation period for demolition, mothballing, and/or self-abandonment, and I believe that the Foundation has a responsibility to identify and secure additional partners before affecting any change to the infrastructure or funding support at the observatory.</p> <p>"We owe it to our children, our future leaders, to uphold the integrity that this facility has provided in regard to STEM programs and community efforts. By continuing to integrate these skills throughout our communities and in our schools, we are showing our future leaders that we are investing in them and that their statewide community wants them to be succeed in return.</p> <p>"Green Bank is a vital link to the future of our home state and entire nation and we simply can not turn our backs on this word class facility."</p> <p>Am I out of time? Okay. I just want to say that the Green Bank Telescope, or as I affectionately call it The Great Big Thing, is a friend and I don't want to lose my friend. Thank you.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
2	a	Shelly Moore	Capito	U.S. Senator	<p>Letter read by Mary Elizabeth Eckerson for US Senator, Shelly Moore Capito: "If there is a word to describe the Draft EIS I would use the word "exhaustive." I commend those who took the time and effort to compile this report. Though I'm not able to attend this meeting, if they are anything like those in the past to discuss the future of Green Bank, I know there are First Responders standing next to researchers and school children sitting near their teachers along with current small business owners and maybe more than a few future scientists. This represents the impact and the opportunity that Green Bank embodies.</p> <p>"When I submitted a letter in November of 2016, I asked NSF to not overlook the less easily measured impacts which, among soil and climate impact hit home to me as I read through your report.</p> <p>"We have talked about how Green Bank is the potential portal for history-making research, but let's not overlook that the Green Bank Observatory is a certified Red Cross shelter for this area, that the water tower is used by several fire stations, and that the GBO staff, in addition to their daily work, serve as the backbone to this area through their work in community organizations and emergency service crews.</p> <p>"In addition to monitoring potential life in the solar system, these men and women are playing a huge role in improving life for those in Pocahontas County. I have long advocated the partnership model for Green Bank. In this time of limited financial resources from the Federal government, maximizing partnerships, whether with universities, other government agencies, or private industry, is something we should always be pursuing.</p> <p>"I have been and will continue to be an advocate for the potential that exists at Green Bank. That potential rests in its facilities, its community and in the men and women who work here. Let's work together to fulfill that potential for it holds exciting promise for all of us. It is truly an honor to serve you in the United States Senate. Sincerely, Shelly Moore Capito." Thank you.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
3	a	Evan	Jenkins	Congressman	<p>Letter read by Jordan Maynor for Congressman Evan Jenkins. Green Bank is truly a gem in the mountains of our state and it must be fully funded and preserved. We know the incredible work that takes place here, the undeniable influence this facility has on scientific research and the irreplaceable impact it has on our community and on our State. This facility must remain open and fully operational.</p> <p>"Just yesterday I met with top NSF officials to discuss the future of Green Bank, the Draft EIS, and the work being done to identify new strategic partners to work with NSF here at Green Bank.</p> <p>"I have also had multiple conversations with NSF Director Cordova and the Foundation over the past few years in an effort to make the strongest case possible for a strong, secure future for Green Bank.</p> <p>"I am encouraged and very optimistic that the commitment from NSF is sincere and the future funding possibilities are real. As your Representative in Congress, I am pledging my full, active support to facilitate contacts and build relationships with other Federal agencies to secure a new strategic partner.</p> <p>"We must preserve this world-class telescope and research facility. As potential partners come forward, the focus will always remain in ensuring that Green Bank is able to continue its ground-breaking research and that West Virginia is still able to bring in top scientists and researchers.</p> <p>"We must also preserve the exceptional educational resource the Green Bank Observatory gives students, a truly unique opportunity for hands-on experience.</p> <p>"For many of the students who come to Green Bank, this visit will shape their future career aspirations in science, technology, engineering, and mathematics. The lessons learned at Green Bank will stay with these students for a life time.</p> <p>"The Green Bank Observatory affords incredible job opportunities for the people of West Virginia and those who are here are a true asset to our state. The employees here not only dedicate their time to researching life's great mysteries but they also give so much back to the community by helping students learn and prepare for a successful future.</p> <p>"We have a world-class observatory and world-class employees. The call I make to the NSF and the call I ask you to make here today is that we are here ready to work with you to make sure that Green Bank stays open and fully operational. And we also call on NSF to make sure that the core mission of Green Bank is not lost, the mission of discovering what makes our universe work, discovering how stars and planets form, and how they can support life, and discovering the fundamentals of life. The Green Bank Observatory is important to West Virginia and is important to the world. Thank you for being here and making your voices heard. This is another opportunity for all of us to show the value of Green Bank and what West Virginia has to offer. Keep Green Bank here and keep Green Bank open.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting		
4	a	Jack	Tade	Corporate controller of Associated Universities, Inc.	<p>AUI is the organization that manages or is responsible for managing the NSF Green Bank Observatory and it's operations. On behalf of AUI I'd like to strongly express that we support the outstanding scientific research performed here at this facility and value the deep involvement with Pocahontas County and their communities. We look forward to working with the National Science Foundation throughout the process and hope to continue our support for and service to the local communities. Thank you.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
5	a	John	Taylor	Vice President of the Central Appalachian Astronomy Club	<p>I am the vice president of the Central Appalachian Astronomy Club, and our club, and I don't know how I got to go right after those high powered speakers, but our Astronomy club annually, for the last 14 years, in cooperation with the Kanawha Valley Astronomy Club and with the collaboration, of course, of the Green Bank Observatory has held an affair here, called a star party called Star Quest. Star Quest is billed as the only optical and radio astronomy star party. We get to operate the 40-foot telescope as well as look, it's a great dark sky site for a star party. Most star parties are held in tents, we've got this nice facility at our keynote speakers. We have four keynote speakers. It's basically a four-day event. In the past, we've had Alan Bean who is the fourth man to walk on the moon. We've had Carolyn Shoemaker. We've had Seth Shostak. So we've had some really high powered folks to come in to our Green Bank star quest. This is a unique facility to hold a star party in. Like I said, most of them are held in tents. We've got a great facility to do this in. And as an educational facility and -- this is just one of many things that Green Bank Observatory does. I'm a retired school teacher. Some 25 years ago, I participated in a two-week National Science Foundation teachers affair that we had a workshop basically. Then we had a number of speakers in and learned a lot of Astronomy. And basically, I went back to my high school and started an Astronomy class based on that. And I had, for several years, a number of students pass through my classroom taking Astronomy and it was all inspired by Green Bank Observatory. So Green Bank Observatory as an educational facility is unmatched, and it would not exist as an educational facility without the observatory being here and the work that the observatory does. So, you know, we are very grateful. I can't speak to the science as well as a lot of the people, but, you know, this is a facility, it's probably the only observatory, radio observatory that's in a radio quiet zone. There's got to be something to be said to keep that operating. So by all means, I think the Green Bank Observatory should be as fully funded by the National Science Foundation as it can be and collaborators should be found to keep it working. Thank you, very much.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
6	a	Jim	King	co-founder of Central Appalachian Astronomy Club	<p>And I've been with John here for several years in regards with the Star Quest. He's pretty well told you about that event. Some of the other things that have happened as regards to the star quest is that we have children's events and the children come here with their families and attend star quest and, hopefully, they're inspired to pursue science, and we need scientists. In our own club, we have several of the club members who have gone on after being in the club to be Physicists and Geologists, et cetera. And that -- so it's all from a spark of a place like this, you know. We come here and we learn things and we try, you know, as we come here trying to teach some things, you always learn some things. So it's really a win-win situation for us that Green Bank is here. And it would be a devastating blow to our club if we could not have this facility to present our star party. There is no other facility in the state that we could go to that we would have this kind of infrastructure. The other thing is like Green Bank, if you close your eyes and you can't see anything; right? Well, Green Bank is an eye with a telescope to the sky. It sees things that optical telescopes cannot see. There's, you know, like pictures out in the 00 and they're showing like galaxies. Well, this little picture in the middle, that's what we could see with an optical telescope. With a radio telescope, we saw all these clouds of hydrogen gas all around it. So it's important that we have this kind of equipment infrastructure to see the universe. We are like a small speck in the universe, the whole planet. But if we, you know, can't see and don't understand what's going in the universe then our ability as a race, society, whatever, is limited. We need to understand what's going on out in the universe and this is a, one of the most finest places I've ever been that you can learn and have a lot of real science going on. One other thing here, when we were here, one of the star parties that we had, they had the deep impact where they shot the missile to the comet. And we were the first people -- the head astronomer that was doing this came in here, we were having a meeting that night like this, he came in and told us they had discovered water. They had it had always been hypothesized, but it had never been proven. Anyway, but I mean, basically, that's what I wanted to say. I mean, this is a really important place. The people here are top notch. I would hate for them to have to go out and look for other jobs, because, and I'd hate to lose a lot of friends because there's a lot of friends I have here. So thank you, very much.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
7	a	David	Umling	Farmer	<p>And I guess, I haven't read this report. I apologize to anybody for that, but if I had, I'd probably be up here talking about a bunch of acronyms and technical terms that nobody's going to understand and I'd rather just speak plainly to you. But basically, what I'm concerned about is having seen that there are only four options that this National Science Foundation has come up with to evaluate in it's report, I'm quite dismayed that we have here a body that represents the scientists and the intellect that we depend on to try to answer some of the most difficult, perplexing, and complex questions about our existence in the universe that we have to face today. And the best that they can do is come up with four alternatives, two of which is shutting this thing down. This facility has a 50-year life span. Over that time it's had some important discoveries. And now they say there are other facilities that make it obsolete, basically. Well, I would have to ask, you know, if we're not really seeing here the unintended final results from long deferred maintenance and upgrade of our facility, when things could have been made more relevant or kept up to the highest technology that exists today, but I understand this facility still makes important discoveries. So I question, you know, whether we're seeing a self-fulfilling prophecy here and the expectation that NSF is going to divest it's investment in our community. I think the State has done a lot for the National Science Foundation, and for this facility as well as it did for Sugar Grove. I live in Pendleton County and the Sugar Grove facility in our county is in the National Quiet Zone. It was set up for it originally as well. And if the National Science Foundation wants, is appreciative of the investment that was made on their behalf to make this facility something important, then they should have put money into it while they had it instead of waiting until they get to the point where they don't have money and then saying they need to close it down. Well, I don't think that's a good decision, I don't think it represents perhaps a policy that was sustainable or good to begin with. But I would like to remind them of a scene from the movie, Carl Sagan movie, Carl Sagan's movie Contact, where the star of that particular story Ellen Arroway, has made this discovery of other civilizations and picked up this signal from some other society, extraterrestrial out there in the vicinity of Vega. And she had a person that she worked for by the name of David Drumlin who was very much against everything she did, and wanted to shut it down many times and worked to defeat her efforts to try to fund her program that resulted in this discovery. And of course when the discovery is made, these people from somewhere else has sent us plans for, design plans for transport that will take one astronaut to go and visit them and make the first contact. And Ellen decides she wants to go on this trip. And, but so does David Drumlin and when the two of them compete, she's asked some very difficult questions by a committee that makes it hard for her to tell, to be honest and to be able to earn the committee's support for her candidacy to be the astronaut. But David Drumlin, he goes ahead and tells them whatever they want to hear and he's the one who wins. And later on when he meets up with her he says, Ellen, I'm sorry. I wish this was the kind of world where the integrity and honesty that you showed before the committee in trying to answer those difficult questions were rewarded instead of taken advantage of. And her one line response was, Funny, I thought the world was what we make of it. And I want to ask the National Science Foundation: What do you think you're going to be making of our world when you make this decision? I reject the idea that this facility need to closed down and shuttered. I know what happened to our community in Pendleton County when Sugar Grove was eliminated, and I don't believe that anything good has ever come to West Virginia when outside interests have divested themselves of their obligations to our state. And I would question seriously whether you're just going to do the same thing to us. Thank you.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
8	a	Diane	Schou		I am here in Green Bank because of a special environmental -- oh, Dear I lost the word -- but because of the environment here. I was injured by over exposure, from over exposure to emissions from a cell phone tower. There are a number of other people here who are also harmed by electromagnetic radiation. There was one day that several of us reacted. We didn't know why, but there are 82 different symptoms and out of eight people, six of us reacted at the same time. This was about 3:00 o'clock in the morning. We don't know what happened. It woke me up. It woke up six other people. I contacted the government to find out what was it that occurred at 3:00 o'clock in the morning, that we woke up, we got out of bed, we did stuff, we lived miles apart, what happened? And this is why I am here at Green Bank because there are less electromagnetic radiation emissions. It's safer here. And a number of people are here because they have less symptoms by being here. There are many, many emissions that are invisible. Some of them may be legitimate, such as emissions from cell phone towers, fortunately not here in Green Bank. But there are also emissions, they may be illegal. And one emission, I contacted a person when several of us were detecting it, and I was told that it was, they could not tell what that emission was. They were prohibited from doing that. And if they did they could be, I don't know what the consequences were. I guess that's about the summary of this. This is why I'm here in Green Bank, and why the observatory is essential, and it's essential for people around the world, not just for West Virginia but this is the safest place and a safe place to live.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
9	a	Sue Ann	Heatherly	Education Officer at GBO	I didn't read the Draft EIS from cover to cover, but I did do some searching on it and would like to bring up a few points that I think were either understated or need further investigation before final draft or before the Final EIS is produced. And one them is, of course being the education officer, is the impact of the observatory's educational programs which really do depend on having a vibrant scientific operation here. It's just not possible to have the alternative happen where we give tours of, you know, decaying facilities out there in the field and trying to operate an educational program without a scientific program happening here. On page 3-59, the Green Bank Observatory's education programs are listed there and then they're referred to several times throughout the whole document, but they are completely under reported. And when comments were sent in last time around, I sent them a seven page detailed description of numbers, all the educational programs that we do that you can find in the comments from last time. I think they need to be addressed in the final report because it's a lot bigger than was stated.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
9	b	Sue Ann	Heatherly	Education Officer at GBO	Regarding that the 20-meter telescope was not mentioned very often at all and kind of slated to either be mothballed or a potential telescope to be removed from the site, but it is our robotic telescope that allows students all the way up through undergraduate and even graduate school, to use a regular telescope no matter where they are. And so the impact of the loss of that reaches far beyond our community and our state. So I want that to be addressed also.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
9	c	Sue Ann	Heatherly	Education Officer at GBO	With regard, regarding historic properties, the 43-meter was listed as one that should be kept, but yet the table telescope was listed as one that could be potentially demolished and I thought that was odd. That's the first one here. That's the one that Frank Drake used, so I don't know what, you know, what rationale went into that but I'd like to see a response to that.	Considerations for Document Analysis	Cultural	Public Meeting	11/30/2017	
9	d	Sue Ann	Heatherly	Education Officer at GBO	And finally, I searched for West Virginia University, I'm an alum, and a lot of the educational programs that I do are in partnership with WVU and we make use of a very vibrant astronomical staff and it's just faculty that are there. And they are there because of the GBT and because of this observatory. Yet that environmental impact, that socio- economic impact which goes far down to our county wasn't really addressed, I didn't see in the Draft EIS as far as the loss of this place for West Virginia University's Astronomy department and what that would do. They have garnered over \$13 million in grants since 2012, when this whole nightmare began. So and that's for research using the GBT. So I think that needs to be brought out as a big environmental impact. Thank you, very much.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
10	a	Micky	Holcomb	Faculty at WVU in the Physics and Astronomy Dept.	I am not an astronomer. I'm a materials physicists. As far as I know, my research field has absolutely nothing to do with anything going on here. In fact, this is my first time coming. It's very nice. I wanted to take time away from my own work today because in the eight and a half years I've been at WVU, I've seen the incredible impact that the Green Bank Observatory has had on our department's research program. Since 2006, our Astrophysics faculty has grown from one to six, and that group brings in more research dollars per capita than any other in our department. The Physics Frontier Center Award, which are very competitive, shows that they are not just one of the flagship research programs at WVU, but thought to be one of the most transformative science programs of the broader Physics community. There are currently 15 graduate students working with the group and the majority of which are involved in research with the Green Bank Observatory. An even greater number of undergraduates are involved with researches for pulsars with the GBT and many of these students got started as high school students in the Pulsar Search Collaboratory Outreach program. Let me do something that's a little unusual and be brutally honest about my own field. Most physicists and maybe even most scientists aren't the best at communicating the importance of their work to young generations; however, this program has been really important, almost like a gateway drug, for bringing awareness to STEM fields in the state and beyond, and in particular, has been critical for increasing the number of West Virginia girls going into these fields. In fact, the fraction of female physicists, Physics majors has increased from 10 percent a decade ago to 30 percent now. And a good fraction of those girls joined because of the Physics Frontier Center. Every once in a while, one of those excellent young women or men will switch to my field and I'm so happy that this program has encouraged them to pursue a career in science, which is so critical for our country's future, not just West Virginia. So the Green Bank Observatory is the premier science facility in the state and is critical for both WVU's research profile and the education that remains open at current funding levels.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
11	a	Micky	Holcomb		I'm a Materials Physicist. In my work I've had the privilege to work at a lot of different national laboratories around the United States and globally, Lawrence Berkeley, Argonne, NEST, for example, and it's possible that those facilities might be able to boast more tours to students but I highly doubt more tours per person or more tours per dollar funded. And what I've observed is that this place does way more than just tours. I've observed the tours that have been given to students at other national facilities and never do they get to have hands-on activities that I've heard about today and that I've heard about in the past. So I think that's a really amazing and unique thing that is done here. And I just want to state that as a professor, I hope anyone who's ever tried to teach a child can related to this. There is a huge difference between giving a lecture and letting a person actually get their hands dirty and make mistakes and learn from those mistakes. So this is really a unique capability and it is clear that there's a huge trickle-down effect on state and globally and this impact will not be the same if research were to leave. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
12	a	Blake	Humphrey	Student body president at WVU	And less than 48 hours ago I would have never expected that I'd be at the Green Bank Telescope today with you all. But after hearing about this hearing, I wanted to speak on the importance of this to young people, not only at West Virginia University but in the State of West Virginia. And I look here and I see two young people and I think about them all across the state. And I'm from West Virginia and I think of them and the impact that this would have on the future of our young people. But to speak of the student impact, and my friend from WVU just touched on that, not only do we have undergraduate and graduate students here at the Green Bank Telescope and working in partnership with Green Bank, but we also have research, exploration, innovation, education, training, and life changing experiences that can change someone's trajectory. Now, I'm going to talk very briefly about the fact that recently, WVU obtained an R-1 research classification and we have a world-class student body and world-class students who do amazing things each and every day, including in partnership here with the Green Bank Telescope. And my own unique experience here today, and I want to underline that word "unique," I think emphasizes the importance of the Green Bank Telescope for the State of West Virginia. You know, before we started all of this, I had the chance to take a quick walk out over to the telescope and taking a peek at it only emphasizes to me the importance of it's uniqueness in West Virginia. And the activities that are undergoing here at the Green Bank Telescope can continue to inspire research because of the fact that as it says -- I did it again -- as it says, outside on the wall entering, "The universe is whispering to us," and no doubt, the Green Bank Telescope is listening. In Morgantown, we say at West Virginia University that Mountaineers go first. Mountaineers go first. And today I think that we should all say as West Virginians, as a science community and beyond, that the Green Bank Telescope has gone first and by gosh, the Green Bank Telescope must continue to go first. Thank you, very much.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
13	a	Mayuresh	Surmis	Post-doc at WVU	I'm a post-doc at WVU and I actually work on some of these things like pulsars, for example. I have no written statement with me but people have talked about how science is important so I won't want to go into that. But the first real experience at the GBT which I had after joining here as a post-doc, is the PSE, which is where school kids actually get involved in active research with us people and, I mean, I have seen how people's faces light up when they see something which only scientists are suppose to see so --I mean, as a scientist, I would really like this facility to be open but just from a perspective of a layman, in order to understand what people in science are doing and getting inspired by that and, you know, you don't have to necessarily end up being a scientist yourself. But even if you are not ending up as a scientist, you see these people doing those extraordinary things. Being able to be one of them for some time and understand how things work, that's something which I think should not be taken away from school kids. So I guess from that standpoint, I would rather like to have facilities like this open. To add to that, I come from India where there's an another observatory called the GMRT, where I actually wasn't in charge of -- there's something called a science day where about 20,000 people visit the facility in two days. And I have seen the wonder on people's faces when you explain to them what we are doing here so -- And I would really like people to still have that sense, you know, adventures, you know, just looking at the sky and, you know, knowing that place in the universe, knowing how things work so such things are real important for that. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
14	a	Sheena	Murphy	Associate vice president for research development at WVU	Thank you for coming to Green Bank and thank you for the opportunity for us to provide input into this important process. I have taken the time to read the draft environmental report. It covers biology, water, geology, culture, visual aspects, but no where in the report, anywhere, does the word "pride" or "proud" appear and that is an oversight. The Green Bank Telescope is one of the premier facilities of which West Virginia is proud and we have every right to be. Indeed, any state would be proud to have this facility and we're just fortunate enough to have it in our backyard. As well as being a linchpin of the community, is it of vital importance to outstanding science at WVU as well as graduate and undergraduate student training.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
14	b	Sheena	Murphy	Associate vice president for research development at WVU	I'm now going to quote from an NSF report that was issued earlier this week which was a review of the Physics Frontier Center, NANOGrav, which is one of the principal users of this facility. It is an exhaustive review. I'm just taking little pieces from it. "NANOGrav is making great scientific progress and has an excellent chance of detecting gravity waves within the award period. The team has an extremely strong publication record resulting from these many research accomplishments. As a result, NANOGrav is a clear and visible leader in the field and well ahead of once comparable efforts based in Europe, South Africa and Australia. The detection of Nanohertz Gravity Waves is probably not far off and will reveal a completely new aspect of the universe." These are directly from a NSF report on the NANOGrav center issued this week. So what isn't there to be proud of. And so when you turn to the environmental impact survey, it's very thorough but the devil is in the details and we don't know what those details are in moving forward. The preferred agency alternative is for continued operation but with reduced funding. What reduction is planned? There are no numbers in the report. If we use what happened to Arecibo as representative of what might happen here, it frightens me because there the funding falls right off the cliff and we don't know what to anticipate here. Likewise, there's a statement that collaborators are being sought and new partnerships. Who are these collaborators? How aggressive is your search for these collaborators? So in closing, the absence of hard numbers and identified collaborators in this preferred action plan A, only offers a false sense of security. We are proud of the GBO and I ask that the NSF keeps it a facility that we in West Virginia and the nation can continue to be proud of. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
15	a	Paul	Baker	Post-doc at WVU	I'm a post-doctoral fellow at West Virginia University. I work in the Center for Gravitational Waves and Cosmology, NANOGrav, which we've heard about a little bit. And I will say that the socio-economic impact on the facility goes well beyond just the local community but extends across the entire state. My job wouldn't exist without the Green Bank Observatory so that's a reason. But just WVU in general is drawing lots and lots of research money from research at the Green Bank Observatory and the strength of the astrophysics group there is dependent upon the Green Bank Observatory. So any reduction in scientific operations will have and economic impact that extends far beyond the local community, throughout the entire state. Thanks.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
16	a	Carla	Beaudet	Engineer at GBO	I know that there's going to be more brought out about the socio-economic impact and my focus is just on that segment of the EIS. And it's the only part that I read so here we go. I'd like to thank the members of the EIS committee for doing a great job on the socio-economic impact section of the Green Bank draft EIS. When I addressed this committee last year, I was afraid that in a cut-and-past world that section of the report would come out looking like the socio-economic impact section of the Arecibo EIS which listed minimal impacts. I'm very happy to say it's clear that you listened to the outpouring of concern and disbelief from this community. That which is at stake is well reflected in the Draft EIS both in detail and also in the executive summary by considering the impacts to West Virginia, Pocahontas County, and Arbovale-Green Bank area separately. We did not sweep the worst of impacts under the rug as would have happened if only West Virginia were considered as a whole. By listing to the many ways the Green Bank facility serves the community and by pointing out that alternative services are non-existence in this area, you make it clear what vital resources would be lost if Green Bank Observatory folded. By detailing the numerous capacities in which Green Bank employees participated in and support the local community, you plainly illustrate what's at stake here so thank you, again, for listening to us.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
17	a	Kaitlyn	Witt	Member of NANOgrav	One of the things I just wanted to point out was that, as some people have said before, Green Bank's impact goes much farther than just the local community or even just the state. I'm a member of NANOGrav which some people have spoke about before, which is a national collaboration and we also collaborate internationally. So Green Bank's data affects not just our country and our state but also research worldwide. And it's not just graduate students or faculty and high-level scientists that benefit from the use of the facility. I teach an undergraduate lab where students are able to use the 20-meter telescope and without that, they would have no way to do that. Many of them have heard of Green Bank before they took the class. A lot of them are from West Virginia and that spurred their interest to pursue Astronomy even though most of them are not Physics or Astronomy majors. So it's been a wonderful opportunity for them and those students will spread nationwide and hopefully spread their interest and knowledge of what they've learned. So it's a great interest-building and inspiration to a lot of people that should stay around.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
18	a	Rodney	Elliott	Physics Student at WVU and President of WVU	I participate in research that relies heavily on observations from GBO, but I'm also the president of the WVU Astronomy Club. And one of the things I get to do in that capacity, I consider a privilege, actually, is a couple of times a month I get to interact with the public and share the night sky with them from our rooftop observatory in Morgantown. I can't tell you how many kids I've met that have been inspired by this facility, inspired to pursue a career in science and I'm concerned that any loss of funding to this facility or others like it will be effectively shutting a door to an entire generation of future American scientists. That's all I have.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
19	a	Olivia	Young	Physics student at WVU	My first actual experience with Green Bank was the week and a half I spent here when I was in tenth grade during West Virginia Youth Science Camp. During that time, the seeds were sewn for this farm girl from a small tiny roadside town in the eastern panhandle of West Virginia, to one day realize that she wanted to be an astrophysicist. Now, that brings me to where I am at this current moment. I am an undergraduate, a sophomore, at WVU studying Physics. I'm involved in the pulsar research with Dr. Maura McLaughlin and we use the GBT to discover and study these fascinating stars that act as laboratories in the sky for some of the most amazing physical processes in the entire universe, including research on detection of gravitational waves. However, my fellow undergraduates, professors, and graduate students and I aren't the only ones that are having this once-in-a-lifetime opportunities and experiences that the GBT offers, presented to us. Through groups like SPOT, which is the Scientific Public Outreach Team and the PSC which is Public Search Collaboratory, Pulsar Search Collaboratory, pardon, we go to elementary, middle and high schools throughout the state and bring them wonders of the universe and a passion of scientific discovery to young, brilliant minds of our state. The impact of the Green Bank Telescope is far reaching and vitally important to not only the progression of scientific research but also to the development of the youth of our state. I can say with absolute confidence that because I'm a West Virginian, I am a scientist. And I'm a scientist because of the GBT. So I implore you on the grounds of our youth, of our state, and of humanity as a whole, please continue to fund with the utmost of your ability the wonders and opportunities the GBT brings to our tiny planet from beyond the reaches of our solar system and our galaxy. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
20	a	Bob	Sheets	Pocahontas County Historical Landmark Commission	The thing I would like to say is I would like to commend the group, as Carla did earlier, for the work they did in the historical section with at least one thing that Sue Ann brought up earlier, the 85-1 Tatel telescope should definitely be on there as an historical landmark. It was the first dish here and it's where Frank Drake went first here in West Virginia in his search for extraterrestrial signals and I think that's something that should be upgraded in the report. I'll address it in written comments later on. The other thing I would like to do in this period as I'm talking to you is encourage those of you that are local and have been here for a while, like Mr. Harold Crist, and have knowledge that we may not have -- and these folks may not have.	Considerations for Document Analysis	Cultural	Public Meeting	11/30/2017	

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20	b	Bob	Sheets	Pocahontas County Historical Landmark Commission	As I said, they did a good job with the history -- but there are some things out there that we may not be aware; for instance, on the original encouraged action, the Hannah House is preserved but in the next, it is demolished. And that house was the home to George Burner, and Mike Holstein and I serve on the bicentennial commission here and George Burner was one of our first county commissioners. He was a delegate to the Virginia legislature for two terms back in the 1820s, and we would hate to see that historical landmark go away. He took up arms at one point, that was called the Civil War. His father took up arms at one point, it was called the Revolution and he was at Valley Forge with Georgia Washington. So there are some historical components here\ that these folks may not know about. I think they've done a good job with what they had to work with. But those of you in the community, if you have stories, if you have knowledge, if you have information, please convey them in the written comment period, get in contact with me, Jason Bauserman, we need to add the rich historical legacy that we do have here and make it part of the ongoing record. Thank you.	Considerations for Document Analysis	Cultural	Public Meeting	11/30/2017	
21	a	Kathryn	Williamson	Astronomy professor at WVU, Former education specialist at GBO	I arrived here in 2013, with a big, bad Ph.D. and no practical skills at all. And so thanks to Sue Ann Heatherly and all the staff here in Green Bank, I gained really all of my inspiration to, and all of my purpose, honestly, in giving back to students and giving back to West Virginia. I'm not from West Virginia. I'm from Georgia, but I feel like West Virginia is my state now. I see there's so much potential, there's so much pain, there's so much hardship, but I believe that West Virginia has so much potential. And the Green Bank Observatory is part of that potential. Every semester, over 200 of my Astronomy 106 students use the 20-meter telescope through the Sky Night Robotic Telescope Network. So I want to underscore what Sue Ann said, that needs to be included and emphasized in the report. Through using the telescope, my students are able to determine our direction of rotation around the center of the Milky Way, that we live in a spiraling galaxy, and we find evidence of dark matter. Now, most of my students aren't going to be scientists and most of them aren't ever going to need to really talk about dark matter, but it gives them that sense of pride and it gives them the skills to think critically and that's what our nation needs. That's what West Virginia needs. So Green bank Observatory is basically why I'm at WVU. There's no way that I would have the skills in order to give back to the students at WVU and the students in our state without Green Bank Observatory. While I was here, we also started the Science Public Outreach Team which Olivia mentioned. We trained dozens of college students around the state, all operated out of Green Bank. So we're giving back. We're inspiring over 4,000 students every year in K through 12 audiences. But the biggest impact is on the college students. Without any prompting, our ambassadors, our future -- they're education majors. They're our future educators. They have just said on their on volition, I was afraid to teach science and now because of coming to Green Bank, because of participating in SPOT, I'm not -- they're excited to teach science now. That's one of the greatest investments we can make in this state. And SPOT is just one of the amazing programs. People have mentioned the pulsar search laboratory. No one has mentioned the First-To Network which is about training first generation college students. And there's also PING, Physicists Inspiring the Next Generation, which is a completely, fully diverse camp of students from all over amazing socio-economic brackets, all different races, all different -- rich, poor, there's all types. And I've just never seen that kind of education anywhere else. And it's what inspires me. So I truly believe that my whole purpose was shaped by my experience here, so thank you.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
22	a	Kathryn	Williamson	Astronomy professor at WVU, Former education	I would like to see the educational theories that are driving the alternative option B, if this is just going to become an educational facility, because all of the educational theories that I use in my publications and in my NSF funded proposals state that an authentic community of practice is necessary for the highest learning gains. So I don't understand why NSF would chose an option that it's own NSF educational research funded initiatives show is not ideal. That's all I have to say.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
23	a	Paul	Marganian	Software engineer at GBO	So right. So my role, I'm a software engineer here at the Green Bank Observatory so, of course, if we shut down, that would affect me. But I'd like to talk about how this would affect not just me, not just the town of Green Bank, not just Pocahontas County, not even just West Virginia, but how this affects our nation. So let me just tell a little story. So my father is an immigrant. He came to this country back in the '50s. And he came here to get a top-notch education because back then, this is where you went to get a top-notch education, especially in the STEM fields. And that has remained true for decades. But there are certain trends that are visible now and it's not quite clear whether that's going to remain true or not. So an example that I gave when I talked here last year was we've been doing work with the Chinese. The Chinese government is dumping money into basic research. They're not trying to play catch-up. They're trying to pass us. Okay. I was there two years ago and I remember working in their facility and seeing this huge construction right next door and I'm like, what is all of that? Oh, that's our lab. And I come back here back here, you know, to look at Options A, B, C and D and talking about shutting us. So what the hell; right? Sorry. You can scratch the hell part. So -- all right. So where was I. I said I'd get back to the whole robotics thing. Well, I'm teaching robotics because my kids are interested in STEM subjects. If this continues, when they get to college age, when they get to grad school age, where are they going to go for a top-notch education. Where will the center of that be on this planet? Where is it going to be? Part of that answer is right now, right here. Are we going to stop investing or are we going to abdicate our leadership role in the world? Okay. So let's keep America great and let's keep investing in the future. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
24	a	Brent Shapiro	Albert	Graduate student in physics and astronomy at WVU	I'm a graduate student in the department of Physics and Astronomy at West Virginia University, and I'm also the president of the Physics and Astronomy graduate student organization there. I think -- and a lot of my work is in pulsars and some of it's with NANOGrav. And pretty much all of my research is only possible because of this facility. And I know that there are also a lot of other graduate students at WVU. I think there let's 15 or so others in Astronomy, some of who can't me here tonight. They're graduating soon and are filling out job applications and have based their entire career off of observations and research they've done here at Green Bank. And whether that's at WVU or coming down here over the Summer for weeks or months at a time. This place is incredibly important, for them and for building careers and myself, hopefully, included. And just from a personal note, grad school is sometimes rewarding and often very, very grueling and the first time I came down here actually was for this public meeting last year and it was dark by the time we got here and all I got to see of the telescope was this blinking headlight. But I got to come down in May for the observatory training workshop here which was a fantastic workshop, but being able to see the telescope in person is really, really inspiring. It's an incredible facility, this whole place is just an incredible facility and sometimes that really helps to motivate you and to keep doing the research that we're doing. And I really hope that the NSF will continue to fund this facility to the best of their ability in the future. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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25	a	Marty	Bloss	Staff at GBO	My comments are going to be to look beyond the EIS Draft document into the future. I was struck by a very complete document that addressed many issues and leaves many very big issues completely un-addressed, and I'd like to speak to some of those if I may. In particular, there's discussions about potential removal of facilities, modification of facilities, but there are no budget numbers given for any of these things. And I think in a view of transparency, when decision making is happening concerning facilities versus cost of operations, there needs to be some transparency into how those numbers are derived, the assumptions behind them, and how they play out going forward. You can infer a budget, sort of, if you look at the economic impacts and we're talked \$3, \$4, million, \$5 million, potentially from some of these impacts and there's mention of how that is to be funded. And one would assume that had nothing to do with our operational funding but when, in an atmosphere of silence, it's an unknown and I think that needs to be shared more broadly.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
25	b	Marty	Bloss	Staff at GBO	I would like to speak also to site expansion. So one of our charges has always been, since this process started, is to expand our opportunities, both in the science and commercial endeavors; however, the EIS has actually constrained us greatly in being able to do any changes to the site. Essentially, we were frozen in place for the last couple of years and not able to make a substantial changes because that would upset the baseline, as I understand it, of this report. Well, as we go forward, it's been my experience that once a report exists that people keep coming back to that and back to that and back to that and if the agency preferred approach is followed, we must have relief to be able to do the kinds of things that new endeavors the observatory require with a minimum of obstruction and problems, because it can be areal problem as we go forward. And then lastly, I'd just like to comment that part of this needs to talk about what is considered success criteria for any of these options, and most importantly, the agency preferred option. And right now, everything is about revenue and finances. They're very important. They're what keeps the lights on. But science is what drives the site and there needs to be an metric as we go forward that also looks at the changes in the science community and our contribution to those changes as another metric into the success of the observatory in whichever of these forms that it takes. Thank you.	Considerations for Document Analysis	Purpose & Need	Public Meeting	11/30/2017	
26	a	Anthony	Mintor		In page 4-108, it states that in the worse case scenarios that the loss of STEM education here would be adverse to the county. This is really an understatement. If you look of the number of astronomers in the United States, you can estimate that it's about one out of every hundred thousand people in the United States are actively in astronomy working on advance degrees or with an advanced degree. Of that, only a quarter of those are women. So it's something like one out of 200,000 are women in astronomy. But from Pocahontas County alone, I can think off the top of my head of two women who have gone through the program since I've started working here that have gone on and are seeking an advanced degree or do have an advanced degree working in Astronomy. Our county only has about 8,000 people. That's one out of every 4,000, 50 times my guess at the national average. That's what the STEM education program is doing, amazingly, beyond anything you can imagine in the national average in a state that has historically been at the bottom. So this is a real treasure having the STEM programs here which rely on the science being here and we need to keep that alive because we're doing amazing things, not only locally but within the state and within the region. So I just want to really share that "adverse" is an understatement for catastrophic if we lose these programs. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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27	a	Sarah	Burke-Spolaor	Member of WVU Physics and Astronomy Dept.	So I'm speaking today as a member of both of the West Virginia University Physics and Astronomy department. The department has been a long supporter of Green Bank Telescope and Green Bank Observatory, facilities both in the science and in the outreaches as you've heard a lot of today. I'll highlight that again. I'm also here speaking as a collaborator in the NANOGrav project. I currently lead the Gravitational Wave Astrophysics working group. And NANOGrav is, of course, very generously funded by the NSF through the Physics Frontier Center. I know it's really interesting for me to read, at least, the first 20 pages of the DEIS and select other pages and I stumbled upon the phrase where we are meant to consider GBO as a cultural resource. And it struck me that there was a phrase that this is defined as a current historical, cultural and natural aspect, what makes a cultural resource. And it occurs to me that GBT is right now making history through NANOGrav. We are just now in the past two years, LIGO was able to discover gravitational waves, just two years ago in 2015, reported just last year in 2016. And really, the ramp up of this science and cultural awareness in humanity has just come about in the past two years. And it has been after the assessment that was done of the importance of the science that's now being discussed in the context of Green Bank. So these developments have all been very rapid and really, you know, NANOGrav is now leading gravitational wave science. It will be, in the next few years, expected to really open the gravitational wave spectrum and change the world in the way we can perform astronomy and explore the universe, explore the structuring of the universe, through it's studies of black holes. And this is really a change that fundamentally develops us in a way that hasn't been changed since, basically, Galileo started observing Astronomy and electromagnetic emission. We're now using gravitational waves. This is a fundamental capability of humanity. GBT gives half the sensitivity to NANOGrav and NANOGrav will play, certainly, a historical role in the coming decade, if no longer. And I just wanted to add to that our continued success with NANOGrav, at least over the next few years, really relies on GBT being available to us to continue this NANOGrav effort. The other main thought I wanted to add to this is that we just want to simply support, express support for either the no-action alternative or the agency preferred alternative, in that first, we really want to continue NANOGrav science. We want to bridge the gap until alternative facilities can come available to support this really historical effort that we are now performing. At WVU itself, the department, you've heard a lot about the really fantastic education programs that have been happening. We use the 20-meter in our intro Astronomy classes. That's about 200 students per semester. We have two semesters a year. Over a couple of years, that accesses thousands of students, brings science directly to them, puts science in their hands and makes them perform research. And that's a really unique thing to be able to do. It's one thing to just have data presented to you and say, hey, make a plot of this. That's science. That's one aspect of science. But actually collecting data, making that into some conclusion, that's very fundamental and observe, something you, yourself, observed about the universe, it's really amazing. And just like through the Pulsar Search Collaboratory, we have accessed hundreds and hundreds of students that are in high school and are able to bring literal Green Bank Telescope data to the computer, the desktops of those students to actually look at the Green Bank Telescope data, look at stuff that scientists have not even looked at because they have been given the responsibility to take a look at that data and make some observation, have we've found a new star in the universe or have we found a burst from a distant galaxy. So I think, I just wanted to conclude that WVU aims to continue to support and use Green Bank facilities, not just GBT but also the 20-meter and other ones on site and we hope to perform what science and what outreach we can going into the future and we aim to support that as much as we can. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
28	a	Mali	Minter		One is, the EIS draft mentions -- and I know you can't answer this but I'm saying this so that maybe someone will answer this -- it mentions that in 2006, an NSF study was done and it said that the GBT was possibly over-funded. My understanding is that the 2006 report had incorrectly reported the construction cost by a lot. And so a more extensive review was done. However, I cannot find any more extensive report anywhere so I really would like to know if a more extensive report was actually done and what the results were and where it would align with funding from that.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
28	b	Mali	Minter		The other thing I just wanted to touch on, Sue Ann touched on it, it was one of the main things I was going to talk about, was if -- I mean, of course, everyone is full funding and then we're really happy on Option A; however, if it were to go on to a different option, I think there are some fatal flaws in Option B. It says that you'll go to a tourism education facility. Then later, it says in your statement that the amount of tourists that will come will go down by half, at least, and the less, the less facilities that are up kept as far as mothballing or destroying or whatever you do to the telescopes, the less people that are going to come here. And so, basically, Option B is going to sink further and further and further down where there's no tourism coming and that will really impact our community, and so I think you need to think about that.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
28	c	Mali	Minter		The other thing is, and I think Sue Ann touched on it, when you do these educational programs, they are fantastic. We have some people here who have bene parts of them; however, when you do them and you're going to reduce the staff to just have education and the science center, I don't know if you really understand that when a group comes in, they call and say, hey Ron, Hey Tony, Hey, Jay, or Hey, all you scientists, or hey you computer engineer or hey you, you know, computer scientist, can you come back talk to this group. We're doing this and we really need someone to talk to them about that. You're not going to do that when those 45 people aren't employed here. You're not going to have the educational opportunities you think you're still going to have because you're going to be missing a generous part of your staff.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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28	d	Mali	Minter		So that said, the only other thing I had, and I know you all want to go on break, is and I'm sorry because I meant to have it typed out, I think there are some issues with -- as everyone said, you've done a really good job putting it all together, but I still think there are a few issues with the housing and the socio-economic impact on the housing because you say, well, you know, people will be moving off-site because they won't be able to live on-site. So that will be good for the housing so there won't be that bog of an impact. But then there's not that many houses on-site compared with how many people are going to be losing their jobs, so there's a lot of people who are leaving. And they can't -- the people that would be losing their jobs if you went to B, C, D, would not be able to be employed in the same manner here in Pocahontas County. So I think some of your statistics may be a little bit off in that but I didn't get it written up nicely so I'm just going to say that in passing. And that's it, thank you.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
29	a	Charles	Sheets	Member of Greenbrier Economic Development Corporation	As a resident of Green Bank, West Virginia, and also a member of the Greenbrier Valley Economic Development Corporation which represents Pocahontas County, I'm on record of writing a letter in support of the Green Bank Observatory last November when many of you were here. But I want to thank the National Science Foundation returning to Green Bank Observatory and inviting the public to comment on their draft environmental statement, DEIS. Anyway, I'm happy that the National Science Foundation has acknowledged the importance of the scientific community of Green Bank Observatory and its scientific discoveries over the past 60 years. And in light of the constrained budgetary environment, the National Science Foundation says it must provide a balanced research portfolio with the largest scientific return for taxpayer dollar. In looking up the National Science Foundation's 2018 budget request to Congress in its continued long-standing commitment to support basic research and education across all fields of science and engineering, the budget request is \$6.65 billion, which is a decrease from 2016, by the way. The total of the West Virginia government budget, our state budget in West Virginia for 2017-2018 is only \$4.5 billion for a population of 1.8 million people. The National Science Foundation's only research facility of this type in West Virginia and Green Bank Observatory, working in conjunction with the West Virginia University, is providing a scientific curriculum for students to obtain their Doctorate in Astronomy and that's the only curriculum in West Virginia. And this was evidenced by the great students that we have here. And I'm really inspired by those students. I don't know if they have a class greater back at WVU or not. But I was really inspired to hear them. I want to support Senator Manchin's offer to the National Science Foundation director to have a public hearing with the scientific community of the importance of continuing funding to maintain the Green Bank Observatory scientific facility. I support the DEIS finding in its preferred alternative which keeps Green Bank Observatory open with reduced National Science Foundation funding. Since the agency has acknowledged the importance of Green Bank Observatory to the scientific community, I trust that the funding will continue at GBO at the current level and not engage in a slow strangulation of funding so that Green Bank can no longer exist. Once again, I thank you very much for this opportunity.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
30	a	Bert	Schou		I'd like to thank the National Science Foundation for the opportunity to respond today and the importance of science and education is what my theme will be. Just before I came to this meeting today I was with a meeting called Sigma Xi. Sigma Xi as you well know has 76,000 members. We have two chapters here in the State of West Virginia; one is in Williamsburg at the West Virginia School Osteopathic Medicine. And one of the persons there asked me to ask why -- he had written letters and had not gotten any response, even that the letters had been responded to, Dr. Larry Davis, our president -- we have an officer's meeting. We have been up here to the Green Bank facility with a whole busload of people and really enjoyed bringing these scientists up here to study what's going on here. In addition, the Green Bank or the West Virginia or the Greenbrier Chapter of Sigma Xi sponsors fairs, their science fairs, and there is a science fair here at this part of Pocahontas and the school here in Green Bank and they're very active. We have four active schools or more that come to the science fair that the Sigma Xi group in Green Bank or down in Williamson or Lewisburg puts on. As you can see, I didn't prepare this and I can write some thoughts afterwards. With this importance to science, I think that we need to look at how important it reacts as well as the students have indicated here. I also think it's important, we have two national presidents, one of them is still in our chapter. We've had one before and he couldn't be here today. He's out in New Mexico or he would have been here. And so there's a great importance of it, of coming here and I think the essence of all of this is science is really important and these students are picking it up here and they're getting enthused and that's of great economic importance. So I wish that you would evaluate that in your whole program. Thank you.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
31	a	Ryan	Lynch	Astronomer at GBO and Coordinator of Summer Student Research Programs	I am an astronomer here on staff. I am also the coordinator for our Summer student research programs so I'm going to focus my comments primarily on education and research. So first, I was a little disappointed to see that the Draft EIS did not seem to mention our observatory's long standing and outstanding REU Research Experience for Undergraduates program, which is an NSF funded program, as well as the Physicist Inspiring the Next Generation program. I might have missed it, but if I didn't, I put some numbers and made reference to those in my public oral comments last year, and I'd be happy to share those with you again with you guys, any information that you guys need to make sure that's corrected in the final statement.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	

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31	b	Ryan	Lynch	Astronomer at GBO and Coordinator of Summer Student Research Programs	I also wanted to address the region of influence and how that is defined for the education of socio-economic impacts. So there are a lot of comments already about the impacts of the Observatory, not just within the local community and within the state but really nationally and globally. So I just wanted to share some numbers to kind of back that up. So there were 32 states and territories of the U.S. that were represented during the public scoping period and 13 countries other than the U.S. Out of 201 commenters that provided and addressed on the written comments, were from outside the State of West Virginia. That's 44 percent; 61 commenters, 10 percent were outside the U.S.; and 67 percent of all comments dealt with either research or education. So my understanding is that the region of influence as it is defined narrowly as being the local community and maybe extending out to the State. But I think that demonstrates that Green Bank has an impact that is national and really global. And if you really want to assess the impact and education and on employment, you need to include the entire country and the entire world. These are of researchers who depend upon the observatory to further their educational career as well as their professional careers. There was a line in the draft EIS that the RY was not officially widened to the state beyond the State of West Virginia because it would dilute the economic consequences of the proposed action alternative. Those of you that were here last year would remember a young woman, a high school student from West Virginia who got up here and rocked it in her comments. Anyone who listened to her talk cannot possibly say that expanding the region of influence would dilute anything and I think we've heard that from other people here as well.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
31	c	Ryan	Lynch	Astronomer at GBO and Coordinator of Summer Student Research Programs	And the other thing I want to address is the magnitude of the impasse under the Action A alternative. There's a line that says that maintaining STEM related training, the impasse would be minor, adverse, and short-term under action alternative A. But that really depends on the funding model that we settle on with partners and whether or not those partners take away from the open sky science time. If the open sky science time really drops, and the research funding also drops then the educational and research opportunities drop as well. And it's not going to be minor and short term. It's going to be severe and long term. And I really encourage you guys to take a look at that and fund the report. Thank you.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	
32	a	Jason	Bauserman	Resident of Green Bank	I am a resident just north of here at Bartow, and I happened to move back here as a back-to-the-lander out of Washington, DC in 1971. This has just been a great place to come. And we've had three sons and they're all living in West Virginia, a couple of them living here still. I just want to say what the observatory has meant to our family. My wife, Julie, has been a piano and voice teacher for 45 years. They -- well, even today, the observatory lets her come down and do rehearsals on the Baby Grand over here and sometimes she's taught lessons here at the Observatory. But I asked my wife before I came today, I said, Julie, how many people, how many kids of observatory people have you taught. And she said, you know, I bet you 75 of my students have been observatory kids. And that's really helped us to finance us and helped us to stay here. So that's a real big thing. Likewise, I was in charge of Green Bank soccer for nine years and that meant finding 12 to 15 coaches each year, finding referees for every game, finding some grass mowers, and, of course, we were on Observatory property for our soccer fields. And I, too, can say probably that 75 percent of my volunteers for the soccer league, and this was through the mid-'80s through the mid-'90s, were observatory personnel. I mean, it was just really helpful and just really a great community thing for the Observatory and for the local people here. Last year, I was actually involved in planting potatoes here on observatory property. I picked 30 tons of rock out of my five acres behind the Green Bank library and I got 15 tons of potatoes. Not a very good conversion but I think we did better than anybody else. Maybe it was those extra rocks that got picked. My son, Jonah, who does work here at the observatory, he happened to go -- well, he finished up Pocahontas County High School and was in the school-to-work program. He wanted to come here to the observatory to do the school-to-work program and he did. And I guess he did so well they asked him, could stay you on with us? When he was here he was, you know, soldering as an electronic technician under a microscope. They said, you're just so nice and clean and do a great job. So he was signed right out of high school in 1998. So it's just about been 20 years, it was, he was here. But his first job was to run the stainless steel cryogenics line all the way up the big scope. He had never soldered or welded, whatever you do with stainless steel. He soldered the whole thing from top to bottom, didn't have one leak in it. And then the other great thing, I'm just so proud of him, I guess they had seven new receivers or 14 new receivers they needed for the big scope. He actually put together seven of them and still maintains those seven today. But he does have a couple of extra jobs to show you that they're really trying to save here. Not only is he maintaining those seven receivers but he is also, goes out and checks every cell phone tower within 100 miles of here and he rides the little white truck with the antennas to look for RF. So he's really doing what was three jobs as one. But, gee, my time is out. But here just three or four weeks ago or maybe a month, five weeks ago, he, Katie Couric came here -- and that is under-reported, how many people are coming from all over. But he spent five and a half hours running her around and showing her for her National Geographic article. So I really cannot imagine this community without the personnel and the workers here at the Green Bank Observatory. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
33	a	Jason	Bauserman	Resident of Green Bank	Just two real quick comments. One is, well, just a month ago, I had my 50th college reunion at Bridgewater College in Bridgewater, Virginia, and I met one fellow and he found out that I lived close to Green Bank, and he said, Gee, yeah, 50 years ago he came over here to the observatory and he was a Physics major and I think all Physics majors came over here. But when I found out what he did, he lives in Nebraska now, he came up with a drill core that drills into the polar ice caps and it was two miles deep that he could go with that drill and come up with really, the history of the earth in the polar ice caps. You know, you can CO2 in those and volcanic ash, it's just amazing, that gee, he kind of started out here in a way. The other amazing thing is and what I'm so excited about, so many young people here and your excitement and enthusiasm is just great. I mean, my faith in young people has increased. I've been down here a couple of Summers walking around. To me, it's just like a of the college campus down here. It's just a lot of excitement and enthusiasm and that is just great to see. I'd hate to see that go.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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34	a	Ellie	White	High School Student	<p>So I just appreciate you all listening to all of the comments you've received, both written and oral, from all of the people who've been -- well, not all of the people but only just a small fraction of the people impacted by the observatory. I've received hundreds of letters, outpouring of support. But I'd like to speak about why I think the NSF should restore full, 100 percent funding to the Green Bank Observatory. So I appreciate the fact that you've decided to continue to provide partial funding. But I'd like to bring up some concerns I have about this option. First of all, a reduced, reduced funding by the NSF means the observatory will have to seek outside partnerships as mentioned in the DEIS. If the GBO becomes beholden to institutions who do not uphold the open skies program that you all make possible, the outcome -- sorry, if you don't care -- this outcome would ultimately -- So I'd just like to say that the open skies program is extremely important to the observatory here. If it were to disappear, it would ultimately reduce the diversity of the research currently going on at the observatory and would serve to cut off opportunities to make the next great discoveries in Astrophysics but couldn't do it because their institution couldn't get time on GBT. With the open skies program in place for the GBO researchers and nearly every possible sub-field of Astronomy, are making fantastic findings that bring us closer to a full understanding of our universe. Many of the research topics being investigated with the GBT are in line with the NSF's own astronomical priorities as identified in the New Worlds New Horizons study. GBT is used for and has been used for studies in the following Astrophysical topics that the NSF decided was worthy of completed panels dedicated to in WNH survey. So the first topic would be Planetary System and Star Formation. The GBT has performed several observations concerning astrochemistry, as you covered earlier, in star forming regions and receivers can continue to be developed and proved for high frequency observations of such topics. Also, two other topics, the Galactic Neighborhood and Galaxies Across Cosmic Time, the GBT is used frequently for neutral hydrogen and other frequency studies in the Milky Way and surrounding galaxies. This is something I think really needs to be emphasized. The Green Bank telescope has contributed tremendously to neutral hydrogen studies. In fact, they just implemented a new phaser ray feed on the scope this summer that will basically -- it's like a giant camera. Instead of having one pixel it's like seven. So the GBT is constantly being upgraded, it's constantly being given more capability so there's really no way it can go out of date because it's constantly being recycled and reused with relatively a small amount of money. Another topic that I identified was Cosmology and Fundamental Physics. Green Bank has made tremendous contributions there as well. Many dark matter and dark energy experiments have been undertaken with GBT. One particularly notable cosmology project that was undertaken in the past is the Megamaser, and is currently going on, is the Megamaser cosmology project, basically to determine how fast the universe is expanding.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
34	b	Ellie	White	High School Student	<p>So first, NSF has also identified other areas of interest including education and I'd like to just touch on that as well because that's such an important part of what's being done here. So demographics is one area of interest. So as was touched on earlier by so many people, many of the educational programs at the GBO are aimed at growing diversity in the astronomy community by giving under represented minorities and female students a two-week Summer camp experience introducing them to real high level science. In addition to this, the first two programs encourages STEMing involvement among first-generation college students, education, and public outreach. So the number of students impacted in positive ways is absolutely tremendous. From the Hands-On Radio Astronomer for a Day program which goes out almost constantly involving so many students, to the research experience for undergraduate students, to Sky Net Junior Scholars, so many other programs including just casual mentorships. I'm a high school student from Barboursville, so about four hours away from here, and just from a chance encounter a couple of years ago, I've been able to do actual research on radio frequency interference, telescope pointing, and I will be doing some hydrogen research soon. So from my own perspective as well as so many other students, many of whom are from under represented backgrounds, our lives and career paths have been changed by the mentorship experience we've had here at the observatory. For these reasons among so many others, I feel the NSF would reap large benefits and make great strides toward achieving their goals for science and education by continuing to provide 100 percent funding for the GBO. The continuation of the open skies policy is crucial to keeping up the pace of ground breaking science and student opportunities that move us toward great discovery and more inclusive and diverse future for STEM fields everywhere, so thank you.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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35	a	Ellie	White	High School Student	Last time I talked about the research and why this was a good investment for the NSF based on their previous studies. But this time I'd like to talk about something a little bit more specific to the Environmental Impact Statement, and that's the community and environmental impact, basically. So I say that one of the things that has made the biggest impression on me since I first came here is just this overwhelming sense of community and togetherness that just permeates this place. It isn't just a world-class research and education facilities, it's also the heart of a vibrant community that exemplifies what's best about West Virginia, our ability to come together for the common good. This place acts as an emergency care center, a gathering place for local events, and an economic revenue generator that puts millions of dollars back into the small economy it's compassed by every year. More broadly speaking, it makes a huge impact on the rest of the State and the U'S as a whole, but the far-reaching unrivaled educational opportunities it offers. Students across West Virginia who might otherwise may not have any other exposure to real STEM research and technical work are given a chance to learn about science and technology through programs such as Radio Astronomer for a Day, Skynet Junior Scholars, Pulsar Search Collaboratory, research Inspiring the Next Generation, RAU, RET, First To, and on and on and on. But -- and as I sort of mentioned before, I've benefited from these programs myself. I basically was just here volunteering for an open house. I ran into Astronomer Dr. Richard Prestage and that's led to a mentorship experience that has helped me find my passions along a program developing radio frequencies interference visualization tools. I like to analyze data and look for trends by working a project to characterize GBT pointings they may result in a published paper, and I've learned to think like engineer from building a small loop antenna to detect solar flares. If I wasn't convinced before, there is no question in my mind I will now be pursuing a career in STEM. In a state like West Virginia, in increasing number of STEM graduates, as a result of these programs, will have a tremendously positive impact on the State economy, not to mention giving a morale boost in the face of the current opioid crisis and the dying coal industry. However, if the NSF reduces its Funding of the Observatory, it's possible that the efficacy of these fantastic program could be diminished greatly. The open skies science with full NSF funding ensuring it's irreplaceable for enabling students from all backgrounds to expand their horizons by pursuing research with the GBT. Students who can't afford to go to an Ivy league or another fancy, expensive school with great research capabilities can have an equal chance to pursue a science or technology career if they have access to an open facility like Green Bank. And that's just one of the many zones from where full funding from NSF is absolutely imperative to the future of the observatory and the many people and communities it impacts every day. So thank.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
36	a	Deana	White	Resident of Green Bank	Thank you guys for letting us speak. I'll try and make the time. I think it's evident to anyone who's read the comments from last year that the NSF has had a great return on their investment at Green Bank Observatory. We're here to urge you to choose the no-action alternative, continued NSF investment for science focused operations and restore full funding for the observatory so we can all continue to reap the benefits of this fantastic investment. We know you need the support of many allies to justify this decision in these very competitive times for budget allocations so hopefully all of us here can help with that. As you review the comments made last round, and as I said in my own comment last year, this place is magical. It turns busy, ordinary people into dreamers of what we can achieve just from looking at the feat of human architecture, engineering results that the GBT exemplifies. You can participate in a Radio Astronomer For A Day program and see high school students challenged to learn high level concepts, struggle at first and then up their game, rise to the challenge and make meaningful discoveries about what they themselves can do in just a 24-hour period. You can witness a young, curious but tentative student growing in meaningful ways from opportunities provided by the amazing astronomers, engineers, and education staff here. The Green Bank Observatory is magic. Your continued investment in the observatory returns exponential benefits to society as we stand now and as we move towards our future. We all eagerly watch and anticipate what question will the Green Bank Observatory answer next. We all know instinctively from each of our own gatherings, of stories and experiences with education in its many forms, that the staff here, the resources here and the Green Bank learning philosophy of open skies open minds, open hearts is a model that should be studied and implemented across our nation. We know it's not just individually but as evidenced by the footprint the Green Bank Observatory has made since its inception to this very day, expressed over and over in the letters you've received. We've read at least 600 of these letters. We noted that people from over 30 states, as mentioned before, and territories, and 13 countries. People from numerous institutions and organizations sent you their unanimous support along with their reasons and unique stories. Each letter was moving, informative, and inspiring. Many cited multiple reasons why this facility should be continued to be funded at the highest level, from cultural to historic, economic to health and safety and so on. But the most often cited reasons were education and research and the two cannot be separated. So many of the letters expressed the importance of the observatory to their research and the ground breaking discoveries that they've made or are on the verge of making and how important and unique the learning opportunities that accompany the research are to so many students ranging from kindergarten to post- doctoral studies. What corporation in America wouldn't leap to be able to write the mission statement that the observatory breathes every day and then reap the enormous returns on investment that the observatory achieves for our future. There's also a more traditional measure of return on investment that's evident. I believe the annual operating budget here is \$8 to \$10 million and the observatory generates close to \$30 million for the thriving Green Bank community, Pocahontas County, and the State of West Virginia. The NSF can post that in their earnings report to taxpayers. So as you can tell, I could go on and on and on and on, but let me just finish by saying that we want to help you, the NSF, to communicate your return on investment in earnings to all that we can to help you garner the support you need to restore full funding to the Green Bank Observatory, an outstanding performer and inspiring treasure in your portfolio. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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37	a	Deana	White	Resident of Green Bank	I'm Deana White again, Mom of those two, her over there. So a lot of this has been covered but I just want to summarize it really quickly, that open skies policy allows anyone with a merit-based proposal to gain observing time which means real ground-breaking scientific research can be done by anyone from a student at a small college to a world renowned scientist studying gravitational waves to a high school student with a great idea, and all of those have happened here. There are many small colleges. When we read those letters, there are many small colleges that don't have the resources or the abilities to do this and they can apply for time and they can give their students opportunities that aren't available anywhere else in the United States. The thing that we need to emphasize, I think people have covered it but I'm going to say it one more time, we've got to remember that while like-minded partnerships are beneficial, partnership reduce the amount of observing time available because they're going to want time. So the many different people institutions that don't have these resources to have their instrumentation in their facilities or to partner up with the GBO would lose out. Education opportunities and diverse research subjects would be reduced. Further, per the Draft report, the Section 106 Historic Assessment, that's concurrently being conducted as we discussed, the adverse impacts that have been identified for the collaboration operation option includes removal of some of the historical structures identified as part of the GBO district, and that's potential, that it's any time there's a potential, that's a problem. It's imperative to the historic preservation of the Green Bank Observatory, the United States birth place of the National Radio Astronomy Observatory in response to the space race with Russia and with a rich history in world-leading research results that are on-going today that the NSF provide full funding to continue to operate this facility. Additionally, reduced funding could impact staffing levels. I know it says that Option A, that reducing funding would not impact staffing levels, but if we start partnering with potential NSA or other agencies, the staff would reduce. I mean, it's a fact. It would reduce and if the staff reduces, the economics in this area go down, youth leadership, local education, emergency response, support of the Arts, on and on, that could be impacted. So it's very important that we strongly consider, doing we need partners other than the ones we've already established, and if so, who they are. And I think specifically that people have mentioned before about partnerships needs to be addressed. So that's all I have. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
38	a	Nathan	Tehrani		John Mather, Nobel laureate once said, "That to look through a telescope whether it's for work or for pleasure is always a cool experience but it pales in comparison to watching the look on someone else's face when they look through the eye piece." And even though that's a quote from an infrared astronomer about optical astronomy, I think it absolutely holds true for radio astronomy as well, lack of eye pieces notwithstanding. I've had the amazing opportunity to be involved in a few educational programs here in a very small way for each of them, but I've had that experience to see hundreds of students gain a confidence in themselves, and in some case, watched students in high school who had very little interest in science chose to study, or other STEM fields, in their college careers and they're now beginning their careers in STEM. Now, that's not all of them, but each and every one of the students who did an educational experience here that I got to see, whether they were working on the 40-foot telescope or the GBT, they discovered something in themselves that they could do science. And, you know, if you can map the galaxy, there really isn't a whole lot that you can't do. And each and every one of them discovered that, you know, out there and they discovered that in themselves. So, yes. This is absolutely an amazing place for science but this place, as was just said, is absolutely magical and I hope that magic never leaves.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
39	a	Michael	Holstine	Business Manager at GBO	And I think most of you know me. I'm the business manager here at the observatory, and I just wanted to speak to a few details about this. I will be submitting in the written comment period. But, you know, as you and I discussed today that this is a cooperative effort between us and the NSF. And I think we've worked well together on this program and I want everyone here to know that we've been working well together on this. And I said earlier today, you have your job to do and I have mine to do. And so now it's my turn to talk a little bit. In the Draft EIS, I do want to say that it was a very thorough job. I was impressed by the amount of detail they went into. Like some of the other commenters, though, I am concerned that there was a lack of specificity to some of the vaguer options and ideas that were in place. And it concerned me a little bit when I read some of the statistics that are fairly based to the organization that were wrong. And it concerns me that if those comments or those statistics are wrong, what else might be wrong since the site is stated as having 2200 acres. Well, it's not. It's 2,654.37 acres. I gave them those figures and why that's not reflected, I'm not sure. And I think that's right. It's 45.37 or 54.3, anyway. They'll figure that out.	Considerations for Document Analysis	Visual	Public Meeting	11/30/2017	
39	b	Michael	Holstine	Business Manager at GBO	The information on the reports of which this whole EIS, sort of, is based, I was a participant in those review committees. I'm a little concerned that the actual summaries given by those review committees is not truly reflective of what was stated on the Green Bank operations at the time; however, those reports are not available that I can find. So I will be either happy to speak to you later about trying to get those summary reports or I will reflect my personal observations of what was truly said as a result of those reviews. I will state for the record that in no review that I have ever participated in, by either NSF or operating in AUI or any third-party consultant, has Green Bank ever come out to be too expensive, and, in general, has been stipulated that we needed more funding and we were operating too lean. So I'd really like to figure out where that came from.	Considerations for Document Analysis	Purpose & Need	Public Meeting	11/30/2017	
39	c	Michael	Holstine	Business Manager at GBO	And lastly, without going into too much detail about other things that, you know, that statistically I can comment on, I'm concerned about the, even option alternative A and the fact that any of the options would have anything to do with the demolition of our housing. If you go through the socio-economic part of this, it mentions that there is a 50 percent vacancy rate in the housing in Pocahontas County, and, therefore, housing is freely available off site and, therefore, housing is not necessary on site. And I kept thinking, there is no where in this county that I think of that has a 50 percent housing vacancy. Then it occurred to me as I read through, I think, part of the appendices, as to where those numbers came from. They're talking about hunting camps. And there are structures, tons of hunting camps but those are not houses. The assessor does include them as either a second home or whatever it might be. Right now, in this last two weeks, I would guess that there is probably a 10 percent vacancy because it's hunting season and in the Summer you'll probably have a 50 percent vacancy because nobody is using them. Any rate, those are the kinds of things that I think need a little bit more massaging and explanation, and I do appreciate the opportunity to speak to you and to have you let all of these people speak to this as well. Thank you.	Considerations for Document Analysis	Socioeconomics	Public Meeting	11/30/2017	

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40	a	Suzanne	Stewart	Resident of Green Bank	And I'd like to talk about a couple of things that were mentioned tonight. One was pride. Other than the first couple days of my life and nine years for college and work, I have been a resident of Green Bank. And I am proud to say that I was raised and live today in Green Bank. And when I travel around and talk to people and I say I'm from Green Bank, West Virginia, they say, oh, where is that? And I get to say, have you ever heard of the Green Bank Observatory, the GBT, and they're like -- a lot of people says, oh, yeah. I have heard of that. And there is a sense of pride to say I am from this place where this facility is and where, it is a unique place to live and be, and our lives would be vastly different if we didn't have this facility anymore. And the other thing I wanted to talk about was the national impact. And my cousin, Stephanie Stewart, is a middle school English teacher in Tennessee and you're thinking, English, how is that connected to the observatory. Well, she is, you know, a rock star for starters for teaching middle school, but she always tells me that every semester she has a section where she talks to her students about utopian places. And there are tons of young adult books with utopian stories. And she always uses Green Bank as an example because of the quiet zone and how we don't have cell phone towers and we can't use cell phones and her students are fascinated by that because they can't live without their cell phones. But I think it's amazing that, you know, she is just one person who has found a way to take what the observatory is and to take what the quiet zone is and to turn it into something that isn't necessarily the first thing you think of when you think of this place. And you know, she, to call it utopia and to compare it to some of the utopian places that they study, I think is fantastic. And just think about all the other things that could be covered if we continue to have this facility here and I have invited her up with her students. I hope one day she gets to bring them so they can experience it for themselves. So that's all I had to say. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
41	a	Josh	White	Student	So last year or was it this -- realized that they were going to -- Green Bank Observatory here was going to separate from the NARO and become the Green Bank Observatory which was its own thing. And so I, that was pretty cool. And there is a video contest to show what does the Green Bank Observatory mean to you. And so my sister, Ellie White, and I both submitted contest entries, a video. Each of us sent in a video, of course. So we both ran and I think hers should have gotten first place. Sadly, I did. So she got second place, I got first, and what happened was I decided, you know, hey, I'm just going to make a video for the Green Bank Observatory. And it was fun. I took, I went and I made an animation with a type of animation software I had never used before and I had just a great time with it and if it wasn't for this observatory, I wouldn't have had that sort of experience but that doesn't have anything to do with the observatory at all much. Something else that happened this year, actually, that I had an absolute blast with, was that I'm a home-schooled kid so, you know, I'm not around a bunch of other kids all the time. So there was this group, I'm in this group called Leo Club which is a non-profit sort of, you know, like you go to the mission and you make Thanksgiving dinner and you do, you know, charity stuff. And we decided, Hey, let's come to the Green Bank Observatory, and I'm like, okay. Let's go to the Green Bank Observatory. So we came to the Green Bank Observatory, whoa, and so then all of them came and just had a blast. We went down to the 40-foot and learned how to operate that and that was fun. I mean, my sister has done this before because she has all of these opportunities here. She's done the 40-foot telescope, Radio Astronomer for a Day, Skynet Junior Scholars. She has a mentor named Dr. Richard Prestage. She's doing all kinds of funky stuff with him. I don't understand any of it when she explains it to me, but, you know, pulsars and stuff. And so we came -- where was I -- so we were talking about the Leo Club; right? So we were at the Leo Club and we came and we had a blast with the 40-foot. And I had been there before and then suddenly, I know how to use the 40-foot. Whoa, but not, I mean, I knew how to do it but basically I just hit a button. And so then that was a fun time. I got to hang out with kids and we all played Frisbee and there's a Frisbee on top of the guest house. I don't think anyone has gotten it off yet. And so we just had the best time and we, the next day we went through our data, you know, all of these little pin marks, you know, and so then -- that was fun. And I think we should have full funding. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
42	a	Evan	Smith	Tour Guide at GBO	Two years ago I was about to leave undergraduate education without a job and without acceptance to graduate school even though Astronomy was what I really wanted to do. By a stroke of luck, I ended up getting a job here at the last minute as a tour guide, right in this building. I worked in this room for about a Summer and I was really lucky. And eventually, I got in touch with Richard Prestage, a staff scientist here. He talked me up to three West Virginia University professors who do an extensive amount of work here. It's Loren Anderson, Maura McLaughlin, and D.J. Pisano, and that last guy is now my advisor at WVU. And so I spent about 15 months here working on my radio astronomy skills and building up my resume and eventually, I got into West Virginia University, which is the only graduate school I got into but good enough. And so now I'm a Ph.D. student and I just wanted to say I owe my career to Green Bank Observatory because before GBO my life was like this, and in 15 months, you know, the universe is the limit, not just the sky. So obviously, I'm not just talking about myself here. Ryan Lynch runs a very robust Summer student program and I just, there's probably many other kids that owe their future careers to Green Bank Observatory just like me so -- that's it.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
43	a	Stshidig	Aggarwal	PhD Student at WVU in Physics and Astronomy Dept.	I'm a first year Ph.D. student at WVU in the Department of Physics and Astronomy. And I'm basically from India so this is my first time at the Green Bank Observatory. And I wanted to see the 100 meter dish although it was dark and I wasn't able to. But, yeah. I was there at a smaller observatory in India, which is GMRT which is a significant diameter dish, and the first time I saw it I was still in my sophomore year and it was so awe inspiring. I was like, oh, God, like such things exist and you can do such wonders with these things. And I wonder how lucky those high schoolers are who can actually visit Green Bank Observatory and see that kind 100-meter dish working. And then more so, you can actually, on a push of a button you can actually make that thing go there, make that thing (inaudible) -- look at pulsars or other galaxies, hydrogen and stuff like that and analyze the data. For a high schooler, for a person -- I was from a very small town in Indian that was, that these facilities were not there. But for a person who has access to these resources, it's actually a really valuable thing and it actually inspires a lot of people. And I can understand that, to go into STEM fields, so it's not going to science but actually having solving skills right from the start. And another important factor which I want to point out here is that the radio quiet zone here in this area is a very important factor which radio astronomers appreciate. Because I have experience in radio frequency (inaudible), so I know how noise looks in the radio frequency data. And the radio quiet zone is like a dream come true for astronomers. There is very, very less noise in the data. And this kind of thing is not everywhere. I don't anywhere else apart from Australia in the world. So this thing should be appreciated and I believe, and I hope NSF will continue it's full funding for the Green Bank Observatory. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	

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44	a	Pranav	Sangavi		I don't really like speaking much but this seems to be quite important. So anyway, this thing has been very informative for everyone that has spoken over here, be it the community or grad students, the staff and the staff scientists. It has been informative for all my mentors. And it's kind of a legacy that should, I believe, continue. That -- I worked on a project over the Summer called the Research Experience for Teachers, also an NSF funded program, and high school teachers from all over West Virginia, from all over the country, had the chance to come down -- well, we have done the telescopes down at WVU and they were able to get their own scopes built from scratch and use that to observe the night sky in the radio quiet zone. And it's kind of an opportunity that they wouldn't get otherwise because it's quite noisy in the radio frequencies. And they will use whatever they learned, the experience they had. They even got to use the GBT itself. And these high school teachers, some of them taught middle school, and they can go and share this experience with hundreds of students they will be teaching over all. My research is mostly in instrumentation. I'm an engineer. And again, the staff and the facilities over here would make all of my research work possible. Basically my thesis would depend on Green Bank Observatory existing, and that's all I have to say about that.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Public Meeting	11/30/2017	
45	a	Mayuresh	Surmis	WVU post-doc in Physics and Astronomy Dept.	I am a post-doc studying pulsars and fast radio bursts based at WVU. As an active researcher, I would like to keep working on the GBT data for doing cutting edge research. My main concern though is about the educational impact of the GBO on high school students. As a part of the Pulsar Search Collaboratory (PSC), I have experienced the fascination and wonder on the students faces after coming to the GBO site. After spending a week at the GBO site, it was clear that the students, even though, would not all be scientists, had seen and learned about the natural wonder of doing science and the scientific methodology. It is with this target audience that I have a concern with the GBT losing funding over time, we would be letting go of a critical tool in inspiring future scientists and inculcating scientific temper. I would like to request the NSF to keep supporting the GBT with open-skies in the future to keep doing the leadership role in training future researchers. Even if the NSF does not find enough funds to support the GBT, I would like to urge them to seek suitable partners who are interested in keeping open-skies on this iconic telescope.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	
46	a	Rodney	Elliott	President of WVU Astronomy Club	I am an undergraduate physics major at West Virginia University. I am also the current president of the WVU Astronomy Club. Every year a group of students from WVU drives down to Pocahontas County to help out with the Green Bank Open House and Family Science Day. We get to see first hand how excited both kids and adults are about science and astronomy, and what a phenomenal resource the GBO is for inspiring the next generation of American scientists. Indeed, one of our current astronomy club members says that if it were not for a visit to Green Bank while she was in high school she would not have been inspired to pursue a career in astronomy. I have no doubt that there are many others here in West Virginia and the surrounding region with similar stories. Simply put, I feel that divesting from GBO is akin to closing the door on an entire generation of future scientists from our region. This observatory is not only a one-of-a-kind world-class scientific instrument, it is an invaluable symbol of our commitment to leading the world in scientific discovery. Please keep the GBO fully funded so that we can continue to lead that charge, and more importantly, so that we may continue to inspire future generations to pursue careers in science. Thank you for your time.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public comment)	1/7/2018	
47	a	Benjamin	Denny		I am writing this letter to earnestly strenuously object to any and all curtailments towards the Green Bank Observatory's property and operational facilities. The GBO has remained a stalwart source of educational, inspirational, and employment opportunities within the state of West Virginia. Additionally, any reductions made to the GBO will more than likely offer a slippery slope scenario to the reduction or abolition of the area effectively known as the National Quiet Zone. As it stands, we citizens of West Virginia have more to lose by subtracting funding, equipment, or land from the GBO than we do to gain. The GBO is the only scientific facility in WV that not only offers extensive tours and a well-maintained visitors center, but also lies within close proximity of most of the state's natural attractions and naturalized areas; which helps keep our night skies clear and clean. To jeopardize this facility threatens the future of our state's 'wild and wonderful' environment. Indeed, reigning in the GBO simply makes more room for 'progress' in other areas, ergo seeking natural resources, building low-cost housing, 'brick and mortar' urbanization. Another point I'd like to make is that our state happens to be in a crippling opiate crisis, which goes hand in hand with low standards and accessibility of education. The GBO is the basis for a collaborative effort I am part of, called the Science Public Outreach Team, which is an organization operated by college students throughout the state, who develop intensive, interactive presentations and deliver them to any public school in the state that wishes to simply make time for us. This outreach has already demonstrated a widespread effect upon kids from low density/funded school systems, and has already garnered the interest of dozens of WV public school kids. This aspect is arguably the most important to the future of our great state of West Virginia. Additionally, the GBO hosts another organization, of which I am a member, called the Pulsar Search Collaboratory. The search for Pulsars, to put it briefly, is an exceptional component of our search to map out and decipher the cosmos, as well as getting high school students involved in participating in real scientific research, whereby they are trained by college students to view, analyze, and sort real radio telescope data, to allow a more expeditious approach to discovering Pulsars. Nowhere else in WV are high school students offered the opportunity to achieve a status of a published author in a scientific journal. I hope the aforementioned points illustrate why we cannot afford to downsize the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
48	a	William	Hamilton		I would like to express strong support for the restoration of full funding of the Green Bank Observatory (GBO) by the NSF so GBO can continue their important mission of Open Skies science and education focused operations. The Open Skies policy allows anyone with a merit-based proposal to gain observing time, which means real, ground-breaking scientific research can be done by anyone from a student at a small college to a world-renowned scientist studying gravitational waves to a high school student with a great idea. The Open Skies opportunity is made possible with NSF funding - which is why it is so important that the NSF restore full funding for the operation of the Green Bank Observatory and retain full ownership. While like minded partnerships are beneficial, partnerships reduce the amount of observing time available to the many different people and institutions that do not have the resources to have their own research instrumentation at their facilities or to partner with the GBO. Education opportunities and diverse research subjects would be reduced. Further, per the draft report of the Section 106 Historic Assessment that is concurrently being conducted by the NSF, adverse impacts have been identified for the 'collaboration' operating option including removal of some of the historical structures identified as part of the GBO Historic District. It is important for the historical preservation of the GBO that the NSF provide full funding to continue to operate the facility. Green Bank Observatory is the United States' birth place of the National Radio Astronomy Observatory in response to the Space Race with Russia that resulted in the rich history of world leading research results that are continuing today. Additionally, reduced funding could impact staffing levels and thus adversely impact the surrounding community in so many ways - economics, youth leaders, local education, emergency response, support of the arts, etc. My parents, my younger brother in high school, and me are beneficiaries of the nationally recognized STEM activities available at the Green Bank Observatory. The staff at Green Bank and professors at West Virginia University are heavily involved in these exciting initiatives which have country wide implications. I was inspired partially by visits we've made to GBO, to pursue a Chemical Engineering degree which is 2/3 complete. My brother will likely major in Electrical Engineering/Computer Science. In addition to our own experiences, when we were at the Green Bank Observatory we witnessed how many people - young and young at heart - have been inspired and challenged from visits to GBO. Our future is in good hands as evidenced by the great educational activities taking place because of the facilities and research equipment available at the Green Bank Observatory under the facilitation and direction of the world class GBO staff. I plan to do everything I can to help you ensure that these unique and valuable experiences to inspire our youth and our educators, as well as the groundbreaking research being conducted every hour, continues at the Green Bank Observatory fully funded by and wholly owned by the NSF.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
49	a	Susan	Hamilton		I would like to express strong support for the restoration of full funding of the Green Bank Observatory (GBO) by the NSF so GBO can continue their important mission of Open Skies science and education focused operations. The Open Skies policy allows anyone with a merit-based proposal to gain observing time, which means real, ground-breaking scientific research can be done by anyone from a student at a small college to a world-renowned scientist studying gravitational waves to a high school student with a great idea. The Open Skies opportunity is made possible with NSF funding - which is why it is so important that the NSF restore full funding for the operation of the Green Bank Observatory and retain full ownership. While like minded partnerships are beneficial, partnerships reduce the amount of observing time available to the many different people and institutions that do not have the resources to have their own research instrumentation at their facilities or to partner with the GBO. Education opportunities and diverse research subjects would be reduced. Further, per the draft report of the Section 106 Historic Assessment that is concurrently being conducted by the NSF, adverse impacts have been identified for the 'collaboration' operating option including removal of some of the historical structures identified as part of the GBO Historic District. It is important for the historical preservation of the GBO that the NSF provide full funding to continue to operate the facility. Green Bank Observatory is the United States' birth place of the National Radio Astronomy Observatory in response to the Space Race with Russia that resulted in the rich history of world leading research results that are continuing today. Additionally, reduced funding could impact staffing levels and thus adversely impact the surrounding community in so many ways - economics, youth leaders, local education, emergency response, support of the arts, etc. My family, including my daughter in college and son in high school are beneficiaries of the nationally recognized STEM activities available at the Green Bank Observatory. The staff at Green Bank and professors at West Virginia University are heavily involved in these exciting initiatives which have country wide implications. My children were inspired partially by visits we've made to GBO, to go into Chemical Engineering and Electrical Engineering/Computer Science fields, respectively. In addition to our own experiences, when we were at the Green Bank Observatory we witnessed how many people - young and young at heart - have been inspired and challenged from visits to GBO. Our future is in good hands as evidenced by the great educational activities taking place because of the facilities and research equipment available at the Green Bank Observatory under the facilitation and direction of the world class GBO staff. I plan to do everything I can to help you ensure that these unique and valuable experiences to inspire our youth and our educators, as well as the groundbreaking research being conducted every hour, continues at the Green Bank Observatory fully funded by and wholly owned by the NSF.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
50	a	Scott	Hamilton		I would like to express strong support for the restoration of full funding of the Green Bank Observatory (GBO) by the NSF so GBO can continue their important mission of Open Skies science and education focused operations. The Open Skies policy allows anyone with a merit-based proposal to gain observing time, which means real, ground-breaking scientific research can be done by anyone from a student at a small college to a world-renowned scientist studying gravitational waves to a high school student with a great idea. The Open Skies opportunity is made possible with NSF funding - which is why it is so important that the NSF restore full funding for the operation of the Green Bank Observatory and retain full ownership. While like minded partnerships are beneficial, partnerships reduce the amount of observing time available to the many different people and institutions that do not have the resources to have their own research instrumentation at their facilities or to partner with the GBO. Education opportunities and diverse research subjects would be reduced. Further, per the draft report of the Section 106 Historic Assessment that is concurrently being conducted by the NSF, adverse impacts have been identified for the 'collaboration' operating option including removal of some of the historical structures identified as part of the GBO Historic District. It is important for the historical preservation of the GBO that the NSF provide full funding to continue to operate the facility. Green Bank Observatory is the United States' birth place of the National Radio Astronomy Observatory in response to the Space Race with Russia that resulted in the rich history of world leading research results that are continuing today. Additionally, reduced funding could impact staffing levels and thus adversely impact the surrounding community in so many ways - economics, youth leaders, local education, emergency response, support of the arts, etc. My family, including my daughter in college and son in high school are beneficiaries of the nationally recognized STEM activities available at the Green Bank Observatory. The staff at Green Bank and professors at West Virginia University are heavily involved in these exciting initiatives which have country wide implications. My children were inspired partially by visits we've made to GBO, to go into Chemical Engineering and Electrical Engineering/Computer Science fields, respectively. In addition to our own experiences, when we were at the Green Bank Observatory we witnessed how many people - young and young at heart - have been inspired and challenged from visits to GBO. Our future is in good hands as evidenced by the great educational activities taking place because of the facilities and research equipment available at the Green Bank Observatory under the facilitation and direction of the world class GBO staff. I plan to do everything I can to help you ensure that these unique and valuable experiences to inspire our youth and our educators, as well as the groundbreaking research being conducted every hour, continues at the Green Bank Observatory fully funded by and wholly owned by the NSF.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
51	a	Knudsen	Sophie		I am writing to you in response to the Draft Environmental Impact Statement for the Green Bank Observatory, to express my support of the observatory and my desire to see the National Science Foundation invest 100% in science-focused operations associated with this innovative research and education facility. I want to tell you why the observatory is important to me specifically and my opinion for why it is essential for others. I first visited Green Bank, WV after graduating with a B.S in Chemistry to spend some time skiing at Snow Shoe with friends before applying for and settling into my first "big-girl" job. While I was in school, I spent my summers guiding on the New and Gauley Rivers. I became infatuated with a state I had grown up next door to and knew so little about. Having grown up in Falls Church City, not far from the NSF offices, I was accustomed to Tyson's Corner, Regal Cinemas, and everything else you could need 5 minutes away, 15 with traffic. I attended one of the best school systems in my area, learned about American history, countless wars, but had never heard of Matwan, the battle of Blair Mountain, NASA IV & V in Fairmont, not to mention the birthplace of the National Radio Astronomy Observatory. With this said, spending my summers in a place that inspired exploration, innovation, and determination has been the best decision I have made in my life thus far. I realized then, I always wanted to live in an environment that cultivated my ambitions. I feared I would have to sacrifice where I wanted to live in order to obtain a science-based career. However, while in Green Bank I took a tour at the observatory and fell in love with the history as well as the future prospects of the site. I asked my tour guide if there were any open positions and she ecstatically escorted me to Tracy Samples, the Human Resources director. Tracy told me the only position available for a person with my background in science and outdoor education was the public education assistant position. I applied the same day, interviewed twice in the following weeks, and received an email offering me the position a few weeks after taking my first steps down the hallways of the observatory and into my future. Thrilled doesn't begin to describe my demeanor when I called my mother to tell her I got a job that allowed me to work in close proximity to exciting science and science-minded individuals! My mother was overjoyed; not only was I accepting a job that challenged me and excited me but I was also going to live in an area that sated my need to climb, kayak, and hike. I quickly realized I adored another aspect of the observatory; the overwhelming abundance of strong females in leadership roles and on staff in general. The list includes the director of the site, of human resources, my boss, three out of three total post-doctoral employees, the entire fiscal department, and the tour guide manager. I cannot express how valuable and encouraging that is as a new employee in a scientific environment. The vibe at the observatory is one of family. Everyone encourages everyone else to try new things no matter what division you are in or how capable you may appear. It is beautiful and necessary.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
51	b	Knudsen	Sophie		In the one year that I have worked at the observatory, I became certified by the Society of Professional Rope Access Technicians (SPRAT) to provide rope rescues in case of an incident on the telescope. I became the manager of quarterly family science labs where I provide positive STEM experiences for families and their children, giving these families a resource to supplemental education that, without the observatory, they may not otherwise have. I became the coordinator of a wide-reach organization that trains college students to deliver presentations and activities to K-12 students and advocate for STEM opportunities and careers in West Virginia. With the help and support from every division on site, I organized an eclipse event that welcomed 2,000 attendees, travelling from many states, to the observatory and provided educational videos, activities, and safe methods of viewing the partial eclipse. Also, because the observatory provides space for the local fire department I was able to become a certified EMT and am now a volunteer member of the local Emergency Medical Services. This job has given me so much more than content for my resume. Having gone to a small school, I reaped the benefits of personal education experiences and now, at this observatory in a small town, I can say I provide the same experiences for local youths and adult learners. Many of my friends cannot say their voice, their opinion, carries much weight in their workplace. At the Green Bank Observatory, I can speak up without fear of being overlooked, without anxiety of being corrected by someone I do not know, I can embrace learning from my colleagues because they take the time to teach. If they do not have the time, they will follow up with me when they are able. It is not just a courtesy shown to co-workers, the rising ninth-graders, attending our summer camp, receive the same respect and attention as a visiting astronomer and every employee, from scientist to mechanic takes the time to explain whatever to whomever. My role at the observatory has provided me with so much more than a job title, a retirement plan, or the ability to finance my car. It has given me confidence, drive, community, family, life-skills, and finally, a place to call home. I know more is at stake than these locally beneficial programs though. Without 100% funding of science-focused operations, students like the ones I teach, may not have the opportunity to use the world's largest, fully steerable telescope in the future. They might have the chance to submit a proposal curious in investigating a new concept and possibly discovering an astronomical breakthrough. Open Skies is fundamental for supplying a diversity of ideas and projects to the scientific community and for exercising the capabilities of the observatory's various receivers and innovative new technologies. If full investment is not restored, individuals and institutions that do not have the resources to expand our understanding of foreign objects in the Milky Way, neutron stars, gravitational waves, or to discover chemical environments of distant planets. The Nation risks losing countless hours of new information gained by observations proposed by this and the next generation, through the Open Skies program, made possible by total investment of the National Science Foundation.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
52	a	Duncan	Lorimer	Professor of Physics and Astronomy WVU	I am writing in response to the Draft Environment Impact Statement Report for the Green Bank Observatory (GBO) published in the Federal Register on November 8, 2017. As a Professor of Astronomy based at the Department of Physics and Astronomy at West Virginia University for the past decade, I would like to impress upon you the unique and iconic status of GBO here in the state of West Virginia, and on both the national and international astronomical and science communities in general. Since its construction in 2000, the Robert C. Byrd Green Bank Telescope (GBT) has been at the forefront of many areas of modern astrophysics. In my own research, which is centered around Radio Pulsars, the GBT has made a number of far-reaching contributions which are well documented in the literature. For example, the measurement of a two solar mass neutron star (Demorest et al. 2010, Nature, 367, 1081) has amassed over 1300 citations to date and has profound implications for our understanding of the nature of matter at high densities which are impossible to constrain elsewhere. More recently, the GBT has for the first time detected one of the enigmatic Fast Radio Bursts (FRBs; Masui et al. 2015, 528, 523) and places important constraints on the origin and distance scale of these radio sources.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
52	b	Duncan	Lorimer	Professor of Physics and Astronomy WVU	My relationship with GBO dates back 15 years, and in particular over the last decade I have worked very closely with observatory staff since being a faculty member at WVU. Motivated by the promise of finding new pulsars, and my experience at engaging students in understanding the exotic properties of pulsars, in 2007 I joined forces with colleagues at WVU and educators at GBO to help found the Pulsar Search Collaboratory (PSC). The project was initially funded by the NSF Innovative Technology Experiences for Students and Teachers (ITEST) program. The PSC is now in its 10th year and has been incredibly successful in engaging high-school students in STEM fields and is currently funded by an NSF Advancing Informal STEM Learning (AISL) grant as well as a five-year NSF Track I EPSCoR award. Each year, the PSC has grown by reaching more students, training more teachers, and making more scientific discoveries. So far, the PSC has engaged over 2000 students and 100 teachers in 20 states. The PSC has achieved notable educational goals including reaching first time college-goers and seeing gains in self efficacy and interest in scientific careers, especially in girls. The GBT is one of the best telescopes for pulsar searching. During the summer of 2007, while the GBT track was being refurbished, the PSC received 300 hours of telescope time, totaling approximately 30 TB of data. Since the initial survey observations, further GBT data sets have been acquired. All these data belong solely to the PSC students. While the PSC is part of a larger collaboration of professional astronomers, it is important to note that the PSC data have not been analyzed by astronomers. Once raw data from the GBT are processed into diagnostic plots, the plots are completely analyzed by PSC students and the discoveries belong to them. The ownership of the data, complexity of the plots for pulsar searching, and the interactive nature of the science make the PSC unique among student research programs. In our initial model of the PSC, teachers and students came to NRAO Green Bank each summer for periods of between one and three weeks to learn the fundamentals of radio astronomy and pulsars. During the academic year, teachers recruited new students to participate in the PSC through whole-class activities when student leaders and teachers form teams at their schools to participate in the PSC throughout the year. The PSC culminates with a Capstone Seminar at WVU, where the students learn about STEM fields on campus and present their research results. Current work focuses on distributing the PSC into a truly nationwide and ultimately international endeavor. As part of the AISL award, students form networks which meet at a number of regional PSC hubs throughout the U.S. In data analyzed so far, PSC students have discovered seven new pulsars, including one millisecond pulsar and one pulsar in a binary system. The millisecond pulsar, and others that we expect the students to find, are potentially very useful additions to pulsar timing arrays which aim to detect low-frequency gravitational waves. The letter written on behalf of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) addresses specifically the GBT's importance to this project. Over the years, the PSC has received a significant amount of press coverage. One of the original student discoveries, Lucas Bolyard, was featured as a guest at one of President Obama's star parties at the Whitehouse in 2009 This year, the PSC is being showcased in a feature-length documentary "Little Green Men". In surveys that we have carried out with PSC participants, over 90% of all respondents said that the PSC had changed them in some way. The strongest motivating factors reported were being involved in scientific research, working with their friends and team-mates, and enjoyment. Students reported gains in knowledge, research skills, leadership and friends from participating in the project. When reporting ways in which participating in the PSC had changed them, students listed changes in career path, appreciation for how science is done, confidence and motivation. We found statistically significant increases in interest in three careers as scientists and engineers a result of participating in the PSC. I hope that this letter has described the critical role that the GBT and GBO in general is playing in developing STEM careers on both a state and National level. The PSC is a unique experience for the students and teachers. Students and teachers work hand-in hand with world-renowned scientists. They gain real-world experience as to what it truly is to be part of a scientific team. In these troubled times, where the political landscape of our country and the world needs, more than ever, the next generation of scientists and engineers, I cannot stress how devastating it would be to these efforts if the GBO site were to be decommissioned.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
53	a	Natasha	McMann	Graduate student in astronomy at WVU	My name is Natasha McMann and I am a graduate student in the Fisk-Vanderbilt Master's-to-PhD Bridge Program. I am studying astrophysics with a research interest in pulsars and gravitational waves. I am a non-traditional student and the Green Bank Observatory (GBO) influenced my decision to become an astronomer. I am a native of Pocahontas County, where the GBO is located. I graduated with a bachelor of arts in social science in 2008 with the plans of becoming a minister. I decided to take a year off which turned into four years. During that time, I discerned that I didn't want to be a minister and began looking for work around my hometown. In 2010, I was hired as a tour guide at the Green Bank Observatory. This event changed my life forever. My interest in astronomy was sparked and my career path changed. I enrolled at West Virginia University in Fall 2012 to begin working on a bachelor of science in physics. About a week after I started classes, the recommendation to divest the GBO was announced. My heart sank. I had dreamed of going through school and getting my PhD and someday return to work at the GBO and live in the place I love. I ask that you choose option A and keep the GBO at its current funding. It is not only vital to the science I do but also to my community. A place that will always be home to me. The GBO is one of the largest employers in Pocahontas County and is crucial to its economy. Fifty percent of GBO employees are native to the county. If it gets divested completely the local economy will be devastated. It is also important to the school system. While most rural places lack access to a science facility, the students of Pocahontas County and surrounding area have a world class science facility in their own backyard. Recently, one of the employees helped start a coding class at the local high school. This is an asset to the students because most careers today need advanced computer training and children from rural areas usually don't have access. I, for example, didn't start coding until I was 27 and it proved very difficult. I felt behind other students who had taken coding classes in high school. I am an associate member of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav). NANOGrav uses single dish radio telescopes to time pulsars in hopes of detecting gravitational waves with them. The GBT is one of the best telescopes in the world to time pulsars because of its sensitivity and its capabilities. Approximately 40% of telescope time is used to study pulsars. Losing the GBT would cause NANOGrav to fall behind other pulsar timing arrays and astronomers interested in this field would probably have to look for work outside of the United States. Again, I ask that you please continue to fund the GBO at its current level. It is a vital facility not only for science but for the local economy and education system as well.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
54	a	Ryan	Lynch	Director of GBO	I am writing in regards to the Draft Environmental Impact Statement (DEIS) that has been released for the Green Bank Observatory (GBO). The DEIS fails to fully account for important impacts that would result from any of the Proposed Action Alternatives under consideration, save for the No-Action Alternative. I will be focusing my comments on the Socioeconomic Impacts section of the DEIS, specifically impacts on Education. To begin, the DEIS does not seem to mention, even once, the GBOs longstanding and out-standing National Science Foundation (NSF) funded Research Experience for Undergraduates (REU) program, as well as the newer Physicists Inspiring the Next Generation (PING) program and other summer research programs for undergraduate and graduate students. This oversight is especially baffling given the NSF's commitment to ensuring that it's activities have a broader impact on the educational opportunities for young scientists, especially students from underrepresented minorities (URMs). Furthermore, I personally highlighted the importance of these programs in my written and oral comments during the EIS scoping period. To recap those comments, GBO's summer student programs provide career advancement opportunities for approximately ten students per year. Since 1991, over 40% of GBO summer students have been women, a larger percentage than is found in astronomy at large. This includes a period when GBO was part of the National Radio Astronomy Observatory. The PING program provides research and mentoring experiences specially targeted at students of color, as well as women and other underrepresented groups. Two PING mentors are already enrolled in graduate physics programs at U.S. institutions. PING also includes educational opportunities for dozens of rising high school freshmen from URMs each year.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/7/2018	
54	b	Ryan	Lynch	Director of GBO	GBO's ability to offer meaningful research experiences for students enrolled in these programs would be severely and adversely impacted under any of the Proposed Action Alternatives except for the No-Action Alternative. This includes the agency-preferred option, (continued science-focused operations with reduced NSF support) as it still entails a loss of open-skies time that contributes data to the aforementioned programs. Furthermore, a reduction in open-skies science could lead to a decrease in scientist and technical staffing levels at GBO, which would in turn reduce the available pool of student mentors, necessitating a smaller summer student program. The failure of the DEIS to consider the impact on these programs is a major oversight in the assessment of Educational impacts that needs to be corrected. I would be happy to supply more information on these programs if necessary.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/7/2018	
54	c	Ryan	Lynch	Director of GBO	Second, The region of influence (ROI) for Socioeconomic impacts has been defined as Pocahontas County, particularly the communities of Green Bank and Arbovale, where social and economic impacts will be felt most strongly. This ROI captures the majority of the concerns identified during the public scoping process (DES 3-39). This ROI is inadequate and, in fact, does not capture the majority of concerns identified during the public scoping process. The ROI should be widened to at least the entirety of the United States, and ideally to the entire globe. This reflects the large, global user community of the Green Bank Telescope (GBT), which is relevant to Educational impacts. Comments were made during the Public Scoping Period that reflected the global reach of the GBT, and this is reflected by the locations of those who submitted comments: 32 States or Territories were represented in written comments during the Public Scoping Period, as were 13 countries other than the US. 201 commenters, 44% of those that provided written comment and gave addresses in a US State or Territory, were from outside West Virginia. 61 commenters, 10% of all those who submitted written comment, gave addresses outside of the US. 67% of all comments, written and public, commented on research and/or education. The GBO impacts research and education far beyond the confines of Pocahontas County. I would be happy to share a detailed breakdown of the comments and the data that went into these numbers. The geographic extent of the GBO's educational and research communities that are captured in the above numbers make it clear that ROI used in the DEIS is too small, and thus misses important Impacts. As such, the DEIS is incomplete and flawed. Because of the unjustly narrow ROI used in the DEIS, the category of Education only considers the impacts on the State, County, and Green Bank Elementary-Middle School[s] and the educational opportunities offered at GBO for county residents (DEIS 3-41). This does not capture the impact that GBO has on primary and secondary education outside of West Virginia, and the impact within higher education throughout the U.S. and the world. The DEIS states that the ROI was not officially widened to the entire State of West Virginia because it dilutes the economic consequences of the Proposed Action Alternatives (DEIS 3-40), but this can surely be addressed by a more detailed analysis of different areas within a widened, official ROI. If this is not done then the final EIS will drastically underestimate the impact of the Proposed Action Alternatives. Third, the DEIS does acknowledge the impacts of GBO on the national and international scale (DEIS 3-59), for example through the Skynet Junior Scholars program and the NANOGrav collaboration, but without including these in the official ROI the DEIS presents an incomplete and confusing view of their impact and how it was assessed.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/7/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
54	d	Ryan	Lynch	Director of GBO	Forth, Section 4.11.1.3 states that under Action Alternative A the Green Bank Elementary-Middle School specifically would not be affected and there would be no impact (DEIS 4-84). It also states that GBO would maintain...STEM-related training and that impacts would be minor, adverse, and short-term (DEIS 4-85). These conclusions seem to be based only on an analysis of potential on-site demolition. They do not consider the changes to the Observatory's scientific focus that may occur if the interested parties identified for collaboration reduce the availability of the GBT for open-skies science. If open-skies science time decreases, it will have a severe, long-term impact on college and university students throughout the U.S. and the world. Changes in observatory staffing could also impact the local school system. The DEIS does make reference to these concerns under Action Alternative B (Section 4.11.2.3), so the failure to accurately account for them under Action Alternative A is confusing. Further, Action Alternative B states that the impact on state and national educational programming would be moderate. The impact would actually be severe, and it may be severe under all Proposed Action Alternatives. These issues must be addressed in order to produce a credible Final EIS. Finally, I would like to reiterate my call for the final EIS to formally include the scientific environment and broader impacts as an independent area of study. Nothing seems to prevent the EIS from expanding its scope to include these areas, and without doing so the EIS cannot fully capture the impact of the Proposed Action Alternatives. I once again urge the NSF in the strongest possible terms to select the No-Action Alternative (continued NSF investment for science-focused operations) for the future operations of the GBO. The No-Action Alternative is the only option that will not have severe, long-term negative impacts on the socioeconomic, cultural, educational, and scientific environments of the local community of Green Bank, the State of West Virginia, the surrounding region, the entirety of the United States, and the global international community. The No-Action Alternative is also the only option that will not have severe, long-term negative impacts on NSF's mission to broaden the impacts of its activities and facilities. Please do not hesitate to contact me if you have any questions or would like more information.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/7/2018	
55	a	Joan	Campbell		As a taxpayer and proud American, I must advocate strongly in favor of continued operation of the Green Bank Observatory with full, NSF funding. This is a legendary seat of scientific exploration, and one I have heard about since I was young. Now in my seventh decade, I was able to visit the GBO for the first time last June, and the more I have learned about the facility during and after that visit, the more excited I've become. What we have here is a scientific installation renowned in the entire world, one that can serve any number of different constituencies, but reaching its full potential -- and making the greatest use of the array of hardware that already exists -- requires sufficient funding. Research partnerships are fine and useful, but they are insufficient to open the door to students and independent astronomers who may be ready to open additional doors of understanding for us all. In addition to astronomical discoveries, a fully-funded GBO will provide education and inspiration to many young people who lack only that "Helen Keller" moment to awaken an intellectual curiosity that will change their lives -- and possibly the lives of us all. Hard financial decisions will always need to be made in disbursing public funds, and what one person considers waste, another considers to be essential. However, something that contributes to so many people (local residents, researchers, students, and visitors) directly, and indirectly through increased understanding of our universe, should be a clear priority, independent of temporary political fads. Knowledge may be eternal, but it has to be discovered by us mortals. Let us take full advantage of the amazing facility that is the GBO, as well as the amazing people it attracts. The NSF should return to full funding of the GBO. Anything less is sadly short-sighted.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
56	a	Jane	Shamitko	High school physics teacher	As a high school physics teacher, I have participated in the many educational workshops that were offered by the Green Bank observatory , and funded by the NSF- such as RareCats. This workshop provided me with such invaluable resources and shaped the way that I taught- I became a better teacher . I am so grateful for that experience and for the staff at Green Bank for giving their time and effort to provide this opportunity to teachers in both West Virginia and surrounding states. I have had the opportunity to take students down to the 40 foot telescope to do research on the Milky Way Galaxy and present their findings to the Pennsylvania Junior Academy of Science. Several of these students were motivated to pursue related science careers in college . These students still talk about Green Bank and how inspirational it was to them. I participated in the Pulsar Collaboratory program - the search for pulsars - and had several of my students find pulsars and subsequently have their name listed on a professional abstract as a contributor. This was an awesome experience for them. The Green Bank observatory is an exceptional resource. I love the facility and the staff who work there. They are dedicated in promoting research opportunities for our children and providing training to educators. Please continue to fund this facility.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
57	a	Keith	Johnson	Former Director of Edelman Planetarium at Rowan University	I just learned that there is at least a possibility that the Green Bank Observatory could possibly survive the original proposal to shut it down and demolish the site. I'm writing in support of keeping this facility open in one form or another. Please do this! I'm not a scientific researcher: I'm an astronomy educator. I retired in 2016, after working in planetariums across the country, trying to bring the excitement of astronomical research to the general public. You are undoubtedly aware of the arguments by astronomers for keeping the GBT and the observatory open. The GBT is unique and valuable; it should have a long life ahead of it. The GBO has become a focus for astronomy education on many levels. There are many astronomical projects that would suffer without the data produced by the GBT. Yes, the observatory represents a sizable expense in a time when support of science is dropping precipitously in the United States, more than is the case in the rest of the world. But it seems to me that this a good reason to keep it open. We've forgotten the time when our country was in the forefront of science, and how that changed our lives for the better. Discarding a scientifically valuable facility tells the U.S. public that science is really not all that valuable, that our money could be better spent on pizza, and football... and building walls around our country. Keeping the GBO open, and reinvigorating it, would show that we still believe in the worth of basic science. Disclaimer: At this point I should admit that I have a personal connection with the observatory. I was a summer research assistant — a "summer student" — in the late 1960s, and spent at least two summers having the best science experience of my life in Green Bank at NRAO, as it was called. I also worked a couple summers while in graduate school at the 36-foot telescope in Tucson in the early 1970s, partly as a telescope operator (and partly as a general slave, digging holes for the water-lines and helping lubricate the telescope bearings). I witnessed the excitement and enrichment provided by NRAO to the astronomical community, and tried to bring this feeling to my students in the planetarium dome. I can hardly believe all this might be thrown away. The Green Bank Observatory and Telescope are valuable scientific facilities. It would be foolish to discard them. Please find a way to keep them operating.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
58	a	Stauffer	Kathryn	Resident of Green Bank	In September of 2016, like so many others, I moved to the Green Bank area because of the telescope. I suffer from Electro Hypersensitivity or EHS. The Observatory should remain open and vital because of all it contributes to society and the local community, but it has a deeper purpose for myself and the EHS community that resides here. For us, living here is for our survival. We have no where else to go. I was pleased with the many who made their voices heard at the November meeting including the powerful statement read by Peggy Hawse on behalf of Senator Manchin. Thank you to all who work so hard and fight to keep this Observatory up and running. We, the EHS Community, are very grateful.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/7/2018	
59	a	Guerau	Cabrera	PhD Student at WVU in Physics and Astronomy Dept.	I am a Ph.D. candidate at West Virginia University, Physics. Although I am not an astronomer, I took a radio astronomy course to expand my horizons and visiting Green Bank was a life changing event for me as a scientist. I would like to express my wishes to support Option A.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/6/2018	
60	a	Kaitlyn	Pomilli		I am emailing you to show my support of Option A.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/6/2018	
61	a	William	Crilly	Electrical Engineer and Education and Public Outreach Volunteer Science Ambassador at GBO	Consider a preferable alternative to the current NSF facility funding prioritization process. The inherent difficulty and costs associated with de-funding a successful national science facility can be remedied if the NSF prioritizes the continued operation of facilities at their highly productive times, above the construction of new facilities that do not replace existing facilities. As science funding by the Congress is at risk, it is wise that the NSF not overly prioritize spending on new facilities, as the new facilities risk being shuttered by the Congress during their construction, or during their productive period. The US then continually loses its productive facilities as well as its new facilities. In this funding prioritization scenario, the Congress will question the NSF's ability to wisely prioritize funding. On the other hand, the NSF's continued support and recognition of highly successful facilities encourages the Congress to consider funding these facilities and new facilities. The Green Bank Observatory is a highly productive science facility and should be used as an example to implement this new funding prioritization policy. Consider that foreign nations are investing to compete with US facilities being de-funded by NSF. Foreign nations are intent to copy and replace US science facilities, thus attracting the world's engineering and scientific community to their nations. The development of instrumentation and expertise at foreign science facilities spins off to the foreign nations' industries and education centers, and increases the foreign nations' commercial competitiveness. This negative outcome is a natural result of de-funding successful US science facilities. In addition, new foreign science facilities, replacing de-funded yet successful US facilities, have a measurably known scientific customer base to draw upon, reducing the foreign nations' investment risk. The Green Bank Observatory is a prime example of a US science facility to be copied by other nations. Consider that the Green Bank Telescope exceeds the performance of similar telescopes worldwide Science and engineering has a natural aspect of being difficult to confidently predict. Future science and engineering applications of the world's highest gain steerable antenna are not immediately and currently evident. The de-funding of the most effective and powerful measuring instrument of its kind in the world is a high risk that the US takes. The GBT's NSF prioritization below the construction of new facilities that do not exceed the GBT performance should be a warning that the US is risking an inability to answer a future highly important question to the US and to the world.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/6/2018	
62	a	Shapiro-Albert	Brent	PhD Student at WVU in Physics and Astronomy Dept.	My name is Brent Shapiro-Albert and I am a current graduate student studying pulsar astronomy at West Virginia University. I am writing to express my support for option A proposed in the Draft Environmental Impact Statement. I support continued NSF funding of the Green Bank Observatory in the highest capacity, and hope that any collaborating organizations that the NSF collaborates with will make sure to continue the "open skies" policy currently supported by the NSF. For both myself and many other graduate students at WVU, the use of the GBT is central in doing research that we will base the rest of our careers off of. As a pulsar astronomer in particular, the GBT is one of the most important pulsar telescopes in the world, and most of my research to date has made use of data taken at the GBT. My research and career to this point has been heavily based on use of the GBT and even the loss of open skies time on the telescope would be devastating. I am not the only graduate student at WVU for whom this is the case either. I would also like to note that I think some of the educational outreach and impact that the GBO does was understated in the DEIS. Opportunities provided by programs like the Pulsar Search Collaboratory (PSC) for high school students are few and far between, and for graduate students it provides a fantastic teaching opportunity specifically in our field, which can help further our careers after grad school. I hope that my own, and others, concerns are taken into account in the final Environmental Impact Statement, and the NSF works diligently to find collaborators that support both the science and outreach programs currently going at the GBO.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/6/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
63	a	Jessica	Martin	Previous resident of Green Bank	I grew up in Pocahontas County, but now live in Houston, TX. I wanted to take a moment to drop you a note about the impact the GBO has. Not only does it provide something unique to astronomy researchers from around the world, but it also touches the lives of so many others. I could write paragraphs about the impact it creates in the science community, but instead, I would like to share my story. Each summer, I take my two daughters (currently ages 9 and 3) home to West Virginia for the summer, to escape the hustle, bustle, and heat of Houston. We stay for at least five weeks and we look forward to our time of peaceful serenity for the rest of the year. Houston is the fourth largest city in the United States and because of that, the opportunities it affords my girls are endless. We are able to visit aquariums, museums, theaters, you name it... even observatories! And I take full advantage of the easy access we have to these things, because I did not have them when I was growing up in Pocahontas County. However, that being said, I also take full advantages of the things that Pocahontas has to offer each summer. We roam down various hiking trails, play in creeks, visit state parks, run free in the wide open spaces. And visit the Green Bank Observatory. Every summer. My oldest daughter first visited the GBO when she was three. My mother and I took her to the StarLab - crawled through the little opening and settled in to watch the skies come alive. She was in awe for a full thirty minutes, watching the constellations and listening to their stories. During another visit, the GBO was hosting a "Pluto Party" - held to celebrate New Horizons' fly-by of Pluto. She participated in experiments, learned facts about space, even won some "astronaut ice cream" in a raffle. She had an amazing time. She asked Santa for a telescope of her own that year for Christmas (and got it!). Fast forward to this year. My daughter is also a Girl Scout and has the opportunity to participate in "interest groups" within the organization. Some of them include backpacking, dance, robotics, horseback riding, and even astronomy. We were reading a list of the weekend camps being offered for these special interest groups, and which one does she pick? Astronomy! I signed her up and off she went. They did a myriad of activities that weekend, including their own StarLab..."Just like the one in Green Bank Mom!" she exclaimed. Now she wants to join the club full-time, she wants to visit NASA (again) and spend the night there. She has a giant poster of the constellations hanging beside her bed (coincidentally, her favorite constellation is Lyra). She is all things astronomy. This is, in no small part, because of the Green Bank Observatory and the access it granted to one small child. To all the children, really. Sure, GBO is so important in our quest to learn about our universe. People more important than my daughter - real, bona fide scientists - utilize it every day. It's importance to them and to astronomy in general is an absolute, a given. But they are scientists of today. The Green Bank Observatory is also helping inspire the scientists of tomorrow. Like my daughter. Its importance is like a pebble thrown into a pond. One small thing...endless ripples. Fund the GBO.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	
64	a	Ali	Jeney	Student at WVU	I am in support of Option A (collaboration with interested parties for both science and education with reduced NSF funding) in regards to the future of the GBO. It is without doubt that the observatory is of utmost important to the future of space (and earth!) exploration. As an astronomy student and earth scientist, I fully appreciate the impact the GBO has on essential scientific advances.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	
65	a	Abbey	Stephan	Student at WVU	My name is Abbey Stephan, and I am a freshman at West Virginia University. I was first introduced to the Greenbank 20-meter telescope through my introductory Astronomy course during this past fall semester. I took the course to learn more about our galaxy and the sky above us, as well as increasing my general knowledge of the tools astronomers use to gather information about the universe. Defunding Greenbank would take away the resource from hundreds of students like myself, as well as taking away one of West Virginia's treasures. While taking Astronomy 106 at WVU, students were given the ability to use the 20-meter telescope to analyze frequencies emitted by hydrogen clouds to determine information about the Milky Way. We plotted the redshifted and blueshifted frequencies on a diagram of the galaxy, and used this diagram to draw amazing conclusions about our place in the universe. As a class, we discovered that the Milky Way rotates clockwise, and that we live in a spiral galaxy. Without the use of the 20-meter telescope, we would have not been able to draw these conclusions on our own, we would have relied on the work of others instead of being granted the opportunity to become astronomers. This made the data seem more real and manageable, rather than just a concept with no hands-on explanation. Having Greenbank so close to home allows us to explore and go beyond what we do in a classroom. As a student, being able to participate in astronomy has deepened in my interest in the extent that modern science can reach and how astronomers do their work. It protects the landscape by requiring the area to be a Radio Quiet Zone, and gives West Virginia a fantastic piece of technology unlike anything else in the surrounding area. Taking away Greenbank would discontinue both an important resource to West Virginia Astronomers, professors, and students alike, as well as a crucial factor in setting our state apart.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

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66	a	Madeleine	Thompson	Student at WVU	This summer an advisor urged me to sign up for Astronomy 106 and Astronomy 107 at West Virginia University to fulfill my science requirement for my undergraduate degree. When I decided to take this course, I was unaware that it could change my time at WVU and potentially my life. The professors and graduate students that lead these courses and the Astronomy program at WVU have utilized Green Bank throughout both courses—what we have studied has been almost entirely abstract. There is no way to reach into the sky and feel the stars, and there is often no way to even see them, except for when we are using telescopes. We were assigned to assess hydrogen peaks that were collected from the 20-meter telescope at Green Bank and through sorting these frequencies, we were able to see hydrogen structures—the spiral arms of our galaxy! This small example, one of many that I've experienced in just a few short months, has inspired me to potentially minor in Astronomy. Though I have wanted to love science my entire life, I hadn't found a subject that motivated me to go beyond what is taught in the classroom the way that astronomy has. This is because of Green Bank. I have only been to Green Bank once in my life, but I have used it in some way nearly every week while I have been in these courses. I know that I am not the only student that uses these facilities at WVU, and WVU isn't the only university that uses Green Bank either. West Virginia University has a strong astronomy program, likely due to its proximity to Green Bank, and those that teach here and use the Green Bank telescopes have not only worked to prove incredible theories, often using Green Bank, but have also laid the groundwork for the next astronomers to continue making these discoveries. At Green Bank, pulsars, the Ophiuchus Superbubble, sugar molecules, and a multitude of other objects have been discovered just in the past few years. However, because Green Bank is at risk, those that will follow in my incredible instructors' footsteps may not have access to this. There are other telescopes on this planet, but Green Bank hosts the largest fully steerable radio telescope. What makes Green Bank special isn't only its discoveries and magnitude, but also how it has impacted jobs in the area. On November 28, 2017, West Virginia was named the worst state for business by Forbes. Green Bank has employed West Virginians, brought people from around the world to work in West Virginia, and increased tourism in the area. Defunding Green Bank could harm West Virginia, the country, and the future of astronomy. Please consider continuing to fund Green Bank, because when you fund Green Bank you are funding the future.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
67	a	Hunter	Ayers	Student at WVU	I am writing to express my grievances in the possible defunding of the Green Bank Observatory in the Great State of West Virginia. This telescope is imperative to the discovery of things pertaining to our universe. I, along with fellow students at West Virginia University have used data collected by the Green Bank 20-meter telescope to find profound things about our universe. Things such as what type of galaxy do we live in? If it's a spiral how many arms do we have? Things that without the Green Bank Observatory, I would never have known. On a personal level I went to this Observatory myself in my early years of Middle School. My teacher at the time was able to engage wonder in all of us at the observatory thorough both its demonstrations, and being up-close and personal with the devices. The idea of space and what it is has baffled my mind since I was a child, and to be candid, defunding a place like Green Bank would truly kill some of that wonder I still experience. I beg of you to reconsider this suggestion and take my, along with my classmates, grievances to heart.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
68	a	Delaney	Furr	Student at WVU	Prior to taking an astronomy class, I really did not know what purpose the Green Bank Observatory served to me or anyone else for that matter. Upon hearing that the observatory is under threat of being de-funded, I decided to reflect upon my semester of astronomy and recall all of the times we utilized data taken by the telescopes. By analyzing neutral hydrogen emissions collected by the telescopes at the observatory, we detected frequencies throughout the Milky Way Galaxy that were redshifted and blueshifted. This led our class to be able to conclude that we are orbiting clockwise throughout our galaxy. Without this data, it would've been impossible to determine this and our knowledge of the universe would be limited. We, as a class, also used the neutral hydrogen emissions to detect several alternating peaks at significantly higher frequencies. By comparing our prior knowledge to the information we'd just attained, we concluded that the galaxy we live in has spiral arms. By being able to have this physical proof that what we hypothesized was correct, I personally felt more confident in the class and about my knowledge and understanding of the universe we live in.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
69	a	Darby	Coughlin	Student at WVU	My name is Darby Coughlin and I am a sophomore at West Virginia University in Morgantown. I had to take an intro level Astronomy course as a general education class this year and discovered it fascinates me. We use the Skynet Robotic Telescope network for some of our work and it opens up so many doors for students to learn more about our solar system. Defunding this program would lead to less avenues of learning and less interest in astronomy. I have found myself learning incredible things about space with the use of these telescopes and very fun ways to explore our universe. This tool has helped me apply the things I see on Skynet to my overall learning in the course. Without the use of Skynet, all this entry level astronomy course would be is lecturing, Skynet helps all students get involved and actually understand what we are learning. The immense amount of knowledge to be learned with the use of these telescopes is incredible, not only have I used Skynet's resources for academia but I have also used it to my own curiosity. I have expanded my curiosity for certain things in space and these telescopes are a wonderful tool in helping me do that. From a student that is not even a science major, defunding this program would be incredibly disappointing. Please reconsider.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

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70	a	Cole	Creedon	Student at WVU	My name is Cole Creedon and I am a sophomore student currently attending West Virginia University. I am a Business major and decided to take an Astronomy class to be a more well-rounded student and learn more about Astronomy in general. Over the course of the semester we have learned about the Green Bank Observatory and have used its resources to further our understanding of the universe. I was able to use the 20-meter telescope multiple times for my assignments and while using the telescope took a picture of a galaxy among many other things. I can say that is by far one of the coolest things I've done this semester! I genuinely wish that more students had the opportunities that I have been granted just from taking Astronomy 106. Not only did I do research on the GBO during my Astronomy class but I was lucky enough to be able to ride along with some of the WVU professors and other concerned students to the public meeting that was taken place at the observatory. I met a fellow student who was a year older than me that invited me to come walk around and take a quick tour of the building. It was amazing how much I learned in such a short amount of time while listening to a fellow student who was inspired by the Green Bank Observatory to come to WVU and become an astrophysicist. Not only did my new friend inspire me, but just seeing the wide variety of people who chose to come out and speak on their personal experiences at Green Bank made it a very special experience for myself. From representatives of members of Congress to high school students and science club presidents, Green Bank touched a lot of people and has allowed people to follow their dreams and every single person there was clearly passionate about what they were saying; all thanks to the Green Bank Observatory. This telescope is more than just for learning; it creates jobs and brings money into the state. Since West Virginia has lost a lot of its coal mining jobs, one in five people living in this state are on food stamps. The GBT brings in roughly \$12 million in tourism dollars and creates approximately 140 jobs. Taking down this establishment would hurt the economy and the people of this state. If the funding was cut, there is no way that turning the GBO into a place for just tours would bring in the same amount of revenue. Although I grew up in Pittsburgh, I consider West Virginia to be a second home and I am proud of the many accomplishments that the state of West Virginia can provide to the country, with the Green Bank Observatory being one of the top resources. To shut down this observatory is taking away from a great resource for science, the community, country, and world as a whole. I believe that there should be other options other than choosing to defund this facility. Please consider all other options before deciding to deconstruct something that is so important to this country. Thank you for taking the time to read my letter and please take my opinion and those who agree with me into consideration.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
71	a	John	Moore	Student at WVU	I'm a student at West Virginia University and I'm currently taking Astronomy 106 and 107. I'm deeply saddened by the news that the Green Bank Observatory may be defunded. Over the course of this semester I've had the honor of using the 20 mm Green Bank Radio Telescope to look at the moon, and to look at neutral hydrogen in our galaxy. By doing these observations it has helped me learn about space and has helped me tremendously in class. The fact that I'm able to use Green Bank telescopes and actually be able to do observations like a real astronomer is amazing. It would be a shame if Green Bank was defunded because other students would no longer be able to get that same enriching experience that I've gotten this semester. I've gained a new appreciation for Green Bank this semester because of how much I have learned about the universe and space. I feel as if the people that appreciate Green Bank are the people that understand what Green Bank is and what it does, so it saddens me to hear that the National Science Foundation would defund such a great and wonderful resource. I grew up in West Virginia and from what I've learned while growing up is that West Virginians really take pride in West Virginia and all that it has to offer. Green Bank is honestly the coolest thing we have in West Virginia and every time something new is discovered or found it really puts WV on the map, domestically and globally. By defunding Green Bank you not only lose a great resource but you also hurt WV pride. Space is by far the most complicated subject I've ever tried to learn but if there's one thing that I've learned it's that space is a beautiful, vast place and that there is still an infinite amount of unanswered questions that have yet to be solved. Green Bank is a great resource to help solve some of those questions. Space is cool, it is the unknown so it's in human nature to be curious and to want to try to figure out things such as how did the universe begin. I learned from Neil Degrasse Tyson that we humans are made up of space stuff so why wouldn't we want to learn more space since we are made up of it. By defunding Green Bank it just hinders our ability to learn more about the universe. I hope that Green Bank isn't defunded so that astronomers and students can continue to use the telescopes in order to learn more about the universe. I've really enjoyed being able to use Green Bank so it would truly sadden me to see it be defunded.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
72	a	Abigail	Doran	Student at WVU	Green Bank Observatory is a really unique place. I am currently in an astronomy class at West Virginia University, and we utilized the 20-meter telescope to gather data for several assignments. The first time I used the Skynet tool and took a picture of stars, I was astonished. I told my family and friends how I used this program, and they thought it was incredible we had the access to do that. The assignments that we used Skynet for were some of my favorite assignments in the class. I think it really helped show us how the ideas we are learning in class are used in astronomy by real astronomers. If Green Bank Observatory were to be closed, we would not have this amazing opportunity to use this program in our class. This past Saturday I decided to take a trip to Green Bank with my friend, and saw the observatory in person. I was truly impressed and in awe the entire time I was there. I learned a lot of information when I took the tour, and seeing the Green Bank Telescope (the largest moving object on land) blew my mind. The telescope was SO massive. Our tour guide also told us that so many people want to use the telescope to gather data, and it is always being signed out for projects. A Russian group is renting out one of the other telescopes to gather data as well. That was crazy to me; people from all over the world use Green Bank's Telescopes. Green Bank Observatory is a special place because there are not a lot of locations that are perfect for gathering radio telescope data. Green Bank is in the National Radio Quiet Zone, which means for a 10-mile radius from the Observatory, anything that will interfere with Green Bank's data and the radio telescopes is not allowed. Green Bank is the perfect place to have this observatory because of the mountains around the area that serve as a natural boundary to help keep interference to a minimum. If the employees of Green Bank see they are getting a lot of interference, they will find out where it is coming from, and fix it. Our tour guide told us that someone had a faulty doorbell that was causing interference. The employees of Green Bank went to their house, and fixed the doorbell for them so their data would not be messed up anymore. So they do an extremely good job of making sure the amount of interference they have is kept to the minimum. If Green Bank Observatory were to close, it would be a shame. Students use their telescopes, astronomers make important discoveries with their equipment, and if anything, they provide an exceptional educational experience for everyone who walks through their doors. After visiting Green Bank, I found a new appreciation for astronomy. This is truly such a special place, and it would be such a huge loss for West Virginia if the facility were to be shut down.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment		GBO Letters from WVU Astronomy Students
73	a	Mary	Nichols	Student at WVU	I am currently a sophomore at West Virginia University enrolled in an introductory astronomy course. Throughout this course, we have gotten the opportunity to use the program Skynet. Within this program we have particularly used the 20 mm Green Bank Radio Telescope. We have had three different assignments, in which we got to look at the moon and many other things. By having the opportunity to look at these things, I have been exposed to a whole part of learning I have never received before. Because of this, I feel as though I understand what astronomers do on a daily basis and how we know the things we do about our universe. At the age I am, I have sadly never been exposed to anything like this. Because of the opportunities Green Bank provides I truly have created a newfound interest in science and astronomy specifically. Continuing, as an Elementary Education Major, I feel as though every elementary student should have the opportunity to be exposed to this. As I am planning to teach in West Virginia, this is an amazing asset the State of West Virginia has. With that being said, I definitely planned to integrate lessons involving Green Bank into my curriculum. This would hopefully spark an interest about astronomy into children at a young age, which could then even make them decide to pursue a career in it. Defunding Green Bank would be devastating news to not only the students at West Virginia University, but also the whole state. Defunding Green Bank would take an abundance of learning from people globally.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
74	a	Caitlin	Fulp	Student at WVU	I am coming to you as a student in one of West Virginia University astronomy classes. Hearing the news that Green Bank Observatory might be shut down was very heart breaking. After the research and great discoveries I've been able to make in class this year, I have a new found appreciation for Green Bank. It is a very unique and extraordinary part of our state. I believe Green Bank has the potential to display amazing scientific research. Personally, I have enjoyed being able to gain knowledge about our universe with the 20 meter telescope. It enriched my academic experience throughout the course. I want students after me to be able to use this as well. It's a wonderful resource, and an amazing opportunity for students. I would greatly appreciate that you consider all the wonderful aspects of Green Bank Observatory before deciding to shut it down.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
75	a	Nakisha	Papenfuss	Student at WVU	My name is Nakiska Papenfuss and I am a senior Forest Resource Management major at West Virginia University. I am writing this letter in the support of funding for The Green Bank Observatory. You may be wondering what someone in my field of study could possibly gain from the observatory, but in truth any person can gain something. The Green Bank Observatory is a fantastic symbol of scientific advancement and hope for future progress by housing the largest premiere single-dish radio telescope. Green Bank also sits within the National Quiet Zone, which to many is very intriguing. It brings questions to the those who are unaware of what goes on there. With questions come curiosity and with curiosity comes the search for knowledge. Students from Pre-K through college are given the opportunity to gain hands on experience either through satellite communications or in-person activities. I, for example, am currently enrolled in an astronomy class that has utilized the opportunity to use the 20M telescope through SKYNET. Through SKYNET I have personally been able to take photos of our wonderful solar system and beyond while also exploring stars and asteroids I had little to no knowledge about previously. As a Forest Resource Management major, I study the biology of trees as well as their impact on human life. I feel that we cannot fully understand everything here on this planet until we can understand how it started and where this planet came from. And despite the fact that there is so much information unknown to us, we will never be able to gain any new information without places like the Green Bank Observatory. I urge for funding to remain in place for the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
76	a	Amelia	Jones	Student at WVU	My name is Amelia Jones and I am a freshman English major at West Virginia University. Though I am not pursuing a degree in astronomy, I am enrolled in an astronomy course plus a lab component. During this class, we took advantage Green Bank's 20-meter telescope to explore the wonders of the outer universe and dark matter by observing radio frequencies of hydrogen clouds. It is a unique opportunity to be able to use these resources as many do not have access to it. If Green Bank Observatory is defunded, you are subsequently taking away that opportunity from not only future students at West Virginia University, but potential other universities from across the country as well. Science is for everyone and Green Bank Observatory is a paramount resource that deserves to stay. Not only has astronomy taught me about the wonders of the universe but it has also inspired me. The opportunity to help even one person discover their love and passion for astronomy through the Green Bank Observatory is what makes it all worth it.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
77	a	Ashley	Harris	Graduate Student at WVU	I am writing this letter to express my concern with the prospective de-funding of the Green Bank Observatory. I am a Graduate Student at West Virginia University graduating in May with my Masters Degree in Elementary Education. This facility has provided myself and countless other students with an immersive learning opportunity in the field of applied astronomy. The capability to physically collect data and see the processes at work in the scientific field was invaluable to me as a student, and the Green Bank Observatory is one of the few, proud, representations of West Virginia's involvement in the global scientific community. The telescope not only provides students with unparalleled learning opportunities, but it continues to be a foundation of research in the field of astronomy. Additionally, the observatory acts as a 'point of contact' for many K-12 and undergraduate students in the relatively difficult-to-access field of astronomy. Many young students have had their career in sciences initiated through class field trips to the Green Bank Observatory. As a nation, our commitment to funding scientific and educational endeavors is a cornerstone of who we are and what we represent. In order to continue American preeminence in the field of scientific research and astronomical observation, facilities like the Green Bank Observatory must be continually supported by federal funding. I implore you and your colleagues in Washington not to overlook the importance of accessible science and technology learning opportunities for our youth- or established research facilities for our professional scientists.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
78	a	Zoey	Blair	Student at WVU	My name is Zoey Blair, I am a freshman at West Virginia University. It is not unknown that science classes across the nation in high schools are not all they could be. They lack the materials, software, etc. to give the students an experience that will either make them fall in love, simply learn to appreciate, or at least spark their interest in science. I can remember sitting in every science class I had ever taken in high school, completely bored and uninterested. It was not until my first semester at WVU that I began to take interest in science. I had the joy of interacting with the Green Bank 20-meter telescope and seeing for the first time how I, myself, can comprehend and become someone who actually, enjoys science. For the first time science did not simply make me feel inferior, but made me feel empowered. This passion for science coming from a double major in English and Spanish is something to note. By analyzing data from it, I have truly seen the real-life application of science and I have found that I am impressed by what the universe is. Those peeks through the lenses of the 20-meter telescope have changed my outlook on the entire field of science. When I received my data back from observing the hydrogen levels in the Milky Way, I discovered the which peaks were red-shifted and blue shifted, and from this data I was able to conclude which way the galaxy rotates, which is clockwise. It was so interesting using the data from the telescope and seeing science come to life. I grew up in Bridgeport, WV, and even going to a more affluent school than the neighboring counties, the science materials were still lacking and miniscule. Some students may have no idea they love science, because the current school systems have no way to show them. It is so utterly important we keep this telescope funded for the chance that a student will be inspired and change their whole direction in life. We should not deprive these incoming students of facilities that they never had, they may never have anything close. By defunding the telescope, we are eliminating future scientist of America.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
79	a	Anna	Loudin	Student at WVU	The Green Bank Observatory is a very important resource for not only the state of West Virginia but also the nation as a whole. It is a very valuable scientific and educational resource for the state. By cutting the funding for the observatory, there will be damage done to the state. I am a member of West Virginia Science Public Outreach Team (WVSPOT) and our funding is out of Green Bank. WVSPOT is an organization in which we go out and teach STEM lessons to students throughout the state. By doing this, we encourage students to enroll in college and pursue a career in a STEM discipline. Which is very important to the state, since test scores are down. Getting students excited about learning will increase the scores this will also increase the funding to the state public school system. During my trip to Green Bank, I was able to use the 40-foot telescope and it was one of the most amazing experiences. I felt as if it gave me a connection to STEM that I was never able to experience and have it within my own state made the experience even more incredible. I am also enrolled in an Astronomy course at WVU and was able to use and read data taken from the 20-meter telescope from Green Bank. Getting to use this data was a way to link West Virginia to astronomy, which is not something people would initially think. As a future educator, I plan on using Green Bank as a way to get my students excited about careers in STEM. Having such an incredible resource right here in their home state will make the perspective of being a scientist or engineer within their reach. Green Bank is an incredible resource for students of all ages. In conclusion, by cutting funding to The Green Bank Observatory, it will not only be hurting an organization that I am in but will also be taking away a very valuable scientific and educational resource from the state of West Virginia.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
80	a	Julia	Gibson	Student at WVU	My name is Julia Gibson, and I am a student at West Virginia University. I'm currently majoring in psychology with a minor in child development and family studies. Although my major is unrelated to astronomy, I'm taking this class to fulfill a major requirement, and I couldn't have been happier to take this class. Astronomy has always been an interest, and now, with the help of this class and the resources it uses, such as the Green Bank 20-meter telescope, I have come to understand more and more about our universe and our galaxy. With the use of the 20-meter telescope, our class was about to analyze data taken from the telescope to find multiple hydrogen peaks and leave us to determine what kind of Doppler shift they are, which could only leave us to conclude that we live in a spiral galaxy that is more than likely rotating in a clockwise direction. Without the use of the data that we were able to receive from the 20-meter Green Bank telescope, it would have been much more difficult for our class to make those kind of real-world conclusions about our galaxy and harder for us to have a better understanding of how our universe works. Therefore, if the Green Bank 20-meter telescope were to close, future classes would not have the same opportunities that I had to make those kind of life-changing inferences that I did. To keep Green Bank open would be to further future students' education about our galaxy.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
81	a	Patrick	Rao	Student at WVU	Hello this is Patrick Rao, and I am a student at WVU. I'm writing to express my concern about the Green Bank telescope. The Green Bank telescope is a very useful scientific tool that has been used a lot in our class and has definitely made the class more interesting and engaging. My favorite thing we have used the telescope for is collecting the data about the Milky Way. Using the red and blue shifts of objects in the Milky Way we could tell so much. We could first tell the rotation direction of the Milky Way. The redshifts showed the side we are moving away from and the blue shifts showed the side we are moving toward. Using the data, we could also learn the what type of galaxy the Milky Way is, a spiral one. This could be determined because the data had different many different spikes depending on which galactic latitude you are looking at, proving the existence of the spiral arms. Finally, and most surprisingly, we could determine that there is unseen mass on the outer parts of the universe. We proved this because the speeds of objects in the Milky Way do not lessen in speed as they move further from the center as one would expect. The most likely explanation for this unseen matter called dark matter that is on the outer parts of the Milky Way, the gravitational effects of this extra mass would account for the consistent speeds of objects throughout the Milky Way. Overall, I believe that the Green Bank telescopes, we used the 20 meter one, are a very helpful and necessary part of the scientific community of West Virginia, it would be a shame to lose them and all of the contributions they have, and will, make to the exploration and investigation of the cosmos.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
82	a	Rachel	Loh	Student at WVU	Hello, my name is Rachel Loh, and I am a student here at West Virginia University. Since I am majoring in Elementary Education, I was given certain electives that I could take to fulfill my credit needs, and astronomy was one of them. At first, I was not that interested in the class, however, once we got the change to request data from telescopes and look more into the contents of the sky above, I became very intrigued. Throughout my astronomy class, we have been able to do so many things thanks to Green Bank and all of the opportunities available to us. The Green Bank Observatory is a place where I have not visited yet, but in the near future, I plan on taking my friends to go see it. They have not taken the class but are still interested in what the Green Bank has to offer. If the facility were closed, I feel that as students, our chances would decrease of seeing what the world and universe had to offer. For me growing up, I was never interested in science, but after taking Astronomy and being able to see many things from constellations to asteroids, I now take interest. If the Green Bank facility were to close, I think a high amount of student's interest in astronomy would decline because looking up at the stars would not be something they can really observe firsthand unless they take the class. I hope you take into consideration how Green Bank has affected not only my learning, but many other students, and continue to give us the great opportunities that we have been given.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
83	a	Charlotte	Karnes	Student at WVU	I am currently a student at West Virginia University. I am enrolled in an intro to astronomy lecture, as well as an astronomy lab. Throughout this semester I have vastly expanded my knowledge on outer space. It is such an amazing thing to explore and learn about! I have learned about space not only by listening to a lecture, but also through a hands-on approach using Skynet. It was an awesome experience to get to send in my own information and record the data and observe and learn things from my own information. One particular lab I found interesting was the moon phase lab. We had to find the moon on the Skyviewer and then fix it to where it would properly collect the images. Then, we had to set it to the HI filter to block out any man-made frequencies (which I thought was cool, because just by selecting a filter you could block out all those extra radio waves). Then we had to use a daisy scan. I didn't know anything about a daisy scan, or what it was, or what it did, so that was an interesting thing to learn about. Once we received all of our data, we had to conclude whether or not the moon creates its own light, what radio mission is and whether or not the moon is visible to a radio telescope because it creates its own radio waves. There were many more interesting labs, but this one sparked my interest, because we did this lab right after the eclipse, so I was interested in all the aspects of the moon and when we did the lab I learned an abundance of information. In my opinion, I think having the ability to do my own research and send information to the telescope made learning much easier and a lot more fun. I also believe that without the ability to use Skynet, I would not have fully understood how a telescope works, and would not be able to fully understand how to send and receive the information. By shutting down the Green Bank Observatory, it depletes the ability for people to learn and educate themselves. Without the telescopes available, I would not have been able to understand the way telescopes work, the way the information gets processed and received, and many other things! Education is one thing that needs to be protected in today's society and by defunding this telescope, the chance of education will be gone.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
84	a	Megan	Lee	Student at WVU	Hello my name is Megan Lee. I am an undergraduate at WVU, studying to be an elementary teacher. I am also an ambassador of the Science Public Outreach Team (SPOT). I am not an expert in science, physics, or math; but in my Astronomy 106 class with Dr. Kathryn Williamson we were given the opportunity to use the 20-meter telescope present at the Green Bank Observatory (GBO) to analyze neutral hydrogen data. Using that telescope in class made what we were learning feel more real and made me feel like an actual scientist. Also, thanks to the GBO, there are opportunities for me to teach the community about science in SPOT. I went to the GBO when the NSF was listening to the community's comments about the possibility of the GBO being shut down or funding reduced. I listened to the remarks of the horror and sadness that the feels about the prospect of the GBO losing funding or being shut down. Also at the GBO I had the opportunity to go around the facility looking at all the telescopes and to personally see the astonishing size of them, including the 20-meter telescope that my class studied data from. It was truly amazing and breathtaking. When I found out that there are public tours of the observatory, I knew I would be planning a trip with my family to come back. If the NSF were to shut down or take away funding for the GBO, then people like my family would not be able to learn and enjoy the telescopes, and students would lose the opportunity to use data from the 20-meter telescope and would not be inspired by the knowledge that can be gained from radio waves. The GBO has been motivating people in the pursuit of knowledge radio waves and will be able to continue to do so if they remain open with proper funding. I personally have been inspired to learn more about mechanisms behind the telescope, and I plan on teaching my future students about the wonders of the telescopes present at the GBO.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
85	a	Michael	Niggemyer	Student at WVU	I'm currently a student at West Virginia University and I am taking Astronomy 106 and 107. Hearing the news about defunding the Green Bank Observatory has deeply sadden me and many others. While taking this course, my classmates and I have used the 20 meter Green Bank Radio Telescope, allowing us to observe the moon, galaxy, etc., also helping us have a better understanding of the class. When observing the moon with this telescope, we found radio signals. Therefore, we can conclude that the moon does create its own light. Furthermore, we also used data from the moon to learn about the different moon phases. Along with that, we found neutral hydrogen in our galaxy as well. The three conclusions our class drew from just a single week of data from the Green Bank 20 meter telescope is: we are most likely orbiting clockwise, we live in a spiral galaxy, and there must be a vast amount of mass we cannot see (dark matter). The experiences I had with the telescope would be something I would highly recommend to others who are interested in this field. With all that in mind, it would be terrible to not allow others to have the same experiences as I did. Defunding the Green Bank Observatory would not only be bad for science, but our future students as well. I am currently a Political Science major at this university. To be honest, I did not have much interest in astronomy going into this semester. However, after taking Astronomy 106 and 107, and being able to use Green Bank, it enhanced my interest in Astronomy tremendously. I am asking to please reconsider the decision of defunding the Green Bank Observatory. Our world, space, galaxy, etc. is amazing. Furthermore, learning about it can be the most amazing, but difficult thing to learn about as well. Green Bank allows it to be more fun and enhances the interest in this subject. Throughout the course I have learned about how we humans are actually made up of particles that are found in space. This information expanded my curiosity to a higher level, motivating me to learn about what else could be out there to discover. If Green Bank Observatory goes away, it just makes it harder to find new discoveries and limits what we can learn about our galaxy, universe, etc. Using Green Bank has been a true honor this semester, something I have really enjoyed, it would be very upsetting to see it defunded.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
86	a	Maria	Pomales	Student at WVU	I'm Maria Pomales, a West Virginia native and a current student in Professor Williamson's Astronomy 106 course at WVU. As someone who has grown up only a little over an hour from the Green Bank Observatory, I can tell you that it is extremely significant to the identity of the state and the surrounding area because of its importance in the scientific community. Obviously, this is not the only reason why Green Bank is very significant. Students just like myself have benefited from Green Bank's existence. The 20-meter telescope, specifically, has allowed students to make our own radio observations and study them in order to understand astronomy more thoroughly. For example, I personally studied the data of matter within our universe in order to determine which direction our galaxy rotates. Never in a million years did I believe I would be using equipment from the Green Bank Observatory in order to learn, but now that I have I'd especially hate for other students to be kept from having such a fulfilling learning experience. In conclusion, I believe that the Green Bank Observatory is a significant addition to the study of space. It is also a great tool for students of various ages to learn more about the universe around them. Green Bank is a very important place for a large amount of people. It has a deep history, along with a very bright future. It would be an absolute shame if Green Bank Observatory would cease to run.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
87	a	Megan	Gaydos	Student at WVU	I am writing to you today in relation to the Green Bank Observatory 20 meter telescope. Upon hearing that this facility may be closed, I was alarmed. It is a very important tool for astronomy students as well as for professionals in the field. I have personal experience with the telescope which makes its future very important to me. My astronomy class used it to measure radio waves. This helped to deepen my understanding of the fundamental concepts essential to the understanding of the purpose and function of radio waves in the field of astronomy. Radio waves are very important to help us understand the shape of The Milky Way, especially when dust clouds block out visible light. This has given us a warped image which does not capture the true shape of our galaxy. We need the data from radio waves to fill in the gaps in our knowledge.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
88	a	Kiara	Cline	Student at WVU	Hello, my name is Kiara Cline. I am a Photography and Journalism student at West Virginia University. This semester I took a class to satisfy a required science credit that I had always had an enormous interest in: astronomy. I have found the subject of astronomy fascinating since I was a little kid. In the city where I grew up (Charleston, West Virginia) there was an interactive discover museum. A part of this museum was the planetarium. As a child I visited one of the star shows they presented which happened to talk about the constellation Orion. From that moment on I've had a distinct fascination with astronomy. When I first started this astronomy class at WVU I found out about Green Bank for the first time. As someone who has had a deep interest in the topic of our universe I was thrilled. Every time Doctor Williamson spoke about something that was discovered at Green Bank I was thrilled. Hearing so much about it has made me want to visit in the near future; if I had the time available I would have already made the trip. However, after hearing about the possible defunding of Green Bank I fear that I may not get the chance to do this. As someone who has a love and appreciation for astronomy I found great pride in finding out that West Virginia had a part in so many discoveries lately. To defund Green Bank would end that. On behalf of all others who have a love for astronomy, please continue to fund Green Bank. Do it for the dreamers and the believers like that younger me who fell in love with our universe on a school trip to a planetarium.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
89	a	Lexi	Openshaw	Student at WVU	As a sophomore at West Virginia University, and studying early education, it is imperative that many different STEM resources be available to students. One in the heart of West Virginia is the Green Bank Telescope, the world's largest steerable telescope. As a future educator, it is disheartening for me to hear that this great resource tool may be closing due to budgetary constraints. What kind of a message is that sending to our young children who constantly hear about the importance of science, technology, engineering, and math? Especially when one of the most important tools in researching our universe and beyond maybe shutting down for good. In my introduction to astronomy course at West Virginia University, we have utilized the 20-meter Green Bank Radio Telescope. In several of my assignments, we used this telescope to look at the frequencies of neutral hydrogen emission lines. By examining at this information, we are able to conclude that the we are orbiting clockwise in a spiral galaxy, as well as finding evidence of dark matter. Getting the chance to learn such amazing facts about of our universe, thanks to a telescope in the state that I call home, often left my peers and I speechless. I truly hope that every member of the National Science Federation really examines their conscience and makes a well thought out decision before pulling the plug on the Green Bank Telescope.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
90	a	Sarah	Ahmed	Student at WVU	I'm Sarah Ahmed a Computer Science student at West Virginia University, and I'm a curious to know more about our universe. I'm taking Astronomy class, and I heard the unfortunate news that the Green Bank Observatory will not be defunded. Therefore, I would like to talk about the Green Bank Observatory from my own experience in the astronomy class at West Virginia University. It is great to know about our universe and about the galaxy that our planet inside it, but the most incredible thing is to analyze an actual data for our galaxy (the Milky Way) from a reliable and a credible source like the Green Bank Observatory. That gives me the feeling like if I was a real astronomer, which helps me to realize the lesson. This experience tells me that the Green Bank Observatory is not only a place to detect radiation waves or just for astronomers but also it makes me understand the universe. We used data to measure the radio emission for varying objects. For example, we used two scans with different frequencies of the moon. So, with the 20-meters Green Bank telescope, we could determine if the moon emitted a synchrotron or blackbody spectrum. That is such a pleasure to learn something like this. Thus, the credit goes to the Green Bank Observatory. As science lovers, we care about science and everything is letting us know more about the surrounding us. Also, knowing what outside the planet Earth. The Green Bank Observatory is one of the unique places, that helps us to achieve the goal of getting deep into the astronomy world. Many things are showing the importance of the Green Bank Observatory like the location, discoveries and a fundamental astronomy source for students.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students
91	a	Schuyler	Stover	Student at WVU	My name is Schuyler Stover and I am a student at West Virginia University. I am a sophomore majoring in psychology and took astronomy 101 for a lab credit and have been a proud citizen of West Virginia all my life growing up in Ripley, West Virginia. I found myself really enjoying astronomy even though I did not major in astronomy. Astronomy opened up my eyes and made me realize how small I truly was. It also gave me hope for a brighter future for all people getting closer to finally answering the ultimate question of why we are here in the universe and I believe astronomy will help us answer that question. In astronomy 101 we took baby steps and learned how we know what we know. For example, we learned that understanding our galaxy is like trying to map a forest while living in a house in the woods and not being able to leave that house. Only using visible light would have been nearly impossible to map our galaxy. With the help of radio waves we learned that we were spinning clockwise in a spiral galaxy and where we were from the center of our galaxy. Using radio transmissions from Green Bank and learning how to read the frequencies we are able to better understand the universe by giving us more than one look at the universe. In astronomy 101 without Green Bank, we would have had to rely on some textbook telling us the facts of our galaxy, but being able to be apart of the scientific process and proving that we can tell where we are in our galaxy and how things relate to us helps me, as a student, be better prepared for the real world. If Green Bank was defunded future astronomy students would not have had the same incredible benefits I had. WVU partnered with green bank helps thousands of students feel more apart of the classroom and conduct radio based research. It also helps the state of West Virginia give jobs to astronomers and the people that work on the Green Bank telescopes. All in all as a student I strongly support Green Bank and what it does for not only the classroom but for the state of West Virginia.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	GBO Letters from WVU Astronomy Students

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
92	a	Susan	Ellison	Resident of West Virginia and retired teacher	This letter is in support of the Greenbank Telescope and the Greenbank Science Center. My first GB telescope experience came in the early 1990's when a group of Middle School Science teachers from Roane Co. WV. were invited to spend the weekend there for an educational astronomy program training. We were taught how to manipulate their telescopes after being educated about the purpose of the telescopes and how to read the graphs produced by light frequency. We were given a super nice telescope and lesson plans to use in the classroom. What an incredible experience that was! Of course this was before the GBT was constructed. I have talked to numerous educators throughout my 34-year career and they, too, have had this training, or something similar, and they speak highly of their training also. Many educators now have the opportunity to "visit" and understand the GBT, which would be amazing. My son worked at the National Youth Science Camp, held annually in Pocahontas Co. WV, and told me story after story of how they used Greenbank as a source of information and interest for the youth of America who were attending. This Camp has influenced many American youth to pursue a career in a STEM field....my son being one! He has a Chemistry degree from Marshall University and is now teaching high school Physics. Money cannot be the only thing that matters: Science/Technology/Engineering/Math should never be squelched!!!! It is our Past Present and Future. SCIENCE IS EVERYTHING Telescopes there are of National and International importance!!!! Nowhere else could you get the Educational programs held there. Educators and students come away with far more knowledge than when they started. Please keep Greenbank and the GBT funded. My story is one of a trillion that could be told. Don't let that end.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	
93	a	Kathryn	Williamson	Teaching Assistant Professor at WVU	As a Teaching Assistant Professor at West Virginia University and the former Public Education Specialist at NRAO in Green Bank, I am writing to express my strongest support for the Green Bank Observatory to remain open and operational at its current status, or Option A of the proposed alternatives. For the first round of commentary, I emphasized the personal and professional growth I gained by working with the Green Bank Observatory, and those previous comments resonate as strongly now as they did then, but for this second letter I want to focus on two specific items that were either under-emphasized or neglected in the current EIS draft. The Option B alternative to make Green Bank a technology and educational park is simply not feasible. All current educational literature asserts that learners need to be immersed in an authentic "community of practice" for a range of desirable outcomes, including motivation, conceptual learning, and interest development. Tourists are not going to come to the middle of nowhere in West Virginia to tour telescopes that aren't used by professional astronomers. Graduate students who are training to learn the most up-to-date tools of the trade will go elsewhere. They won't choose to come to WVU without access to an instrument like the GBT. Without a sense that "this is where real science is done," K-12 teachers and students will lose interest. Their "wow" and "aha!" moments will feel disconnected from current science. Astronomy, and science in general, will start to feel like a thing of the past, something that had a heyday once, but no more, when nothing could be further from the truth. Going with anything other than Option A will be a huge blow to science education.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment		
93	b	Kathryn	Williamson	Teaching Assistant Professor at WVU	The report acknowledged the importance of GBO for West Virginians, but it neglected the national and international reach of the Observatory. For example, the Physicists Inspiring the Next Generation (PING) diversity camp brings rising 9th graders from all over the country together for an immersive learning experience. Students who are rich and poor, black and white, rural and urban, gifted and struggling, etc., come together as equals in the Quiet Zone as they conduct their own research on the 40-ft. telescope. But even for people for can't come to Green Bank, the 20-meter telescope is accessible online through Skynet. Skynet Junior Scholars has engaged hundreds of educators and middle school students in dozens of states. Also used in college classes, the 20-meter telescope has now been used by thousands of college students at dozens of universities. This online accessibility of the 20-meter telescope was also under-emphasized in the draft report, but it is critically important to understanding the broad community reached by the Green Bank Observatory. Please, do not close another door on science education. Our state, our country, and our world need places like the Green Bank Observatory to learn and grow and thrive.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment		
94	a	Linda	Simmons	Community Liaison for Pocahontas County Chamber of Commerce	This letter is written on behalf of the Pocahontas County Chamber of Commerce in support of the Green Bank Observatory, and we believe the National Science Foundation should continue their investment for the science-focused operations at GBO. The Green Bank Observatory is host to over 50,000 visitors per year providing a unique view of the universe. This results in added local economy for the county. Education and outreach are the center of this strong research-oriented facility. When tourists visit, they spend time at the facility and contribute to the economy of Pocahontas County as well as the State of West Virginia. It is estimated that visitors spend \$150.00 per day for goods and services including transportation, food, recreation, and lodging. This amounts to around \$7.5 million dollars per year spent in West Virginia during visits from tourists. The Green Bank Observatory employs over 100 people year round with an additional 40 seasonal jobs during the summer months. According to the most recent census, around 5% of the total work force in Pocahontas County is employed by the Green Bank Observatory. Employees working at the Green Bank Observatory are actively engaged in their communities and county. They serve as volunteer coaches for sports, and serve as leaders in various youth organizations such as scouts, 4-H and church youth groups. Many are involved with service foundations such as Rotary, Lions Clubs, Women's Clubs, and many sit on local boards such as Senior Citizens, Chamber of Commerce, the Snowshoe Foundation, and the Convention and Visitor's Bureau. Many are involved with local fire departments, a community "Backbone" in times of floods, fires and other natural disasters. Scientists from Green Bank Observatory are involved in activities such as the Eighth Grade educational luncheon held at Snowshoe Mountain Resort each year. In 2016, local scientist and employee of GBO, Hannah Smith (Sizemore), served as the guest speaker during the luncheon. She explained to the students that if you set your goals high, are determined and are willing to work hard, you set your goals high, are determined and are willing to work hard, you can accomplish phenomenal things such as becoming a Scientist for the Green Bank Observatory. Then, you may be able to live and work in a wonderful, familiar environment, a place that has been your home during your entire life. Pocahontas County is sparsely populated with 8,719 persons. The tourism industry in Pocahontas County is one of the country's largest economical industries. The Green Bank Observatory provides research-based information and knowledge to students and visitors as well as scientists around the world. The Pocahontas Chamber of Commerce believes the National Science Foundation should continue to support the incredible work being done at the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
95	a	Kayla	Gibson	Student at WVU	My name is Kayla Gibson and I am an engineering student at West Virginia University. I take the advances of science very seriously and the Green Bank Observatory should be as fully funded as possible for open skies astronomy research. By not fully funding programs like these, the United States will be behind in our children's education and upcoming research. Not only does this effect decades of child and science development. It effects adults as well by stunting the amount of growth in technologies and research available to them. I am from Pocahontas County, West Virginia. My mother works as an accountant at the Green Bank Telescope. My Best friend and I workout at the GBO gym every day unless we are at college. I spent a great deal of time there in my childhood and in present day. I see groups of people coming to the campus of this amazing foundation which holds brilliant scientists ready to teach and beautiful scenery which persuaded them to go into a STEM field. Without being funded fully the GBO will not be as beautiful, the facilities and telescopes will not be as well maintained. There will not be as much tourism or special groups of eager listeners and learners to get interested in science. If the GBO is not funded fully as possible, we will all see the impact this has in years to come. Thank you so much!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/5/2018	
96	a	Jeanne	Sullivan	Professor of Biology and Environmental Science at West Virginia Wesleyan College	I am writing in support of continued, full funding for the Green Bank Observatory. I am not an astronomer, so my support may seem odd. But for over a decade, I was the regional director for the WV Jr. Science and Humanities program, a science/math/technology competition for high school students that is funded by the U.S. military services. I saw many students whose love for doing science was fostered by Green Bank programs. We should not de-fund programs that stimulate student interest and promote science as a career option. Please retain funding for the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	
97	a	Amy	Keesee	Professor of Physics and Astronomy WVU	I am writing to encourage the continued robust funding for the Green Bank Observatory in West Virginia. In addition to the scientific benefits that the unique characteristics of the GBO provide, it is an essential presence for STEM opportunities in a state that has very few such opportunities. West Virginia has the lowest rate in the nation of people with bachelor's degrees. Exposing our youth to the opportunities that STEM provides and the wonders of astronomy is essential to our state's growth and economy. Even if the students don't become radio astronomers, it exposes them to many opportunities beyond the dying industry of coal mining. In the summer of 1999, I did an REU at the National Solar Observatory in Tucson, AZ. During that experience, we visited Kitt Peak Observatory, the NSO in Sunspot, NM, the telescope conducting the Sloan Digital Sky Survey, and the VLA. At the end of the summer and my REU, I traveled to West Virginia to visit my (then) boyfriend. We decided to complete my telescope tour by visiting Green Bank where the GBT was under construction. After driving along the curvy, 2-lane roads for a while, it was an amazing sight to see the support structure rising up over the landscape, a view that I will never forget. Since that time, I moved to West Virginia, married that boyfriend, got my PhD in plasma physics at West Virginia University, and am now a Research Associate Professor at WVU. Several years ago, my husband and our two sons took a vacation to the region of the state that includes Green Bank. We took a bike ride on the Greenbrier River Rail Trail, rode the Cass Scenic Railroad, visited a couple of state parks, and of course visited the GBO, again getting to see the amazing sight of the now-complete GBT as we drove towards it. The kids really enjoyed the outreach activities at the visitor center. I know many West Virginians that have benefited from the opportunities provided by having a state of the art research facility in our state. It would be a tragedy to lose this resource.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	
98	a	William	Howard	Student at WVU in Electrical Engineering	I am a junior in Electrical Engineering at WVU. My focus in undergrad has been on RF communications, and one of the most interesting applications of my field is the work done by the Green Bank Observatory. The GBT is of course the largest radio telescope in the world, and without it being fully funded a lot of science will no longer be available to students. Please consider the impact to the next generation of engineers & scientists as you make this decision.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	
99	a	Shawn	Weaver	Resident of Morgantown, WV	I have brought several students to the Green Bank Observatory, and also attended several classes there myself. The knowledge and sense of wonder they give to all of us there is invaluable.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	
100	a	Amy	Mortensen	Science Department Chair at Liberty High School	The Green Bank Observatory is an invaluable tool for students, teachers, and the public. Decreased funding will have many detrimental effects on STEM education in not only West Virginia, but our nation. We repeatedly hear from employers that they have jobs, but not enough people are qualified to perform them. Many of these positions require STEM related skills. The observatory fosters an interest in STEM fields and gets people interested in pursuing careers that are going unfilled. Investing in educational programs is never wasted money.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	
101	a	Lewis	Cook	Doctor in West Virginia	It is beyond belief that the Greenbank Facility can have anything but support. The list of reasons are obvious and it seems absurd to go through a statement that is as clear to any thinking soul that it should be maintained. Other than the apparent benefit to astronomy research, I will add the following: West Virginia has a very heavy challenge of educating our public (especially children). This facility serves a educational center that we can all be proud off, but also gives us a source of pride. It also provides a positive stimulus to preserve an area in our state, environmentally, that we are losing by the day. One trip to Florida by illustrious president would fund that facility for some time. Are our priorities so blind that we cannot measure the benefit/detriment ratio to come to a reasonable conclusion? If this kind of dilemma continues in our scientific-governmental complex continues, we will certainly all lose in the end.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
102	a	Kellie	Snuffer	Elementary teacher in West Virginia	I am writing as a West Virginia elementary educator who strongly believes that Green Bank Observatory is vital for the training of students and teachers in astronomy, for reaching out to the local community and beyond with educational opportunities, and for economic growth and development in our great state. As both a 4th grade teacher and parent of two children, I have personally benefited from Green Bank's offerings. This fall, my class was able to utilize eclipse glasses provided through the observatory and also benefit from Green Bank's web site during our class discussions and research of eclipses. Additionally, my family and I have grown and learned by visiting the observatory in person as we listened and had questions answered during the tour, explored the exhibits and grounds, and had discussions with Green Bank employees. What a wonderful asset Green Bank is to Pocahontas County, West Virginia, our nation, and those across the world that have gained insights through its programs and services! As I consider the many options that Green Bank offers, I am proud to have this center located in my home state. It offers STEM (science, technology, engineering, and mathematics) activities that can be carried out on site or from a distant classroom, cool clubs to promote the study of astronomy, awesome summer camps that enlighten students, great aids in helping students develop science fair projects (through the Green Bank Science Center), joint projects with WVU students, and undergraduate internship opportunities, among other options. These programs are such valuable assets to so many groups. Because of the above-mentioned benefits offered through Green Bank Observatory, I want to ask the National Science Foundation to seriously consider avoiding plans to reduce funding for Green Bank Observatory. I respectfully ask that the foundation members deeply ponder the impact that a reduction in funds will have on all involved. I want to see Green Bank's funding grow and its programs flourish, in order to positively impact research and learning in the present and future. I would appreciate your considerations very much.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/4/2018	
103	a	James	Bunner	High school teacher in West Virginia	Just about everybody. I reference this facility on an almost daily basis to my 9th grade Earth and Space students. Not only it's scientific importance but also the professional development of West Virginia science teachers. I recently completed the ESS Passport program which the GBT was of major importance. I use the many concepts and ideas that I learned there in my classroom regularly. I have students that have expressed an interest in the various programs at the GBT. It would be a tremendous waste of a facility to limit it's potential.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	
104	a	Joshua	White	High school sophomore in West Virginia	About a year and a half ago, my family and I were walking back to our apartment we were staying in at the Green Bank Observatory. We had just finished filming my sister's entry into a video contest for the Observatory, and we were pretty tuckered out. We arrived at our apartment, and my parents started to make dinner. I was suddenly struck with some ideas for a video of my own- I would use animation to express what the Green Bank Observatory meant to me. Little did I know how much more it would mean to me a year and a half later. Since that day, I have visited the Observatory 11 times, each trip offering a surprise- be it a new piece of knowledge, a new experience, and sometimes a new friend. Though the Observatory is miles and miles separated from the bustle of modern life, it certainly feels as though the place is alive with its own quirky, tranquil energy. While it may be a difficult adjustment for some (regarding the lack of internet service), the Observatory inevitably becomes a very peaceful, quiet habitat for relaxation, inspiration, and learning for most who visit. Each time I visit, I witness some of the amazing experiences offered by the Observatory. My sister is involved in a fair number of these programs, and her enthusiasm, determination and precision has enabled her to soar with these unique opportunities. I, myself, am more of an artist, and not terribly exceptional when it comes to understanding complex concepts of engineering or arithmetic. However, I found it very easy to grasp the concepts of radio astronomy with the "Radio Astronomer for a Day" program, as did the other kids in my group, the Barboursville Leo Club (a youth division of the Lion's Club). While I may not be as knowledgeable as the many brilliant astronomers who work at the Observatory today, I always feel encouraged to ask questions whenever I need to. As my sister's mentor Dr. Richard Prestage once said, "There are no stupid questions...the only stupid question is the one you don't ask when you need to know the answer."	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
104	b	Joshua	White	High school sophomore in West Virginia	<p>However, I understand that the current Agency preferred alternative by the NSF (regarding the Draft Environmental Impact Statement issued November 9th), which calls for reduced funding by the NSF of the Green Bank Observatory, could potentially harm these amazing opportunities I have been able to receive. The alternative explains that the rest of the funding should be acquired by seeking "collaboration with interested parties for science- and education- based operations". However, this sort of partnership would damage the Observatory's complete ownership of the site, parts of it would be owned by the partners mentioned before. If the NSF completely cuts off their funding of the GBO (which is not eliminated as an option by this alternative- reduced funding can be anywhere from 99% to 0%), these partnerships would own the entirety of the Observatory. These partnerships could lead to focuses other than research, leaving behind education programs and opportunities. A generation of potential radio astronomers, engineers, and educators would miss their callings and proceed on, unaware of what could have been sparked in them by this humble, yet incredible little cluster of telescopes and buildings in the middle of nowhere. Another way that the Agency preferred alternative harms the Observatory is that the Open Skies policy may no longer be applied. One of the many standout features this Observatory has for its research is this Open Skies policy, which lets anyone, and by that I mean anyone, use the colossal Green Bank telescope to answer their own questions about the stars, free of charge. This openhearted policy greatly represents the welcoming philosophy of Green Bank itself, and is only able to exist from NSF funding. If the Observatory is funded solely by partners with other focused operations, there is a very high chance that none of these partners will be interested in giving up valuable telescope time to anyone who does not share their interests. This would effectively put an end to the GBO's Open Skies policy, which would be a painful loss indeed. If it weren't for this policy, I would not have been able to meet such fascinating people as Dr. Natalia Lewandowska, a female postdoc at the Observatory who my sister has become good friends with, Nick Pingel, a physics grad who now studies at West Virginia University, Dr. Hannah Sizemore, another female astronomer who accurately predicted how deep beneath the surface ice would be on Mars, and many others. This policy is more than just a welcoming gesture to budding astronomers and educators, it's almost the heart of the GBO itself. I'd like to finish with a brief look at the current status of West Virginia. The opioid crisis is still going strong and the overdose rates here are the highest in the country. This is a bleak time for our state, and it could use any kind of help it can get. One way we can get that help is to inspire future generations to find their passions, boosting confidence and lowering the chances that they will use drugs to get that confidence instead. The Green Bank Observatory is a wonderful example of that sort of inspiration. Nearly every week a new bus-full of young people arrive to take advantage of the amazing educational experiences offered there, and I would guarantee almost every kid that left had something new to think about on their way home from this treasure hidden away in the mountains of our state. In my opinion, the Observatory should be something we take pride in as West Virginians, and that each of us spring to its defense when it is in trouble. I believe that now, it is in danger of losing some of the most powerful tools it has- not only the 17-million-pound telescope or its constituents, but the power the Observatory has of inspiring youth, and welcoming new explorers every day that it can. Please restore full funding and retain ownership of this marvel of science, education, and inspiration so that it may be experienced by generations to come. Thank you.</p>	Considerations for Document Analysis	Socioeconomics	Written Comment	1/3/2018	
105	a	Deana	White	Resident of West Virginia	<p>I am writing in response to the Draft Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on November 9th, 2017. I am writing today to first thank the NSF for their funding thus far and to urge the NSF to choose the "No Action Alternative: Continued NSF investment for science-focused operations" and further that the NSF restore full funding to the Observatory such that they can continue and grow their important mission of NSF-funded "Open Skies" science and education focused operations. Additionally, it is imperative that the NSF continue to have ownership such that the primary focus of the Green Bank Observatory falls under the NSF mission of Open Skies scientific research and education. I have provided full written transcripts of the two abbreviated oral public comments I gave at the November 30th, 2017 public meeting at the Green Bank Observatory and one other written comment. I did have a couple of other issues I wanted to highlight that I know others will cover and may be some overlap to what I wrote before, but I wanted to submit them as well to make sure I provide as much information as possible. They are as follows: The DEIS implies in 1.2 Purpose and Need, page 1-6, that the Green Bank Observatory science capability is lower in priority than other science facilities that NSF funds based on the results of the decadal study in 2010, New Worlds, New Horizons in Astronomy and Astrophysics. This is an incorrect assessment and needs to be addressed. Per the white paper "The National Science Foundations' AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper" prepared by Lockman, Lynch, Frayer, Mason and Ransom, the GBT "has begun significant operations in the 3mm band, giving it unrivaled capabilities for spectroscopy and continuum studies...is now an instrument that is unique worldwide and is a critical complement to ALMA for the U.S. scientific community. These capabilities had not been implemented at the time of the review." New receiver technology has been installed and commissioned on the GBT over the past few years which has made the GBT a premier instrument in high frequency radio astronomy. Additionally, "the GBT is making significant advances in our understanding of gravitational waves, the equation-of-state of nuclear matter, the mass of supermassive black holes, the value of HO, and the physics of star-formation, all key science goals for astronomy identified in a recent National Academy study New Worlds, New Horizons: A Midterm Assessment." These discrepancies in the decadal study versus the facts about the GBT's capabilities need to be addressed and the scientific contribution to the U.S. research fields in astronomy, chemistry, and physics by the Green Bank Observatory should be reassessed. The referenced white paper is attached.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	"The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper" scientific paper

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
105	b	Deana	White	Resident of West Virginia	The Green Bank Observatory contributes to other areas identified as top education goals in New Worlds, New Horizons. Many educational programs at the GBO are aimed at growing diversity in the astronomy community by giving underrepresented minority and female students two-week summer camp experiences introducing them to real, high-level science. In addition to this, the FIRST TWO program encourages STEM involvement among first-generation college students, many from rural areas. The news lately has included multiple disturbing stories of sexual harassment in the workplace and this has sparked honest conversations about the roles and culture of men and women in the workplace. It is imperative that we continue to realize the importance of bringing more women to the table and to empower women to realize their important contribution in all areas – including those in the STEM fields where women are underrepresented. The Green Bank Observatory is way ahead of the curve and has been empowering women to sit at the table and contribute in most important ways for many years. Not only is the Observatory led by an accomplished female scientist, recently there were three female post-doctoral researchers working at the facility, and many of the Observatory programs, such as the Pulsar Search Collaboratory, have significantly higher than average female participation. This holds true also in terms of the number of students hired during summer months to take part in the Observatory’s ongoing student research projects. Another goal of New Worlds, New Horizons is that of education and public outreach. The number of students and educators that the GBO has impacted in a positive way is tremendous. The Observatory offers nationally recognized learning opportunities including the hands-on Radio Astronomer for a Day program, Skynet Junior Scholars, Research Experience for Undergraduates (REU), the program to retain first generation STEM majors called First Two, the Pulsar Search Collaboratory, Research Experience for Teachers, and student mentorships to name just a few. This facility is absolutely top-of-the-line as far as EPO is concerned, and my daughter can attest to that from her own perspective as well as that of several other young students, many of whom are female, whose lives and career paths were changed by mentorship experiences they have had at the Observatory.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/3/2018	"The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper" scientific paper
105	c	Deana	White	Resident of West Virginia	In a state that has been hard hit by the opioid crisis, we are looking for hope and ways to prevent our citizens from being swept up in this terrible epidemic. The Observatory inspires many and gives students, teachers, and adults the opportunity to have a vision of a different future and an experience of personal success that often sparks a long path of learning and aspirations that is a model of a prevention program. Participating in the education and public outreach programs leads many to set on a path to their dreams whether that be one of astronomy, engineering, computer science, electricians, architects, artists, machinists, teachers, etc. The opioid crisis has cost West Virginia over \$1 billion dollars – the Observatory’s annual budget is only approximately \$10 million and has impacted the lives of so many so far and can impact even more if it is continued to be funded and further invested in so that even more lives can be touched and set on the right path due to their EPO programs. The staff at the Observatory are committed to this goal as evidenced by the programs they already provide but also by the opportunities they could provide given the restoration of full funding. With their onsite housing and facilities, the Observatory stands ready to provide educational outreach seminars and training in many areas including expertise in astronomy, engineering, software, data storage, machinists, etc. for students and for adults looking for retraining or enhancements in their current careers. They could increase their impact with funding restoration such that their onsite housing and training facilities could be expanded.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	"The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper" scientific paper
105	d	Deana	White	Resident of West Virginia	The DEIS references a 2006 review funded by the NSF (and undertaken by LMI) and suggests that it states the Observatory is overfunded. The executive staff attended a meeting to review the outcome of this report and the results were actually that the Observatory is underfunded. This discrepancy needs to be addressed in the DEIS. The report referenced has been requested by staff at the GBO such that this can be resolved, but the report has not been provided as of yet. This report needs to be obtained such that the recommendations can be clearly understood. The annual operating budget for the GBO is approximately 10 million dollars and the Observatory generates close to 30 million dollars for the thriving Green Bank Community, Pocahontas County, and the state of West Virginia. The NSF can post that in their earnings report to taxpayers. The Green Bank Observatory is an outstanding performer and inspiring treasure in the NSF portfolio. Again, thank you for allowing us to provide comment, and please let me know if you have any questions or I can provide any more details.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	"The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper" scientific paper
106	a	Karen	Bundy	Retired Science Supervisor at Allegany County Public Schools in Cumberland, MD	I am writing to urge NSF to fully fund the Greenbank Observatory. As former supervisor of Science in Allegany County MD Public Schools, I know the impact of student experiences at the Observatory has had on their knowledge of how scientific research happens, how they can be part of a research team as well as insight into STEM careers that they would never know about without their trip to Greenbank Observatory The impact of outreach to student training and student recruitment to STEM careers carry a high dollar impact in the economic development of West Virginia and rural Maryland communities. I urge NSF to fully fund Greenbank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
107	a	Linda	Stalnaker		<p>To put it simply, as an amateur astronomer, I am concerned and distressed over the future of the Green Bank Observatory. In this day and age of ongoing discussions about STEM education the prospect of defunding, decommissioning and/or dismantling the Green Bank Telescope are wasteful ways of taking this superb instrument out of the science toolbox. With a long list of scientific discoveries and support given to space exploration programs, the largest fully steerable radio telescope in the world has brought shades of science fiction into reality. The GBT is an enduring symbol of what the National Science Foundation does. Quoting from the NSF website: "We are tasked with keeping the United States at the leading edge of discovery in areas from astronomy to geology to zoology. So, in addition to funding research in the traditional academic areas, the agency also supports "high-risk, high pay-off" ideas, novel collaborations and numerous projects that may seem like science fiction today, but which the public will take for granted tomorrow." I have visited the Green Bank Observatory many times. I have toured the Jansky lab, been through the science center displays often, attended the Green Bank Star Quest, and even have been up on the GBT superstructure - a thrilling experience through which I saw the receivers and the nuts and bolts of this tool up close. I have used the 40-foot education radio telescope and accompanied Girl Scouts there where they earned an astronomy badge through the observatory's excellent education department. The times I have been at Green Bank the parking lot has been full of cars, vans, SUVs and motorcycles that have brought travelers, enthusiasts and curiosity seekers to see just what the GBT does. It is a scientific tourist attraction bringing folks to the Greenbrier Valley of West Virginia to experience up close how astronomical discoveries are made without the use of optical telescopes. The Green Bank Observatory has been a shining star in the culture of West Virginia, a state not known for its strong education and cultural achievements. Yet, as I have often said, we do great science in Green Bank, WV. The open scientific atmosphere of Green Bank is where curious minds can come to study and explore and the public is invited to actually touch the tools used. A budget of \$10 million is the proverbial drop in the bucket when compared to the NSF budget and the federal budget as a whole. What I have seen is the money funding Green Bank is not wasted and stretched as far as it will go by the employees and scientists at the facility. Even the receivers for the GBT are machined there to specifications reflected in the astronomical endeavors of students, post-docs, and professionals. The observatory has been a breeding ground for budding scientists including school aged children, and even some amateur astronomers, because of actual hands-on experiences that have cost them little to nothing to participate. Perhaps one the saddest days I had was when I found out the observatory had to start charging for public bus tours and information sessions. The location the Green Bank Observatory is a great spot made quiet by federal law. The National Quiet Zone (that also benefited the now closed Sugar Grove naval base) helps keep the RFI in check while still allowing a modicum of civilization to exist at Green Bank. No cells phones, but life goes on and the folks there seem not to suffer even by their own admission. It is not a desolate spot as compared to where other radio telescope facilities are located. Let us too not forget how Green Bank got the largest fully steerable radio telescope in the world. The tragedy of the catastrophic collapse of the 300-foot telescope in 1988 paved the way for US Senator Robert C. Byrd to push for a replacement to be built. And it was a replacement built with science in mind with its minimally non-obstructed receiving area and massive steering mechanism. And let us not ignore the White Paper authored by Green Bank and National Radio Astronomy Observatory scientists (arXiv:1610.02329v1 [astro-ph.IM]). They have delineated how the GBT of 2012 when the NSF portfolio review was conducted is not applicable to the GBT of 2017, that the radio telescope is indeed already advancing the scientific areas NSF identified five years ago. I urge the National Science Foundation to consider continuing full support - and more - to the Green Bank Observatory, and to even bring it back into the fold of the National Radio Astronomy Observatory. A part of mankind's future depends on what space has to tell us. We must continue to discover and to do that we need tools such as the Green Bank Telescope and Observatory. Thank you for your consideration.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/3/2018	"The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper" scientific paper
108	a	Deana	White		<p>I am writing in response to the Draft Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on November 9th, 2017 . I am writing today to first thank the NSF for their funding thus far and to urge the NSF to choose the "No Action Alternative: Continued NSF investment for science-focused operations" and further that the NSF restore full funding to the Observatory such that they can continue and grow their important mission of NSF-funded "Open Skies" science and education focused operations. Additionally, it is imperative that the NSF continue to have ownership such that the primary focus of the Green Bank Observatory falls under the NSF mission of Open Skies scientific research and education. The Return On Investment (ROI) that the NSF has achieved with just 3% of their Astronomy budget is one that most corporations would love to boast of to their stakeholders. Being a strong advocate and fan of the Observatory, I took advantage of the fact that the letters sent to the NSF and copied to the GBO for the Intent to Prepare an Environmental Impact Statement were published and available to read in the GBO's library. As I'm sure you noted yourselves, letter after letter confirmed the deep impact the Green Bank Observatory has had on so many communities – the local Green Bank one, the state of West Virginia, the country, globally; and the communities of research, education, emergency response, local culture, etc. Letters were sent from over 32 states – from California to Texas to Pennsylvania. Many letters were sent from abroad – from Germany to Australia to Chile. Girl and Boy Scout troops, grade school and high school teachers, University and small college professors, people from NASA and Hubble, businesses and local community groups, elected officials, concerned citizens, etc. sent their words of support and their reasons – many stated with eloquence and great passion. The common thread that becomes evident as you keep reading these letters is the profound impact the Observatory has played in so many people's lives – shaped them – inspired them- challenged them all due to the immeasurable contributions the Observatory and its staff have continually made to the fields of research and education under the Open Skies program, made entirely possible by the NSF's full investment into the Observatory.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	

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108	b	Deana	White		<p>Many letters state how they were first turned on to the world of research and pursued higher education just because of an experience at the Observatory. Many of those inspired are First Generation college attendees – pursuing a STEM field of education. And, many of the inspired have gone on to successful careers – not just in astronomy – but in medical fields, environmental science, the Arts, education, etc. The NSF has more than reaped the rewards from this investment. I sent a public comment in last year and participated in the public hearing along with my family because we have been so deeply impacted by the Observatory and the people who work there. We’ve dedicated much of our time and money advocating for this facility because of our experiences there. I mentioned in my last public comment that the Green Bank Observatory is Magic. Our experiences this past year have been no less so – and I’d like to explain. I want you to hear what the NSF’s funding of the Observatory is securing. My daughter, now a senior in high school, has continued to work with astronomers Dr. Richard Prestage, Dr. Frank Ghigo, and Dr. Jay Lockman, as well as Engineer Steve White, Education Director Sue Ann Heatherly, and many others at the GBO. She’s been working at several things – RFI mitigation last year, GBT pointing accuracy analysis this year, and she has built a small loop antenna that monitors solar flare activity by monitoring submarine signal transmission strength variation. This summer, she was asked to give multiple presentations about the antenna to a broad array of audiences at the Observatory. Her first audience was a combination of First 2 – which is a group of first generation college students studying STEM fields and who are supported by Green Bank Staff and others to help them stay in college and their field due to the unique challenges of being the first in their family to go to college. With them was a group of Research Experience for Teachers (RET) – who are middle and high school teachers there to develop challenging hands-on STEM curriculums to take back to the classroom. These very important two groups are possible because of direct NSF funding and the opportunity to participate in these groups at a high-level active research facility and interacting with the high caliber staff working at the Observatory. The response to my daughter’s presentation was great – but the opportunity for us to see what they were doing was even better. The second group she gave her presentation to was to the Society of Amateur Radio Astronomers (SARA). SARA is a group of varied background professionals who have recognized the significance of the GBO as they hold their annual Eastern conference every summer at the GBO, while their Western conference varies from place to place. Listening to the high-level feedback that came from this group to my daughter’s presentation was eye-opening – I didn’t understand much of the technical talk they were saying – but what I did understand is that these were an assembly of inventors and problem solvers at the GBO to take advantage of the facilities available there and they were excited to see a young person showing interest in their craft. The last group my daughter gave a presentation to was an amazing group of highly enthusiastic and talented rising 9th graders at the Observatory to participate in the Physicists Inspiring the Next Generation (PING) program. The PING camp brings roughly two dozen students from across the country to the Observatory for 2 weeks to participate in all manner of science experiments including learning how to use the 40 foot – the first automated radio telescope. Their response to my daughter’s presentation was inspiring – the promise of each of these students most evident. We also attended some of the organized scientist talks given each evening while we were there by GBO staff members given to all of these groups and were again energized by the synergy of learning and excitement for learning between the high caliber instructor giving the talk and the audience. The events and groups I mentioned above are an example of just 1 week in the life at Green Bank! I didn’t mention that the RET and First 2 groups built horn antennas from scratch, programmed the software, and set up to scan the sky for Neutral Hydrogen right by the historic Reber telescope.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
108	c	Deana	White		<p>Nor did I mention that same week – Grad students from Brigham Young and West Virginia University were testing their phased array receiver which would expand the pixel view of the sky they would scan. Imagine that – the Green Bank Observatory – while working to detect the ground breaking science of gravitational waves, finding significant repeating FRBs, and searching for ET, providing these excellent learning opportunities for students and teachers alike – is the proving grounds for new equipment, software, and instrumentation designed by students in college. Further, imagine what those experiences provide to the solution of some of our engineering, research, technology and policy issues of today? This amazing amount of activity and opportunity is only made possible by the NSF’s investment in the Open Skies science and education program at the Green Bank Observatory and any reduction in funding stunts the growth of our country’s most valuable resources – our future inventors, engineers, artists, and problem solvers. The Return on Investment that the NSF is reaping at the Green Bank Observatory is growing exponentially. The experiences young and young at heart alike at the Observatory are self-motivating and inspiring – not motivated by test scores – and it is directly because of being in an active research facility – surrounded by the cutting edgiest of technology – amazing feats of engineering and machinist talent – and truly high-caliber scientists, engineers, and educators. The investment the NSF is making into not just this forefront of frontier research but the education, incubation, and facilitation of our future problem solvers is as I said in a previous comment – a model for our country to inspire our youth to be our next generation of leaders. We as a nation, are facing many crises, two at the forefront are the opioid addiction and the tsunami of sexual harassment reports that are finally being brought to light. In a state that has been hard hit by the opioid crisis, we are looking for hope and ways to prevent our citizens from being swept up in this terrible epidemic. The Observatory inspires many and gives students, teachers, and adults the opportunity to have a vision of a different future and an experience of personal success that often sparks a long path of learning and aspirations that is a model of a prevention program. Participating in the education and public outreach programs leads many to set on a path to their dreams whether that be one of astronomy, engineering, computer science, electricians, architects, artists, machinists, teachers, etc.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	

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108	d	Deana	White		In a state that has been hard hit by the opioid crisis, we are looking for hope and ways to prevent our citizens from being swept up in this terrible epidemic. The Observatory inspires many and gives students, teachers, and adults the opportunity to have a vision of a different future and an experience of personal success that often sparks a long path of learning and aspirations that is a model of a prevention program. Participating in the education and public outreach programs leads many to set on a path to their dreams whether that be one of astronomy, engineering, computer science, electricians, architects, artists, machinists, teachers, etc. The opioid crisis has cost West Virginia over \$1 billion dollars – the Observatory’s annual budget is only approximately \$10 million and has impacted the lives of so many so far and can impact even more if it is continued to be funded and further invested in so that even more lives can be touched and set on the right path due to their EPO programs. The staff at the Observatory are committed to this goal as evidenced by the programs they already provide but also by the opportunities they could provide given the restoration of full funding. With their onsite housing and facilities, the Observatory stands ready to provide educational outreach seminars and training in many areas including expertise in astronomy, engineering, software, data storage, electricians, machinists, etc. for students and for adults looking for retraining or enhancements in their current careers. They could increase their impact with funding restoration such that their onsite housing and training facilities could be expanded. The news lately has included multiple disturbing stories of sexual harassment in the workplace and this has sparked honest conversations about the roles and culture of men and women in the workplace. It is imperative that we continue to realize the importance of bringing more women to the table and to empower women to realize their important contribution in all areas – including those in the STEM fields where women are underrepresented. The diversity goals that are included in the New World New Horizons vision of the NSF couldn’t be better implemented than at the Observatory. The Green Bank Observatory is way ahead of the curve and has been empowering women to sit at the table and contribute in most important ways for many years. Not only is the Observatory led by an accomplished female scientist, recently there were three female post-doctoral researchers working at the facility, and many of the Observatory programs, such as the Pulsar Search Collaboratory, have significantly higher than average female participation. This holds true also in terms of the number of students hired during summer months to take part in the Observatory’s ongoing student research projects. I know this has been a long letter – but it could be so much longer. Our experience at the Green Bank Observatory are Magic, and from reading so many of the letters that were sent to the NSF last year, so many others agree. My family and I are working hard to help the NSF hear all of these voices and assemble allies to ensure that the NSF retain ownership and restore full funding to the Observatory such that they can continue and grow their important mission of NSF-funded “Open Skies” science and education focused operations. Thank you for your consideration of our comments and please let me know if we can provide any additional information	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
109	a	Steven	White		As a thirty year senior engineer for the GBO, I appreciate the thoroughness and attention to detail of the draft environmental impacts study. The assessment on the impact to the local community economically, socially, educationally, and environmentally is both accurate and fair. I thank you for these efforts. A shortcoming of this process is the exclusion of the impact on the global scientific community. Two students studying at WVU and having which worked on India's Giant Meter Wave Telescope attested to the uniqueness of the GBT and its role in their scientific endeavors at the 2017 public review. Many scientist have come forward at the 2016 and 2017 meetings articulating the impact on reduced open skies time on their research. I am sure many more have written letters to this same effect. Does this not warrant at least some consideration given the US Government's desire to retain global leadership in scientific pursuits? A logistical problem with this process is the continued referral to divestiture recommendation by the Portfolio Review Committee report of 2012 that is in many ways contradictory to the 2006 AST senior review committee report as evidenced in the executive summary sections ES.1 in the statement: As explained in this DEIS and during public meetings, NSF relies on the scientific community, via decadal surveys and senior-level reviews, to provide input on priorities, and this community has repeatedly recommended NSF divestment from GBO, as well as from other observatories currently under similar review, in this constrained budgetary environment. Unfortunately, no other forum exists to dispute the claims sited in ES.1 and ES.2. For example the 2006 Senior Review recognized the cost review for Green Bank citing \$75M for GBT construction cost was incorrect. The actual build cost was in the \$100M-\$110M range and as a result the operating cost are more in align with expectations yet, the smaller number is often cited to support divestiture. The committee also recommended the GBT be part of AST division's base budget, but a reduction in costs of GBT be considered, not a divestiture. Thus, the inclusion of the portion of the statement stating.... this community has repeatedly recommended NSF divestment from GBT... should be removed. The ES.2 Purpose and Need section of the executive summary contains the following closing statement: At the same time, the scientific community evaluations cited previously indicate that GBO's science capability is lower in priority than other science capabilities that NSF funds. The declarative statement is based on the general recommendation of divestiture, yet specific quantitative evidence of the lower priority of the GBT are not cited. Since the PRC 2012 recommendation, the scientific community has continually emphasized the unique and irreplaceable capabilities of the GBT for detecting nanoHertz gravitational waves, characterizing the Sunyaev-Zel'dovich effect, and probing both intergalactic and extragalactic star forming regions at millimeter and sub millimeter wavelengths. Without the GBTs full open skies capability, new and exciting discoveries cannot happen. Thus, the statement without further citations and explanations should be removed from section ES.2. The preferred option needs to be adequately quantified. The often cited 30% to 40% NSF funding will seriously undermine tire capabilities of the GBT. A more reasonable percentage given the ongoing cost cutting measures and inclusion of outside resources is needed. Careful consideration of reduced open skies observing is a fundamental of any forth coming option. Adequate funding will allow complete and efficient usage for the entire design life of the GBT, and allow the educational and public outreach programs to thrive. Just as the cosmic microwave provides a unique and scientifically intriguing window into the universe, so does the Green Bank Telescope. Take heed to the over one hundred testimonials provided by university professors, graduate students, local citizens and future scientists and astronomers. The message is simple. The reduction of the funding to address the lack for highly rated scientific proposals is a misguided solution. The GBT provides a unique opportunity for these same proposals and reduced funding only exacerbates the problem. The inspiration of our future scientists is at stake. Although the DEIS specifically states the intention not to examine the scientific merits of the GBT, the inclusion of the discrepant statements and preferred options clearly does. The DEIS needs to be changed to reflect these facts.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	

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110	a	Ellie	White	High school senior in West Virginia	Again, I would like to register my support for continued, full (100%) NSF funding of the Green Bank Observatory, the NSF's No-Action Alternative. Below I've attached the text of the second oral comment I gave at the NSF Public Hearing on November 30, 2017. Thank you for giving me the opportunity to speak today, and for the support you've provided to the Green Bank Observatory in years past. I would like to voice my strong support for full (100%) NSF funding of this facility in the coming years, so that the GBO can continue to serve its global, national, and local communities as it always has. One of the things that has made an impression on me since I first visited the observatory is the strong sense of community that permeates it. This isn't just a world-class research and education facility, it's also the heart of a vibrant community that defines what's best about West Virginia – our ability to come together for the common good. This place acts as an emergency care center, a gathering place for local events, and an economic revenue generator that puts millions of dollars back into the small economy it is encompassed by. More broadly speaking, it makes a huge impact on the rest of the state and the U.S. as a whole with the far-reaching, unrivaled educational opportunities it offers. Students from across West Virginia who otherwise may not have any other exposure to real STEM research and technical work are given the chance to learn about science and technology through programs such as Radio Astronomer for a Day, the Pulsar Search Collaboratory, Physicists Inspiring the Next Generation, and Skynet Junior Scholars, initiatives that inspire young learners, many in this state, to enter STEM fields. I've been a beneficiary of these inspiring opportunities myself; a chance encounter with astronomer Dr. Richard Prestage at one of the Family Science Day events led to a fantastic mentorship experience that has helped me to find my passions. I've learned to program by developing an RFI visualization tool; I've learned to analyze data and look for trends by working on a project to characterize GBT pointing that may result in a published paper; and I've learned to think like an engineer from building a small loop antenna to detect solar flares. If I wasn't convinced before, there is no question in my mind that I will be pursuing a future career in STEM. In a state like West Virginia, an increasing number of STEM graduates as a result of these programs will have a tremendously positive impact on the state economy, not to mention giving it a morale boost in the face of the current opioid crisis and dying coal industry. However, if the NSF reduces its funding of the observatory, it is possible that the efficacy of these fantastic programs could be diminished greatly. The Open Skies science that full NSF funding ensures is irreplaceable for enabling students of all backgrounds to expand their horizons by pursuing research with the GBT. Students who can't afford to go to an Ivy League school with great research capabilities can have an equal chance to pursue a science or technology career if they have access to an open facility like Green Bank, and that's just one of the many powerful reasons for why full funding by the NSF is absolutely imperative to the future of the observatory and the many people and communities it impacts daily.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public comment)	1/2/2018	
111	a	Ellie	White		I would like to register my support for continued, full (100%) NSF funding of the Green Bank Observatory for years to come. Below I've attached the text of the first oral comment I gave at the NSF Public Hearing on November 30, 2017. Oral Comment Thank you for giving me the opportunity to speak today, and for listening to the comments, both written and oral, given by so many people who have been positively impacted by the Observatory. I would like to speak about why I think the NSF should restore full (100%) funding to this facility. I appreciate the fact that the NSF has decided to continue to provide partial funding, but I would like to bring up some concerns I have about this option. First of all, reduced funding by the NSF means that the observatory will have to seek outside partnerships, as mentioned in the DEIS. If the GBO becomes beholden to institutions that do not uphold the wonderful Open Skies program that the NSF makes possible, the telescope time available to students and researchers who are not able to procure funds to become partners would be diminished tremendously, or perhaps even disappear. This outcome would ultimately reduce the diversity of the research currently going on at the observatory and would serve to cut off opportunities for researchers who may make the next great discoveries in astrophysics, but couldn't do it because their institution couldn't get time on the GBT. With the Open Skies program in place for the GBO, researchers in nearly every possible subfield of astronomy are making fantastic findings that bring us closer to a full understanding of our place in the Universe. Many of the research topics being investigated with the GBT are in line with the NSF's own astronomical priorities, as identified in the New Worlds, New Horizons decadal study. The GBT is used for / has been used for studies on the following astrophysical topics covered by NSF panels in NWNH: Planetary Systems and Star Formation: The GBT has performed several observations concerning astrochemistry and star-forming regions, and receivers continue to be developed and improved for high-frequency observations of such topics. The Galactic Neighborhood and Galaxies Across Cosmic Time: the GBT is used frequently for neutral hydrogen (and other frequency) studies of the Milky Way and surrounding galaxies, and their continuing evolution and interaction. Many important discoveries have been made in these areas using the GBT, such as the HI filament connecting M31 and M33, which has interesting implications for the study of dark matter and its impact on galaxy formation. Cosmology and Fundamental Physics: Many dark matter and dark energy experiments have been undertaken with the GBT. One particularly notable cosmology project is the Megamaser Cosmology Project, in which the GBT discovered many water masers in distant galaxies that can serve as a geometrical method of determining H0, the rate at which the Universe is expanding. In addition, the GBO as a whole contributes to other areas identified in NWNH, especially education: Demographics: Many educational programs at the GBO are aimed at growing diversity in the astronomy community by giving underrepresented minority and female students two-week summer camp experiences introducing them to real, high-level science. In addition to this, the FIRST TWO program encourages STEM involvement among first-generation college students. Education and Public Outreach: the number of students that the GBO has impacted in a positive way is absolutely tremendous. From the hands-on Radio Astronomer for a Day program to Skynet Junior Scholars to the annual REU program to individual student mentorships, this facility is absolutely top-of-the-line as far as EPO is concerned, and I can attest to that from my own perspective as well as that of several other young students, many of whom were female, whose lives and career paths were changed by mentorship experiences we had here at the observatory. For these reasons among so many others, I feel that the NSF would reap large benefits and make great strides toward achieving their goals for science and education by continuing to provide 100% funding to the GBO. The continuation of Open Skies policy is crucial to keeping up the pace of groundbreaking science and student opportunities that move us toward great discovery and a more inclusive and diverse future for STEM fields everywhere.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public comment)	1/2/2018	

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112	a	Ellie	White		I would like to voice my strong support for continued, full (100%) NSF funding and ownership of the Green Bank Observatory. Below I've listed how the Preferred Agency Alternative of Partnerships with Interested Parties with Reduced NSF-Funded Scope would affect the GBO's impact on various aspects of the local, national, and global scientific community. Local Economy. At its current operating status with NSF funding, the GBO contributes nearly \$30 million a year to the local economy, compared with its \$8-10 million operating cost, which seems to me to be an excellent return on investment. The GBO attracts over 50,000 tourists a year to the area and numerous visiting researchers, students, and educators from around the world, which is a boon for local businesses and nearby tourism locations. Over 100 people are employed at the facility year-round, a number that increases to over 140 during the summer months; the good jobs provided by the GBO allow its employees to make valuable contributions to the local economy. If the GBO loses NSF funding and joins with a non-scientific partner (i.e. the Dept. of Defense) that tourism draw may dry up, and employment availabilities could shrink, leaving a gaping hole in the struggling West Virginia economy. Culture. The cultural experience of visiting the GBO is unlike any I've ever witnessed or heard about in the state of West Virginia or anywhere else in the country. The juxtaposition of the high-technology facility and the surrounding technology-abstinent community makes for an unusually engaged and inquisitive atmosphere – instead of checking their phones, the people in Green Bank and the surrounding area interact personally with one another. Observatory employees and other local community members are there for each other, no matter if they're from Pocahontas County, Germany, Charleston, or the U.K. – people of all different backgrounds, countries of origin, and occupations mingle peacefully in this unusually inclusive and tight-knit community. If I were to sum up the Green Bank atmosphere and culture in one sentence, I would say it reminds me of a cross between a metropolitan city and the old Western Frontier – people who live in Green Bank are exploring new horizons and are ready for adventure, just like the pioneers of the past. If the GBO lost NSF funding or became partners with a military or non-civilian agency, the globally diverse culture of scientific inquiry and close community would be harmed tremendously by the reduction or elimination of scientific research and job availability for those not born in the U.S. Health, Safety, and Community.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
112	b	Ellie	White		The GBO, its employees, and their spouses all contribute significantly to the health, safety, and success of the surrounding community. The facility itself can serve as an emergency shelter should the need arise, providing citizens a place to stay, eat, wash, and receive first aid and a means of life support for people on oxygen. GBO employees and their family members help ensure the safety and health of their fellow community members by serving in positions such as Deputy Fire Chief, EMTs, firefighters, ambulance drivers, County Search and Rescue, Local Emergency Planning Board members, Amateur Radio Emergency Services, as well as High School athletics coaches, timekeepers, and scorekeepers.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
112	c	Ellie	White		In addition to safety and health considerations, GBO staff and their families also provide valuable services to the local schools and the community as a whole, serving in the following capacities: School Board members, tutors, Read Aloud volunteers, Literacy Fair judges, Social Studies Fair judges, Science Fair help and mentoring, Math Field Day, scout leaders, local theater and arts support, among several other community positions. The Observatory itself provides funds for students by contributing to the Business Partner Scholarships and the Pocahontas County High School Science Scholarship, and hosts the annual PCHS Science Fair, Hour of Code, and county Math Field Day. Education.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
112	d	Ellie	White		The educational opportunities provided by the GBO and its staff are absolutely unrivalled in West Virginia and really the rest of the country. The Observatory runs educational programs all year long, hosting student groups for the hands-on Radio Astronomer for a Day program in which students are taught to use the educational 40-Foot radio telescope onsite and analyze their data afterward. The GBO also runs an annual PING (Physicists Inspiring the Next Generation) camp for underrepresented minority and female middle-school students from across the country, giving them the opportunity to learn about science in a very hands-on, immersive two-week camp. Radio astronomy participation in the Skynet Junior Scholars program, as well as the Pulsar Search Collaboratory (run in partnership with WVU faculty) are both made possible by the availability of the Green Bank 20-Meter telescope and the GBT, and both programs have been extremely effective in educating middle and high school students about the world of astronomy and STEM made possible by NSF funding. The GBO hosts several undergraduates in their annual Research Experience for Undergraduates (REU) program, allowing students to work on projects in the fields of astronomy, engineering, and computer science under the mentorship of GBO staff members. These projects often result in published papers, which is a huge benefit to students when seeking employment or acceptance to grad school. Another, more recent, program for undergraduates called First Two was kicked off last summer by the education director Sue Ann Heatherly; this program provides support to first-generation undergraduates in STEM majors from West Virginia and various other locales, and is just another example of how the Observatory seeks to foster broader and more diverse participation in the science and technology work force. The GBO provides opportunities for educators of all grade levels, from K-12 to graduate-level professors, teaching them projects and concepts to take back to their classrooms. Teacher programs include: Research Experience for Teachers (RET), the Residential Teacher Institute program, the Earth/Space Science (ESS) Passport program, and hosting of the Chataqua Short Course programs. If there is any reduction in NSF support and therefore loss of Open Skies science and/or staffing levels, the educational opportunities offered by the GBO will suffer tremendously and may decrease the number and diversity of students that they are able to reach and inspire to follow their passions in STEM and many related fields. Less Open Skies time on the GBT means less time available to students who may be motivated to pursue a career in STEM after observing a pulsar or a cloud of neutral hydrogen with the GBT, an educational experience you couldn't come by anywhere else.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
112	e	Ellie	White		<p>Research and Technology. As the largest fully-steerable radio telescope in the world, the GBT is a vital instrument for modern astrophysics research. The GBT has conducted, and continues to carry out, studies on gravitational waves, pre-biotic molecules in space, planet formation, cometary composition, star formation, mapping of moons, asteroids, and planets (in conjunction with Arecibo), dark matter, dark energy, and the expansion rate (H0) of the Universe, among so many other fascinating cutting-edge subjects. According to Lockman et al in their 2016 White Paper, the GBT is making significant “advances in our understanding of gravitational waves, the equation-of-state of nuclear matter, the mass of super-massive black holes, the value of H0, and the physics of star formation, all key science goals for astronomy identified in New Worlds, New Horizons: A Midterm Assessment.”¹ The GBT has recently become a powerful instrument for high-frequency observing with the commissioning of the MUSTANG-2 and Argus receivers, which allow the GBT to observe between 75-105 GHz and 75-116 GHz, respectively (Lockman et al, 2016). The implementation of these instruments has led to an expansion of the GBT’s already impressive science capabilities, allowing the GBT to perform new and exciting research on star-forming regions, molecular clouds, and astrochemistry which may have an impact on our understanding of astrobiology. The GBT’s capabilities in this frequency range makes it an invaluable counterpart to ALMA; since the GBT runs 6500 hours a year (more than any other telescope) and can be dynamically scheduled so that it makes its high-frequency observations in the best conditions possible, this makes the GBT an ideal instrument to make initial studies on high-freq. targets to obtain initial results and therefore act as a “pathfinder” for ALMA and, in the future, James Webb Space Telescope observations (Lockman et al, 2016). The reduction or elimination of Open Skies time on the GBT as a result of non-science partnerships or reduced NSF funding would have an extremely negative ripple effect for both the NSF as well as for observers across the world. If the time available on the GBT for observations which could serve as “pathfinders” for the NSF’s latest (extremely expensive) projects – such as ALMA and JWST – is decreased, the efficiency of ALMA and JWST observations will likewise decrease. In addition, reducing the GBT time available to any scientist or student with a great proposal (as a result of decreased Open Skies time) would amount to reducing the diversity of the NSF’s research profile. The GBT is still a frontline instrument with capabilities increasing as we speak; to me it would seem very unwise to slice the efficiency of such a productive, high-tech instrument as the GBT which is still working toward reaching its prime.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
112	f	Ellie	White		<p>Some Closing Thoughts. The Green Bank Observatory is a wonderful facility for so many obvious reasons, and I’d like to share what a tremendous impact it has had on me, personally, as it is one of the main reasons I’ve decided to pursue a career in STEM. Ever since I was an eight-year-old girl I’ve loved the GBO, and my love and admiration for the facility has only grown as I’ve gotten to learn more about the ins and outs of it. When I was fifteen I was lucky enough to participate in a Radio Astronomer for a Day program; operating the chart recorder and telescope, seeing the redshift of the HI line, and analyzing my data the next day convinced me that science was not only something that I could do, but that it was something I would love to do as my future career. A chance encounter with observatory scientist Dr. Richard Prestage at an Open House event at the GBO later that year led to an exciting research project the summer after my sophomore year, in which I helped design a Python RFI visualization tool and conducted simulations of white noise to determine the statistical characteristics of RFI. In the fall of my junior year, Dr. Prestage and Observatory engineer Steve White helped me build a small loop antenna for solar flare detection. This year, as a senior in high school, I’m working alongside Dr. Prestage, Observatory scientist Dr. Frank Ghigo, and TPOINT software creator Patrick Wallace on a project to characterize the X-Band pointing performance of the GBT to determine if and how it can be improved. Additionally, I’ve had the opportunity to work with Dr. Ghigo and Dr. Jay Lockman to create a proposal to study neutral hydrogen in the M31 halo using the Green Bank 20-Meter Telescope. Perhaps most excitingly of all, I’ve also had the wonderful opportunity to work with several GBT staff members and WVU professors and grad students on a new project called Open Source Radio Telescopes, a program (founded by Richard Prestage) which aims to provide students and their teachers with amateur radio telescope designs and curricula in order to provide a hands-on experience with real science and electronics projects to foster interest and participation in STEM fields. From these experiences at the Observatory, I’ve discovered a passion for engineering and instrumentation that I never thought I would develop, so much so that I now plan to double-major in physics and electrical engineering. I’ve gained skills and knowledge that I never would have acquired otherwise – from Python programming to public speaking to data analysis to collaboration to learning to think methodically and skeptically like a scientist, I can’t say how much I’ve grown from working with the fantastic scientists, engineers, educators, and staff members of the Observatory. Because of them, I now have the confidence and foundations of knowledge I’ll need to succeed in the science world. My experience at the GBO is not an unusual one – students from all over have reported similar stories of how the Observatory’s educational opportunities and welcoming staff have changed their lives and careers for the better. This facility has touched so many lives already that it would be a huge shame if its impact were to suddenly cease in whole or part due to funding difficulties. While the NSF’s Preferred Alternative outwardly does not seem like a negative outcome, the devil is in the details – in reality, it could have a very harmful and lasting impact on the GBO and its surrounding community. If partnerships do not come forth and the NSF does not make up the difference, the facility may well face a disastrous funding crisis. If partnerships do come forth but threaten to cut Open Skies time and/or staffing levels, again the scientific community, the local community, the state of West Virginia, and the U.S. standing in scientific research will be drastically harmed. I hope the NSF will continue to fully fund this outstanding facility, now and for years to come to ensure that future generations of scientists, students, and West Virginians can continue to reap the many benefits provided by this fantastic facility, the cutting-edge wonders of engineering and science it makes possible, and the compassionate surrounding community it continues to support and nurture.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
113	a	Anne	Barth	Executive Director of TechConnect West Virginia	On behalf of TechConnect West Virginia, I write in support of the National Science Foundation's "Preferred Option A" regarding the future of the Green Bank Observatory in Pocahontas County, West Virginia, as contained in the Draft Environmental Statement. Thank you for sharing this letter with Dr. France Cordova and the leadership team at the National Science Foundation. TechConnect West Virginia is a coalition of professionals dedicated to growing and diversifying West Virginia's economy by advancing innovation-based economic development and entrepreneurship. With members representing education and research, private industry, and the public sector, the organization serves as a forum and facilitator to enhance awareness, spur collaboration, and raise the discussion of issues needed to strengthen the state's innovation ecosystem. We believe it is imperative to maintain and utilize the investment by the Federal Government in the facilities at the Green Bank Observatory for both scientific and economic reasons. We urge NSF to continue funding the Green Bank Observatory, at reduced levels if need be, for the following reasons. First and foremost, the facility has the capability to continue making important contributions to research conducted as part of the North American Nanohertz Observatory for Gravitational Waves, or NANOGrav Collaboration, working to detect gravitational waves and explore pulsar timing in an effort to ultimately open a new window on the universe. West Virginia University is one of the lead academic partners in this important NSF initiative. Second, the quiet zone in which it resides is one of only two such places in the United States that allow for this type of gravitational wave research. Scientific experts working on the NANOGrav project have concluded that the Green Bank Telescope simply cannot be replaced by other telescopes in conducting this research because of accessibility, sensitivity and flexibility, and its location in a radio free quiet zone. Third, the Green Bank Observatory serves as a center of STEM education for students in West Virginia and beyond, who are able to engage with the facility whether in person onsite, or by logging on to their computers. As an inspiration to generations of students, the Green Bank Observatory has also contributed to the nation's need for highly-skilled scientists and engineers. As America competes across the globe to develop the next generation of leading U.S. scientists, the Green Bank Observatory must be positioned to continue to play a crucial role in this talent pipeline. Lastly, the Green Bank Observatory is a truly accessible facility that enhances the tourism infrastructure of this region of Appalachia, bringing a glimpse of the universe to average Americans from all walks of life. Programs and activities boost the local economy with an annual economic impact of \$30 million. In conclusion, the Green Bank Observatory is a rare and productive treasure and we urge the NSF to continue making investments in this unique facility.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
114	a	Robert	McClain	Science teacher at Independence High School	I am writing this email to ask your help in funding the observatory to continue to allow them to be able to reach out to my students. Several of my students went on to promising careers in science due to our work with Green Bank. Their continued funding will allow them to inspire the next generation of future scientists. Not only students, but teachers as well. My time working with Green Bank reignited a passion in me for motivating students to explore and look beyond themselves. Thank you for taking time to consider this request.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	
115	a	Nima	ShahabShahmir	Student at West Virginia University Institute of Technology	My name is Nima ShahabShahmir, currently a computer science student at West Virginia University Institute of Technology. Unfortunately I could not participate during the Draft Environmental Impact Statement and National Science Foundation's public meeting on November 30th, 2017 for the evaluation of Green Bank Observatory's future activities. However, it was brought up to my attention that public comments are still open and I wanted to share my own experiences at this facility. During the summer of 2017 I was a mentor for First 2 Network internship and stayed at Green Bank Observatory for two weeks. Funded by the National Science Foundation, First 2 Network aims to teach the exceptional value of studying a STEM based major to first or second year college students. It is crucial that the future of science and technology is studied through STEM educational fields, students who pursue these majors will indeed have the right skills to develop solutions in new and creative ways. My experience at Green Bank Observatory was just fantastic and I am sure that the rest of the students had the same thought in mind. It was truly exciting and almost unbelievable to see all the radio telescopes in real life, learn the technology behind them, and also learn about the scientific results which were gathered by using them. Probably one the most amazing experiences was actually using the 40 foot telescope to gather information from the hydrogen content in the milky way galaxy and comparing our data with what experts have gathered throughout the years. In conclusion, the valuable knowledge that I have leaned within those short two weeks both about radio telescope and planetary science have completely changed my vision in life and fully encouraged me to continue studying in a STEM field of education. When I have heard the news that based on the near future decisions the observatory might be closed or discontinue the science and research activity, I have felt the need to share my personal thoughts and hope that others will do the same. The observatory is truly an inspirational facility and I support all of its future scientific research and educational activities.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/23/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
116	a	Roger	Trusler		This letter is written to strongly encourage the continued operation of Green Bank Observatory [GBO] with continued support from NSF for science focused operations, including further support through collaboration with interested parties for science and education-focused operations. Although reduced NSF funding is under consideration, I encourage minimal reduction as only absolutely necessary. This is the best method for supporting scientific projects and educational opportunities the, thus enhancing the GBO and the Pocahontas County community. As a citizen of Pocahontas County since 1973, I have personally experienced and observed the valuable contributions that the GBO has contributed to the County's school system, business community and social fabric. Over the years, the GBO has been a valued supporter of Pocahontas County educational initiatives involving math, science and technology. GBO employees and visiting scientists have been actively providing: 1]. opportunities for science camp hands-on experiences, School-to-Work mentorships for high school students, teacher work-study programs; 2]. technology support for computer installation, networking, programming; and 3]. consultations for system-wide troubleshooting regarding technical issues. County-wide, the GBO continues to contribute significantly to the Pocahontas County business community. Millions of dollars of employees' payroll flow through the local banks and business communities. This influx of dollars plays a critical role in sustaining and creating business and job development. Payroll and sales tax revenue from the circulation of these dollars contribute millions of dollars to support governmental entities locally and within West Virginia. Additionally, thousands of tourists visit GBO each year, spending approximately 7.5 million dollars in the local and State economies. The employees and visiting scientist contribute greatly to the social fabric of Pocahontas County. These individuals become involved in community service activities/projects that have positive impact upon adult and youth activities....serving with fire and rescue; coaching little league, soccer, midget football and/or varsity sport; participating in civic, religious, senior citizen and/or school organizations/functions; and devoting volunteers on local boards and/or committees involving education, recreation, health-safety, scouting, 4-H, etc. . In summary, Pocahontas County is the most sparsely populated county East of the Mississippi River, with an area of approximately 1,000 sq. mi. GBO is a critical component of the educational, economic and social fabric of this rural County and the State of West Virginia. A viable means must be determined for the continued science and education-focused operations of the GBO	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/21/2018	
117	a	Denise	Gipson		I have been privileged to work with students at Green Bank as a WV teacher last summer. Green Bank is one of WV's unique resources, something to inspire our students and give them pride. Radio astronomy is the wave of the future, as new discoveries are being made about our universe and our galaxy. Also, radio telescopes can be accessed remotely and used during the daytime, which is key for secondary science teachers. In addition, Green Bank is ideally situated for radio astronomy, both in terms of telescopes and in its location. Finally, I have seen students use this resource and get excited by STEM careers and research. But this can't happen without "open skies" - access to the telescope and curricular programs require a lot of personnel to develop and maintain these vital resources.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/21/2018	
118	a	Jay	Cole	Senior Advisor to the President WVU	I am e-mailing to suggest that the National Science Foundation work with the National Park Service to make the Green Bank Observatory (as well as the Arecibo Observatory and the Jansky Very Large Array) a national historic park. This would help to preserve these historically significant facilities, promote their educational mission, and permit cutting-edge research to continue. After about a decade of study and planning, a November 2015 Memorandum of Understanding between the secretaries of Interior and Energy established Manhattan Project National Historical Park. Operated jointly by the U.S. Department of Energy and the National Park Service, this park consists of three sites: Hanford, Washington; Los Alamos, New Mexico; and Oak Ridge, Tennessee. Each of these sites played an integral role in the development of the atomic bomb and the impact of atomic energy on America since the 1940s. This park represents a new model and is different from many other national historical/historic parks in at least two ways: (1) the park's focus on science and technology; and (2) the coordination among three very disparately located sites. I outline briefly this background on Manhattan Project National Historical Park because I believe it can serve as a useful template for the establishment of a similar park focused on radio astronomy. A Radio Astronomy National Historic Park would also focus on science and technology and could also include three sites: Arecibo, Puerto Rico; Green Bank, West Virginia; and the Plains of San Agustin, New Mexico. Each of these sites has played, and continues to play, a vital role in exploring the cosmos and improving the science and technology behind radio astronomy. If the National Park Service were willing to consider another multi-site, science-and-technology-oriented park, I believe one dedicated to radio astronomy would be a great fit and promote public awareness of a very important scientific endeavor with the potential to transform our future...Inspired, then, by Manhattan Project National Historical Park, I believe it is reasonable to think about Arecibo, Green Bank, and the Plains of San Agustin as three sites making up an "Exploring the Cosmos" National Historic Park. There have already been steps taken down this path: the Arecibo Observatory is on the National Register of Historic Places, and the Grote Reber Radio Telescope at Green Bank is designated as a National Historic Landmark. This idea would call for the NPS to continue the experiment begun with Manhattan Project National Historical Park and embrace new elements in its mission at a time of worsening budget constraints. It would also require NPS and NSF to work together, much as the Departments of Energy and Interior did to create the Manhattan Project NHP.	Alternatives Considered	Alternatives	Written Comment	12/21/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
118	b	Jay	Cole	Senior Advisor to the President WVU	Our fascination with the cosmos is as old as humanity itself. Unaided gazing into the night sky, looking for patterns or portents, dates back thousands of years. Understanding took a tremendous leap forward with the use of optical telescopes, instruments that magnified images from the visible portion of the electromagnetic spectrum, in the 17th century. On this timeline, radio astronomy is a relatively young science. Focusing on the nonvisible, radio frequency portion of the electromagnetic spectrum, scientists attempted to detect radio waves from space as early as the 1890s. The first successful detection, however, did not come until 1932, when Karl Jansky at Bell Labs detected radiation from the center of the Milky Way galaxy. Over the last 85 years, from studying the origins of the universe to verifying Einstein's theory of relativity, radio astronomy has emerged as an exciting subfield within astronomy and astrophysics. Enabling its emergence has been the construction of enormous radio astronomy instruments and facilities. For a half-century, the Arecibo Observatory's radio telescope in Puerto Rico was the world's largest single-aperture telescope at 1,000 feet (305 meters) in diameter. The Robert C. Byrd Radio Telescope at the Green Bank Observatory in West Virginia stands 485 feet (148 meters) tall, has a diameter of 328 feet (100 meters), and weighs 16 million pounds. It is the world's largest fully steerable dish telescope. The Very Large Array, located on the Plains of San Agustin not far from Socorro, New Mexico, consists of 27 different telescopes that, at their widest separation, span a distance of 22 miles (36 kilometers). Not only are these engineering marvels, they are also scientific instruments of tremendous power and sensitivity that make the study of the cosmos possible. These three facilities — Arecibo, Green Bank, and the Plains of San Agustin — are to radio astronomy what Hanford, Los Alamos, and Oak Ridge were to atomic energy. And while radio astronomy has not had as much impact on American society and culture as atomic energy, that would change in a nanosecond if one of these sites were to receive a signal indicating extraterrestrial intelligence. Indeed, Green Bank is where the systematic search for extraterrestrial intelligence began in 1960. If received, such a signal would transform the human condition forever. Even discounting the probability of detecting extraterrestrial life, radio astronomy is responsible for discoveries that shape our understanding of everything from space travel to the nature of time. They provide, in situ, exposure to the rigorous process of conducting research, the magnificent instruments that make such research possible, and the careful application of that research to solve fundamental questions about the universe. The educational and outreach opportunities for visitors of all ages are limitless.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/21/2018	
119	a	Fred	King	Vice President for Research, Chemistry Professor at WVU	I write regarding the Draft Environmental Impact Statement for the Green Bank Observatory that was released for comment on December 9, 2017. I offer the following comments from my perspective as the Vice President for Research at West Virginia University and a member of West Virginia's Science and Technology Council. Although I believe that the Green Bank Observatory's importance to the national infrastructure for scientific research has been underestimated in the review that led to the call for divestiture and should be reexamined in light of recent discoveries regarding gravitational waves, I will focus here on my continuing concerns for the social and economic impact that divestiture will bring. I appreciate that the preferred option theoretically would afford continued operation with minimal impact; however, I have yet to see a plan for how that option would be operationalized or a realistic assessment of who the partners might be who could come up with sufficient funds to replace the NSF funds that will no longer be allocated for the Green Bank Observatory. From the economic perspective, it is important to note first that the Green Bank Observatory is the 5th largest employer in the county. Of the funding allocated for the Observatory, just over \$9M covers salary for approximately 110 full time employees. Significantly those are also some of the best jobs in Pocahontas County, accounting for the majority of high wage jobs among various employers. The impact of those jobs on the local economy in terms of the other jobs they in turn support is significant. This is in a state with an already high jobless and poverty rate. I cannot help but note that the funds that NSF is redirecting from the Observatory will go to support jobs in Chile, not the United States, at a time when we need those jobs for our citizens! I raise the jobs point because I also believe that the National Science Foundation is defaulting on an implicit social contract that began with the founding of the Observatory and the National Radio Quiet Zone in 1958. Since that time, the citizens in the Zone have foregone many modern conveniences and the development of advanced wireless telecommunication systems in order to maintain the National Radio Quiet Zone. This is significant because this sacrifice puts the community at a disadvantage in competing for many businesses and jobs that might otherwise be enabled by such systems. This is a 60 year sacrifice for which there must be some consideration. It is not even clear that with the proposed divestment, this will change. The community may still face restrictions on the development of these systems, thereby limiting the ability to attract new industry or create jobs for its citizens who will lose their income with the changes at the Observatory. It is also important to note the impact on employees who have built lives and careers in the Green Bank and Arbovale communities. As the Observatory reduces its staff, there is not likely to be an employer who can replace the level of jobs that currently exist. This means that those who have bought houses in the community and need to relocate will find a market in which their ability to sell their house will be significantly constrained both in terms of price and time on market. This is an inappropriate way to treat employees who have dedicated their careers to serving the needs of the National Science Foundation. Now in terms of broader impacts on society, when it comes to the local community the employees of the Observatory also make up a substantial portion of the fabric of that community. In particular, the volunteer efforts of the Observatory staff in serving their community have a significant impact that will be extremely difficult to replace. Because of the nature of their work and their commitment to the community, members of the staff can provide services ranging from mentoring k-12 students in science, technology, engineering, and mathematics to serving as volunteers in the local emergency services such as fire and rescue. This is significant in a very remote small community such as where the Observatory is located. If the Observatory staff is reduced, there will be a disproportionate reduction in the community services that they provide. The Observatory also contributes directly to the wellness of members of the community through access to its recreation facilities. The Observatory has also made available meeting space for community events that will no longer be accessible if there is any significant decline in its operations. In short, a reduction in support for the Observatory will have a very clear negative impact on the local community – a community that has worked synergistically for 60 years with the National Science Foundation to help it achieve its mission and serve the nation.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/21/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

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119	b	Fred	King	Vice President for Research, Chemistry Professor at WVU	Last but certainly not least, there is the impact on STEM education regionally and nationally, which cannot be duplicated at ALMA. Each year over 50,000 people visit the Observatory, mostly these are children and their families who come to see a world class research facility focused on astronomy. Although this has a significant impact on the local economy in terms of tourism, it is really the ability of the educational resources that have grown up around the observatory to serve as an exemplar of science and an inspiration to budding scientists and engineers that needs to be considered. Observatory outreach activities such as the Pulsar Search Collaboratory are changing the lives of k-12 students, engaging them in the wonders of scientific discovery and demonstrating to them that they have the ability to play a significant role in such discovery. Significantly, the location of the Observatory makes it also available for a hands on experience for students from a large region of underserved communities that have little resources for STEM education. Any loss of funding that supports this activity will have a drastic impact on our ability to inspire and recruit future scientists in these communities. We will lose a potential component of the pipeline for our workforce and limit the career opportunities that they might otherwise have available. In reflection, these concerns arise from a larger concern that the budget available for the GBO will decline. I realize that under the preferred alternative this might not be the case; however, lacking a clear plan for how the budget is retained as NSF funding declines is deeply concerning to me. I believe that the National Science Foundation has a responsibility to the citizens of this community to offer an assurance that they will not let a decline occur that will negatively impact their lives and that only when they have found partners to fully replace any reduction in funding will that reduction occur.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/21/2017	
120	a	Laura	Gibson	Senior Associate Vice President for Research & Graduate Education and Associate Dean for Research, School of Medicine at WVU	I am writing to convey my support, in the strongest possible terms, for the continued operation of Green Bank Observatory in Pocahontas County, West Virginia. This national resource not only provides access to world class radio astronomy instrumentation for basic and applied researchers, but also outstanding STEM educational programs with truly transformative impact in the local community. As a native West Virginian, I can attest to the importance of the unique scientific treasure that is the GBO. It serves as a beacon of scientific exposure, investigation, and discovery for young citizens in our state and region. A West Virginia student's first chance to see the Green Bank Telescope and experience the GBO Science Center provides a formative connection to the spirit of inquiry and learning at a time when students are developing a sense of wonders of our universe. One cannot overstate the significance of these opportunities in a region of Appalachia with few alternatives for STEM engagement. Indeed, many visitors to the GBO are stimulated to pursue education in the STEM disciplines and ultimately choose careers as engineers, physicists, astrophysicists, professors, and computer scientists, to name a few. Equally compelling is the role of the GBO as the cultural core of the local community. The telescope itself is situated in a dramatic, pristine natural environment that is dedicated to continued scientific and educational initiatives. Additionally, the GBO staff members serve as volunteer coaches, science mentors and emergency personnel, and the public recreation area provides a focal point for cohesion in the local Green Bank and Arbovale communities. The 5th largest employer in Pocahontas County, the GBO provides vital economic sustenance by furnishing more than 110 full time, high quality jobs in a county whose unemployment rate surpassed the national average in each of the last three years. In summary, the Green Bank Observatory is not only a point of pride for West Virginia, it is a vital tool in spurring educational, social, and economic opportunities for students and families in West Virginia. The National Science Foundation Draft Environmental Impact Statement (DEIS) indicated that budgetary constraints are forcing the agency to consider divestment from GBO in favor of ground-based facilities with higher scientific impact. However, in the past 5 years NSF has awarded via its highly competitive peer-reviewed evaluation process, over \$13.3M in 8 separate awards in WVU researchers for scientific projects that depend critically on access to a fully functioning GBO. It would seem that this sizable investment is a testimony to the high impact of the work being conducted at Green Bank. In closing, the NSF has demonstrated its commitment to promoting science and advancing prosperity, healthcare, and national defense. In few other places can continuing investment allow NSF to so directly address their mission as it can at the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/21/2017	
121	a	Paul	Kamienski	Resident of West Virginia	I have submitted comments on the GBO DEIS report previously. Listening carefully to the NSF presentation as well as the comments from the 42 people who spoke at the public meeting at GBO on November 30, 2017, led me to provide additional comments on the GBO DEIS as well as the overall process, and especially NSF's plan to divest GBO / GBT. I believe that 1) the DEIS report greatly understated the social and economic impact of curtailing activities at GBO, 2) the impact of divestment of GBO on its continued full functioning has not been addressed, and 3) the original decision to divest GBO appears to be based upon faulty data. These errors need to be corrected, and the divestment decision needs to be reassessed accordingly. Specifics on these points are as follows: 1. Social and Economic Impact of Curtailed Activities Understated in DEIS – Although the DEIS did comment on the social and economic impact including “community cohesion”, terms such as “minor” or “moderate adverse long term impact” along with brief examples did not nearly address this important issue. Written comments submitted to NSF after the November 9, 2016 public meeting totaled 817 with virtually all strongly supporting continued full operations. Similarly the oral comments at both the November 9, 2016 and the more recent November 30, 2017 meeting gave a clear and resounding message that GBO is critically important to the community, to Pocahontas County, to West Virginia and to the scientific community. GBO scientists and others who access the telescope are conducting exciting and meaningful research, and they and the facilities have a very positive impact on students, both in college (esp. WVU), in high school and even middle school, promoting science and STEM careers. Students who spoke, many from rural areas, described their interactions with GBO scientists as life changing or career changing experiences. It was also clear that the overwhelming sentiment was that meaningful educational outreach results from the scientists doing top notch research at GBO (indicating that Approach B is not viable). Excluding the impact on WV overall, because it would dilute the numbers, is inconsistent with comments from the public and WV state officials. In my view the DEIS report did not adequately capture these messages. If you emailed some or all of the meeting sign-up sheet participants who provided their email, I believe that you will find strong concurrence with this view. The DEIS should be rewritten to more fully capture this perspective, especially to indicate that Option A is clearly much different than the other options.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/20/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
121	b	Paul	Kamienski	Resident of West Virginia	<p>2. Impact of Divestment vs Reduced NSF Support for GBO – Much of the discussion and reports have focused on a need to reduce NSF funding for GBO, and while “divestment” of GBO and other NSF / AST facilities has been included in preamble presentations by NSF, the implications of such divestiture has not been fully explained or considered. Reduced funding is one thing, divesting of the facility including responsibility for insuring that the facility continues to operate in a cost effective manner is entirely different. Divestment would mean that NSF would no longer be responsible for the cost of maintenance and improvements at GBO. As described in the DEIS report (Purpose and Need, Section ES-2):</p> <p>a. 2006 - AST Senior Review (SR) Committee recommended that GBT be a component of the Radio-Millimeter-Subcommittee Base Program and cost reductions at GBT should be sought. b. 2010 – NRC conducted its sixth decadal survey in astronomy and astrophysics and recommended that facilities should be identified that NSF-AST should cease to support to release funds for other facilities or programs. c. 2012 – Portfolio Review Report (PRC) recommended that AST “divest” of the Robert C Byrd Green Bank Telescope (GBT) among other facilities, and strong efforts by NSF for facility divestment should continue as fast as is possible d. 2016 Mid Decadal Report – NSF should proceed with divestment of facilities that are judged to have lower scientific value including GBT. The NSF Agency Preferred Approach A: Collaboration with Interested Parties for Continued Science-focused Operations with Reduced NSF Funding, includes a proviso that other third parties would need to “come forward” with funding. I guess this means that NSF might continue to provide some funding for selected research or education outreach programs provided that the site receives enough funding from others to stay open. No specific information is provided on how this might work, specifically how much funding will NSF provide? Timing for divestiture and defunding? Who specifically would be responsible for the site? If sufficient funds were not found would the NSF preferred Approach A degenerate to Approach B (not clear this is feasible), to Approach C which would quickly lead to Approach D or complete shut down? The consequences of “divestment” and “reduced funding” need to be clearly explained before such a decision is finalized and agreement reached 3. Need to Re-Evaluate GBO Divestment Decision The above provides interesting and relevant background but the core issue that needs to be discussed and re-evaluated is who made and or approved the original GBO divestment decision? What was the basis for that decision, and were the facts and analysis all correct? Higher operating costs compared with other newer facilities apparently contributed to the decision, but there is at least some indication that the numbers used were not correct and the analysis was flawed. At a minimum any errors or inconsistencies should be corrected, and any comparisons with other facilities should updated, which should result in re-evaluation and reconsideration of the divestment decision.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/20/2017	
122	a	Nate	Van Wey		<p>I write in support of the continuation of strong support by the National Science Foundation of the Green Bank Observatory (GBO). In times of strained budgets, decreasing support of STEM programs, and a sad anti-science stand from political leaders, the work done at the Green Bank Observatory is essential to the scientific community, the local economy, and the national education programs that it provides. I have been involved with education programs at Green Bank for a number of years and have seen the impact the GBO has had on literally thousands of students. The opportunities it has provided STEM-interested students cannot be equaled by other facilities and other educators. The enthusiasm students develop for science by interacting with engineers, astronomers, technicians, and educators certainly carries over to their classrooms, to their families, and to their communities. It can bring back science education, research, and support to this country. I urge the NSF to strongly consider support of the many fine programs that the Green Bank Observatory offers to our young people, to cutting edge research, and to public outreach.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	
123	a	Casey	Griffith	Library Clerk at Philippi Public Library	<p>The Green Bank Observatory should be allowed to continue to be full funded as they have been. It's an important facility used by students and professionals alike. This summer, the Eclipse program we held would not have been possible without Green Bank Observatory leading the way. One must remember that the observatory has been used for SETI, for various NASA projects and is continued to be used to help teach students with a professional interest in Astronomy. To de-fund the observatory in any way would be a major set back for those who continue to use it to teach and for those who are being taught. Please keep the funding for the observatory at its current level.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	
124	a	Susan	Mayer	President and CEO of Litigation Abstract Inc. in Missoula, MT	<p>This is a short note to reiterate the importance of the GBO, not only to West Virginians and students of the University, but also to students of astronomy around the country and the world. I first became involved with the GBO more than 20 years ago from Montana. It has had an impact on lives and learning for students young and old. I endorse its continued existence and funding so that future students of astronomy can continue to benefit from its presence and access. Thank you.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	

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125	a	Angela	McKeen	Teacher at Notre Dame High School in Clarksburg, West Virginia	In response to the consideration of reducing the funding for the Green Bank Observatory, I would like to take the time to remind you what amazing opportunities student researchers gain with access to the Green Bank Telescope. The Green Bank Observatory has countless opportunities for student researchers. The Green Bank Observatory Radio Astronomer for a Day program provides an authentic research experience for students in grades 5 and up. School groups and youth groups of all kinds and ages may visit the Observatory for an overnight stay. The central theme is conducting observations with a working radio telescope to investigate our Universe! We supplement the program with tours and hands-on activities as well. It's amazing what students can learn in just one day. This program meets Next Generation Science Standards Nature of Science standards. Another opportunity for research is the Skynet Junior Scholars. My nephew has been a Skynet Junior Scholar since 2015. This research program was part of his experience at a West Virginia State 4H camp and since then, he has encouraged at least 12 others to attend training for research. I know that seems like a small number. However, he is just one student. Green Bank Observatory reaches hundred of students and ignites a passion for research like little else I have seen before. Leaders and youth gain access to research grade telescopes around the world including a 20 Meter Radio Telescope here in Green Bank! Through a series of fun observational astronomy activities, you can take images and radio data, do experiments, earn online badges, and participate in research projects like tracking asteroids. Collaborate with others via our online forum and team projects. All the learning and observing is online, so what are you waiting for? Skynet Junior Scholars is funded by the National Science Foundation, so you must already know it is working. Please reconsider your decision to leave the Green Bank Observatory open at a lower funding rate. Without the funds, the telescope times will be greatly limited to scientists only. How can we, as West Virginia science educators, continue to grow scientists in fields such as these if students no longer have access to do the research of scientists?	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	
126	a	Linda	Blake	University Librarian Emerita, West Virginia Regional History Center	The Greenbank Observatory creates a sense of awe for tourists, students, and scientists. It is a fixture in West Virginian and is featured in West Virginia promotional materials. As more lands become populated in the United States and more land destroyed in West Virginia, this is one place still pristine and perfect for the functionality of the telescope. Please consider preserving its future for the state, the nation, and the world.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	
127	a	Elizabeth	Gallaher	Teacher at Capital High School, 9th Grade Earth and Space Science	I feel that the Green Bank Observatory provides a valuable resource to not only the surrounding community, but for our entire state, and international community. The educational programs that they support truly enrich the educational enrichment of all. The professional development programs that they provide educators is invaluable. And, of course, the support that they provide to the science research community is priceless. I hope that funding is again supported for this facility and not cut. Maybe I can dream and say that it will be increased in the next year.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	
128	a	Sherry	Radcliff	Director of Finance, Treasurer for Green Bank	I am a long-time resident of Pocahontas County and I am writing to express my support of the Green Bank Observatory (GBO) as a science-focused operation. I am the Director of Finance/Treasurer of Pocahontas County Schools and worked in the banking business 25 years, so I understand the economics of business. Green Bank Observatory is a good financial and educational partner of our education system, as well as a viable networking piece of our tourism county. Green Bank Observatory provides economic stability to approximately one-hundred GBO families. This in turn assists our rural county's economic stability. If Pocahontas County would lose Green Bank Observatory as an employer, Pocahontas would suffer financially, approximately \$11.15 million in salaries would vanish. GBO employees would leave our county for other jobs; taking their children from our school systems and tax dollars would decrease - a major funding source for the Pocahontas Schools. This would leave a large void for many businesses too. Pocahontas County Schools need students and we need the Green Bank Observatory! Furthermore, there are many accomplishments that the GBO are known for in the last few years using the massive Robert C Byrd Telescope that other places do not have and the cost to erect another telescope would be expensive. Secondly, the tourism aspect of not having the annual 50,000 visitors to the Green Bank Observatory would have a negative impact of county economic stability. The tourism dollars equates to about \$7.5 million if they only spend \$150 a day. I believe the tourism dollar impact would be much more than \$7.5 million. Please support the Pocahontas County Schools! Our students, use this viable science and mathematics educational facility. We have some of the top math students in the state! Number one students to be exact. What an awesome accomplishment! GBO has helped with this achievement, as well as helping with our STEM and computer science programs. I thank the National Science Foundation for the past financial support of the GBO and I encourage you to continue to support the Green Bank Observatory as an employer of Pocahontas County. This is the place where you can trust your dollars are being spend wisely. Where employees and citizens take pride in jobs and the place they live. Where people want to work. Pocahontas citizens have found a way to live in a quiet zone.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
129	a	Emery	Grimes	President of Pocahontas County Schools Board of Education	We, the Pocahontas County Board of Education Members are writing in regards to the environment impact study of the Green Bank Observatory (GBO). We encourage the National Science Foundation (NSF) to continue with the investment support for the science-focused operations of the GBO. The Green Bank Observatory is an educational partner of Pocahontas County Schools in many ways. Pocahontas County Schools for over the fifty years have seen our high school graduates make their employer the GBO in some facet. Here are some of the reason the Pocahontas County Board Members support the GBO: GBO provides over \$11.5 million annual in job security to Pocahontas County. Over 50,000 tourists visit the GBO each year. That in itself provides a high volume of tourism dollars to Pocahontas County -- economic stability to a rural county. Pocahontas County students collaborate with GBO during science and math projects. Pocahontas students and residents take pride that the GBO is part of their county. The financial loss of not having the GBO in Pocahontas County would have a huge negative impact of Pocahontas County Schools, including loss of tax dollars and students attendance in the school systems because of employees moving to find other jobs. This in turn would likely create employee reduction of Pocahontas Schools. GBO employers for many years have been viable volunteers of Pocahontas County School projects, such as sports, band, forestry program, and science competitions. We would like to provide our sincere appreciation for the National Science Foundation's support of the GBO in the past and we enthusiastically ask for the continued support of the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
130	a	Deborah	Klimek	MD in West Virginia	I am a surgeon and home educator invested in teaching the next generation about science. The Green Bank Observatory is a treasure in terms of educating students about science. Our homeschool co-op benefitted from the recent Total Solar Eclipse 2017 project. We received video training and eclipse viewing glasses which were vital to teach our students before the eclipse occurred. I recently learned the Green Bank Observatory may be losing critical funding which could impact thousands of students. I sincerely hope the National Science Foundation will reconsider this. Field trips to the Green Bank Observatory are vital to the education of the majority of the children in our state. It's always an amazing place to visit and it opens the minds of so many children. It sparks dreams and aspirations to explore deep space for so many of us. I urge you to please reconsider and instead of cutting funding, concentrate on publicity. The observatory is such a hidden gem in the hills of West Virginia. Perhaps more publicity on social media could help bring tourism and visitors to the area and generate more public funding.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
131	a	Thomas	Gray	Retired Science Teacher in West Virginia	Please reconsider the decision to cut funding for the Greenbank Observatory. I was a science teacher for 24 years, and took students there several times for field trips. It was always enjoyed by my students and myself. In addition to school trip, I have also visited the site with family and friends. It is a very good way to develop interest in the solar system, as well as other natural phenomena. I am also familiar with the are in which it is located, and consider it a vital attraction for tourism, adding quite a bit to the local economy, which is struggling like most of WV. I do think that the facility has a much greater value for research and training than it is generally given credit . Please consider keeping full funding for the facility.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
132	a	Joyce	Succurro		Please consider funding this wonderful example of science and technology. I am certain you are aware of the need for children of Appalachia's needs to be exposed to sciences. What more of an impressive way that to introduce school age children to outer space? As you sit in Washington DC look deeply into every building of the Smithsonian. Observe the number of individuals who go through the doors, crying screaming and out of sorts; children who don't want to be there. They are by the thousands each day. Please consider funding Appalachian children's opportunities. Children who want to learn. I ask you to develop programs, provide moneys that will interest students in the next landing on the moon and Mars. Give West Virginia children the same opportunity that we afford hundreds of thousands of children in Washington DC. It will be money well spent. Ask Homer Hickam, the poster child for science and technology. Green Bank provided me with a great appreciation for outer space research. I am truly thankful for the opportunity to observe the radio telescope at work. While there it also allowed me to understand the dedication and commitment scientists must have to be successful, 24/7. I leave you with a universal thought, "You take the school out of the community, you loose the community." Green Bank is a wonderful teaching facility affording many with scholastic opportunity. Please don't let this community slip into outer space. Develop it. Find Kepler-90.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
133	a	Emily	Helton	Middle school science teacher in Fairmont, West Virginia	I'm writing to support fully funding the Green Bank Observatory. I am a middle school science teacher in Fairmont, West Virginia. This summer I had the great good fortune to attend the Earth & Space Science Passport program at the GBO. It was like winning the teacher lottery. I was able to use the 20m and 40' telescopes in order to explore research questions. This was one of many experiences that I and my peers had this summer, all of which made me a better teacher. I cannot describe to you how transformative this experience was, but I do know it would not have been possible without funding from the NSF. West Virginia gets a bad rap. Before I moved here a little over a year ago, I had a mostly negative impression of the state, largely because I hadn't questioned stereotypes in the media about West Virginia. I had no idea that there was a world-class radio astronomy telescope site, to say nothing of the fact that local citizens give up their ability to use cell phones, wifi, or microwaves in order to protect the airwaves around the GBO. Please don't reduce funding for such a gem and point of pride for my adopted state.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
134	a	Connie and Bob	Pirner		I'm not able to take my young students to the observatory but they have come to us. I encourage my families to visit there and I take my family every summer. Please continue to support their efforts. We need more involvement with Science on a hands on level such as they provide.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	

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135	a	Dave	McGill	Professor/Extension Specialist in Forest Resources Management at WVU	Greenbank is a valuable resource to our resource-strapped state. It serves as a focal point for exploring the heavens, supports rural communities, and uses the rural nature of our landscape for state-of-art applications. Hope you continue to support the Greenbank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
136	a	Patricia	Smyth		Please conserve funding for the Green Bank Observatory. It is so important for student training and recruitment, not to mention economic development. The impact, both scientifically and in terms of student training and development, is huge.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
137	a	Elizabeth	Metheny	WVU Extension Service for Hardy County	I am writing in regards the possible funding decrease for the Greenbank Observatory in West Virginia. As a child I remember boarding a school bus for a long twisty drive to the observatory. The educational benefit of this for Appalachian youth is astounding. I was a fortunate child with a family who focused on education outside the classroom, my classmates did not have this support. For many it was the first time they had been outside of Hardy County, West Virginia. For some, this was the first and possibly only exposure to science on this scale. I can vividly remember the gray hair gentleman who taught us all about each and every part of daily operations and now I sit at my desk, a university employee who carries STEM education to the youth of our county. I have to imagine that this experience impacts my want to share the knowledge gained and the experience of amazement with youth. Please consider this long-term educational impact that this observatory has had for West Virginia as you make future funding decisions. Thank you for your time.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	
138	a	Belle	Basnight	Administrative Assistant at Preston Library Virginia Military Institute	E. No-Action Alternative: Continued NSF Investment for Science focused Operations. I see no reason why anything needs to change. Green Bank is a valuable resource and deserves continued funding from NSF.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/18/2017	

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139	a	Kimberly	Dilts	Resident of Pocahontas County	I am writing in response to the Notice of Intent for the Draft Environmental Impact Statement for the Green Bank Observatory published on November 9th, 2017. I would like to register my strong support for the continued operation and funding of the Green Bank Observatory as a fully operational research and science education facility. As a resident of Pocahontas County, WV, I can say unequivocally that the Green Bank Observatory is a cornerstone of the community, attracting world-class scientists from around the globe and enriching the lives of children and adults in this county and beyond. The Observatory attracts 50,000 visitors annually, but more importantly, it is a center of science and learning locally – the impact of having a world-class research facility in a rural community cannot be overstated. We live in a time when the very nature of reality is being called in to question, and science is under unprecedented attack. Having a facility that is on the cutting edge of astronomical discoveries located in this rural community and the diversity of thought brought to this area by the visiting scientists and the example they set – the “if they see it they can be it” effect – is of critical importance in this turbulent time. In a truly isolated, rural community like Pocahontas County, it is rare and extraordinary for students to be exposed to the kind of STEM inspiration available at the Observatory, and it is critical for the Observatory to remain a resource for college students working at WVU and other local astronomy programs. The highly specialized work force that staffs the Observatory is also a boon to the state of West Virginia – a state struggling to find its way in the technologies of the future. These people who work at Green Bank are part of their community and serve as emergency service providers, school board members, youth coaches, board of directors for local banks, community organization members, and many other functions – the community would be devastated by an altered focus from radio astronomy or closure of the Green Bank Observatory. The state of West Virginia should not be losing highly skilled, world sought-after scientists and technicians at a time of such uncertainty in the state’s future. We cannot afford to lose another community, especially one this valuable. Losing the Observatory would also be economically devastating to the surrounding communities. Revenues generated from tourism in the state of West Virginia would also suffer as over 50,000 people visit, purchase tickets, food, and fantastic gifts and educational resources in the gift shop – all purchases providing additional tax money to the bottom line for West Virginia’s income. Based on the salary base and living expenses at Green Bank combined with estimates of average expenditure by visitors to the Observatory, it is estimated that the Green Bank Observatory contributes close to \$30 million to the local and state economies. That revenue would be severely reduced if the Green Bank Observatory either lost funding or was converted to a technological site – no longer the source of inspiring, active science and discovery that thrills the many visitors passing through their doors each year. When you close a facility in an urban area, the surrounding businesses and opportunities absorb the losses. That simply does not happen in a rural community. The pride of having a state-of-the-art facility in the heart of West Virginia, the excitement and enthusiasm that is palpable when the wonders and the possibilities are discovered upon visiting Green Bank that carries over into the classroom or general interest in science, the family atmosphere present at the work place which spills over to a safe, and stable community – these intangibles are very important to reviving hope in a state riddled with job loss from the declining coal industry and tragic opioid addictions and overdoses recently headlining the news.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/17/2017	
139	b	Kimberly	Dilts	Resident of Pocahontas County	You are no doubt well-versed on the world-class science being conducted at the Green Bank Observatory (continued research on pulsars, NANOGrav (gravitational wave studies), Breakthrough Listen (Search for Extraterrestrial intelligence), astrochemistry, star formation, mapping of a near-earth asteroid and the surface of the moon, assisting in the location of lost NASA solar satellite Stereo B, and even the nature of high density matter), so I won’t be redundant here – it goes without saying that the technology available in Green Bank is unique and invaluable to scientists the world over. It is imperative and inherent to future scientific research and discoveries and must continue to receive the funding it needs to operate into the future. The NSF must continue funding the Green Bank Observatory to ensure “open skies” science - the best path to yielding brand new discoveries and understanding of our world and universe – past, present, and future; training for our educators; opportunities to explore new and improved technology; ensuring the stability of a model, rural community; and maybe most importantly, inspiring the next generation of astronomers, physicists, engineers, and computer scientists. When the NSF reduced its funding to the Green Bank Observatory, the staff worked tirelessly to attract outside investment and successfully replaced a huge portion of its budget. They are dedicated to the science happening at the Observatory, as well as to the community it supports. I ask that the NSF continues to support their efforts.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/17/2017	
140	a	Gay	Stewart	Director of WVU Center for Excellence in STEM Education	In 2014, I made what was frankly a dramatic change in my career to come to West Virginia and be part of turning a state around in terms of STEM education. I felt this was a state that needed such change, and could provide a national model for doing so. The educational and economic indicators in the state may lead one to doubt such a thing was possible, but The Pulsar Search Collaboratory (PSC) through WVU and the Green Bank Observatory was one of the features that led me to believe this could be done. Just last year, this program has been extended through an AISL program to reach more students. Roughly 2,100 students have been a part of the PSC. In a state with the lowest college degree rate for those under 25 years of age, PSC students intend to major in STEM fields: 99% are either in college or plan to go to college, and 68% intend to receive an advanced STEM degree (doctorate (45%), master’s (17%), medical school (6%)) and 62% report good to great increases in STEM career awareness. Approximately 50% of these participants are female or underrepresented minority students. Green Bank Observatory has since my arrival been central to other initiatives in STEM Education. They are the lead organization in our successful NSF INCLUDES grant, Improving STEM Persistence in the First Two Years of College. West Virginia lies completely within Appalachia, an area of great rural poverty. West Virginia’s college-going rate is low, STEM course taking in high school is even lower. The efforts of these programs, which rely on the robust research being carried out at Green Bank Observatory for their vitality, is moving the needle for these young people. The impact is far reaching: Imagine breaking the cycle of poverty for the families and communities of these young people! So many Appalachian students have no exposure to STEM careers outside of the mineral extraction industries, which are in a downward spiral. We are working hard to grow a generation of highly qualified mathematics and science teachers for Appalachian public schools, but the need is great, and will not be satisfied in just a short time. Green Bank Observatory serves as a nucleus for efforts to build the STEM pipeline in Appalachia. This is key to our future educational goals, and thus to prepare the future STEM workforce.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/17/2017	

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141	a	Anonymous			I am submitting this email anonymously as my viewpoint would certainly receive reprimand from WVU administrators (WVU does not exhibit a free academic environment as one might envision for a land-grant institution). Publicly, I have already stated support for Green Bank Observatory as to alleviate any friction and suspicions from colleagues and administrators. Privately, my true assessment as a long-time educator and highly successful researcher is that the Green Bank experience is not worth the \$20 million in annual expenditures that one would hope to gain with an investment this large. First, the research coming from Green Bank is not transformative and does not lead to any highly innovative discoveries. The main claim by WVU faculty and administrators is that the research coming from Green Bank will lead to a Nobel Prize in gravitational wave discovery. Such a claim was invalidated nearly a decade ago by the NSF Science Advisory Board; the advent of LIGO and subsequent successful results by the LIGO team (who did receive the Nobel Prize) surely have invalidated this decade-old claim. I am disturbed that the level of funding provided to Green Bank continues on the basis of this claim particularly as NSF budgets do not justify such an investment. Yes, other radio-astronomy results unrelated to gravitational waves come from Green Bank, but there are much better facilities with greater resolution available worldwide. Having a single dish is impressive, but absolutely immaterial to achieving transformative results. An honest survey of the high quantity of journal manuscripts produced by research coming from Green Bank would find quality seriously lacking. Second, frankly, the impact of the Green Bank Observatory on student education and impact is over-rated by WVU administration and faculty. What I have seen is that student's involved in research through Green Bank exhibit a extremely disturbing viewpoint of what is required to be a physicist. Most, if not all, of the students involved in the programs there are merely pushing buttons and running data-mining code. This might be classified as getting students involved in a research program; however, most, if not all of these students end up with an extremely distorted expectation for the level of analytical thinking skills and mathematical skills that are required to study physics and astronomy. I have had several undergraduate students involved in radio-astronomy look me in the eye and arrogantly tell me that math is not required to get a physics degree since they are interested in astronomy. Students involved in the Green Bank Observatory are merely used by faculty as a massive army of button pushers in order to generate results leading to great quantities of publications that lack quality. We certainly have seen an increase in undergraduate students wanting to study physics and astronomy; however, we have commensurately seen many of these students dropping the program, leaving the university outright, or graduating with such poor grades that they are unable to achieve adequate employment. Only a very few head to graduate programs worth mentioning. In my experience, students are capable of much, much more in terms of quality, but alas, they are not given this opportunity through Green Bank experiences. In this environment of limited resources, it is time for NSF to allocate resources in more beneficial directions that can create promising and transformative research environments for students - leading to quality scientific endeavors. The State of West Virginia has lobbied with NSF to keep the telescope longer than is necessary. I am disappointed that NSF as an apolitical government agency has allowed politicians to sway them in the past - despite sound input from leading scientists who have already deduced that the telescope cannot significantly contribute to the advancement of science. In conclusion, NSF should stop funding research that has little real impact based on the amount of funding allocated which is demonstrated in the Green Bank Observatory.	For Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/13/2017	
142	a	Robert	Sheets	PCHLC & PCBC Member	I have two historical concerns related to placement of significant properties at GBO. One is the future of the Tatel Telescope or 85-1. It is currently included in the Interferometer grouping for possible deconstruction. Dr. Frank Drake began the search for ET signals on this instrument and as that now continues with SETI around the world, I believe it is worthy of preservation.	Considerations for Document Analysis	Cultural	Written Comment (also public meeting comment)	12/13/2017	
142	b	Robert	Sheets	PCHLC & PCBC Member	My second concern is the future of the Hannah House, also listed for possible deconstruction. This house belonged to and was occupied by Mr. George Burner, one of first Pocahontas County Court members in 1821. He served two terms in the Virginia Legislature as a Representative of the County. As we are preparing to celebrate Pocahontas County's Bicentennial in 1821-22, this house takes on a special significance. I believe it is also worthy of protection. These concerns are shared by Pocahontas County Historical Landmarks Commission and the Pocahontas County Bicentennial Commission. I would hope that these change in status will be evident in the final draft.	Considerations for Document Analysis	Cultural	Written Comment (also public meeting comment)	12/13/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
143	a	Carla	Beaudet	Engineer at GBO	<p>In my verbal comments to the committee during the November 30th public meeting, I simply thanked them for doing a good job on the socioeconomics section of the DEIS, because I believe they did. However, as a GBO employee who has been suffering this process since its inception, something unarticulated was bothering me, and I've since identified it: The DEIS nicely inventories the assets and (some of the) accomplishments of GBO; it lays out there for neat inspection all of what we have and do here. And while our assets are laid bare in this process, NSF is playing its game close to the vest. Actually, the hand was tipped very slightly by identifying Action Alternative A as the agency's preferred course of action, but even if Alternative A is selected, the only resulting clarification is the elimination of Alternatives B through D, since the vagueness of Alternative A leaves the GBO staff with many of the same questions we had at the start of this process. Action Alternative A "would involve collaborations with new stakeholder(s) who would use and maintain GBO for continued science- and education-focused operations. NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades". Action Alternative A makes it sound like none of this has happened yet. But NRAO has been seeing a dwindling operations budget from NSF since 2010. To an employee who daily feels the effects of staff attrition, and our facility consistently being asked to do more with less, the question arises: CAN this observatory continue to operate with a further budget reduction? It does not seem likely; auditors all report a very lean operation, but I didn't need them to tell me that. Action Alternative A makes it sound like GBO has not yet found any new operating partners. However, we have already been quite successful in that regard. Since the Portfolio Review of 2012, partners Breakthrough Listen, WVU and NANOgrav have come on board, and are currently consuming 28% of GBT time, and providing a similar proportion of its operating budget. Do these partners count as "new"? How many (if any) additional partners are needed? What percentage of the operating budget does NSF expect such partnerships to pay for? How much Open Skies time on the GBT is NSF willing to relinquish? Does "continued science- and education-focused operations" exclude military or commercial ventures? Clearly there are more questions than answers, even if Alternative A is chosen. After being as helpful and forthcoming as we at GBO have been throughout this extremely stressful process, we would like to see a clearer picture of the NSF's plans for us. Will NSF heed Senator Manchin's request and commit to finding additional science and education focused operations partners for GBO before any further reduction in funding our operations? Or, in light of the community outcry inspired by the 2012 Portfolio Review, is NSF just choosing Alternative A to save face, when in fact it will allow GBO to die the death of a thousand cuts, and end up at Alternative C by default? Alternative A, in all its ambiguity, allows for any outcome in the spectrum of these options. Would it be too much of an embarrassment for the NSF to admit that key areas of science were perhaps deemphasized in the 2012 Portfolio Review? Would it be too humbling to admit that LIGO's observation of gravity waves has upended the priorities and instrumentation requirements of the astrophysics community? In spite of a tightening budget since the Portfolio review of 2012, the GBT has become an even better instrument than it was then with the arrival of multi-pixel and W-band receivers. There is now, and always has been, oversubscribed demand for the science we are capable of doing. Would it not make sense, at this juncture, to reconsider the 2012 decision altogether? If NSF will not reconsider its 2012 decision, it needs to step forward with a commitment to our facility that allows us to make plans and move forward. The environment of uncertainty is a constant source of stress and low employee morale, and makes it more difficult for our facility to attract and retain talent. If it were not for a core of dedicated staff here, there would be no GBO. It's time for the NSF to match that commitment by committing some definition to Alternative A so we can ALL aim at a successful outcome.</p>	Considerations for Document Analysis	Purpose & Need	Written Comment (also public meeting comment)	12/11/2017	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
144	a	Deana	White		Below is the second oral comment as written that I abbreviated at the November 30th, 2017 public meeting held by the NSF at the Green Bank Observatory. I will be providing the written version of the other oral comment given as well as a new written comment. I would like to register strong support for the restoration of full funding of the Green Bank Observatory by the NSF such that they can continue their important mission of Open Skies science and education focused operations. As you know - the Open Skies policy allows anyone with a merit-based proposal to gain observing time, which means real, ground-breaking scientific research can be done by anyone from a student at a small college to a world-renowned scientist studying gravitational waves to a high school student with a great idea. The Open Skies opportunity is made possible by the NSF funding – which is why it is so important that the NSF restore full funding for the operation of the Green Bank Observatory. One thing that we would also like to highlight is – it must be remembered that while like-minded partnerships are beneficial, partnerships reduce the amount of observing time available to the many different people and institutions that do not have the resources to have their own research instrumentation at their facilities or to partner with the GBO. Education opportunities and diverse research subjects would be reduced. Further, per the draft report of the Section 106 Historic Assessment that is concurrently being conducted by the NSF, adverse impacts have been identified for the ‘collaboration’ operating option including the removal of some of the historical structures identified as part of the GBO Historic District. It is imperative to the historical preservation of the Green Bank Observatory, the United States birth place of the National Radio Astronomy Observatory in response to the Space Race with Russia and with a rich history in world leading research results that are ongoing today, that the NSF provide full funding to continue to operate the facility. Additionally, reduced funding could impact staffing levels and thus adversely impact the surrounding community in so many ways – economics, youth leaders, local education, emergency response, support of the arts, etc. As we shared last year at the onset of this process, my daughter and son have been beneficiaries of the nationally recognized STEM activities available at the Green Bank Observatory. My daughter continues to be actively involved in research projects for the GBO this year and is participating in an exciting and promising Open Source Radio Telescopes (OSRT) project that encourages middle school, high school, and college students and their educators to build small antennas, feed horns, and radio telescopes complete with hardware electronics and software programming to facilitate interest in STEM careers from a hands-on experience and at the same time contribute to Citizen Science. The staff at Green Bank and professors at West Virginia University are heavily involved in this exciting initiative which has country wide implications. My son continues to be inspired by the Observatory and its staff in his artistic and computer oriented pursuits. In addition to our own experiences, we have been present at the Observatory and witnessed how many people – young and young at heart – have been inspired and challenged to perform at peak levels just from a visit or a two week long camp such as the Physicists Inspiring the Next Generation (PING) camp. The PING camp is a gathering for science focused activities for two dozen or so female and under-represented minority rising 9th graders from across the country. These students were a joy to witness in their curiosity and contagious enthusiasm for learning and the knowledge they already possessed. We were also able to meet and interact with the First Two students, a group of First Generation STEM field undergraduates (many from rural West Virginia) participating in a support group to ensure their continued success in their chosen fields and who were onsite for a research learning experience. At the same time these students were at the Observatory for these programs, there were high school teachers on-site participating in a Research Experience for Teachers program and were developing exciting hands on curriculum to take back to their classrooms. Our future is in good hands as evidenced by these wonderful activities taking place because of the facilities and research equipment available at the Green Bank Observatory under the facilitation and direction of the world class GBO staff. We plan to do everything we can to help you ensure that these unique and valuable experiences to inspire our youth and our educators, as well as the groundbreaking research being conducted every hour, continues at the Green Bank Observatory funded fully by the NSF.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public comment)	12/7/2017	
145	a	Dennis	Egan	Assistant Fire Chief BFD Fire and Rescue	In the EIS Draft Report for the Green Bank Observatory, your comments under section 4.8.3.1 Public Safety on page 4-61 state “the water tank would no longer be in operation, but the fire department would be able to refill tanker trucks from numerous streams in the area,” inferring the loss of the water tower to be insignificant with regards to the department’s water supply. Whoever was consulted for this opinion is not familiar with the challenges of drafting from the small variable streams in our area. Unlike areas with larger streams or rivers, the streams in our area are not consistent. They can often be walked across without getting your feet wet. In winter, the large deep holes required for drafting are often frozen over. If stream water is available, to access a stream for firefighting water requires an engine, a deep hole with a small lift (height from water surface to the pump) near a road. If this type of site is not available or an engine is not available, slower portable pumps can be set and hoses rigged but again it takes manpower and time. Drafting water from streams is not only time consuming, it requires additional personnel, an asset in short supply in our area. The type of dynamic streams in our area can change from one large storm to the next such that a past fill site is no longer appropriate. Sending a tanker and pumping team in search of a fill site can take real time and result in the loss of a home. In short drawing water from a stream is unreliable and costly in both time and manpower, and should be avoided when possible. The Green Bank water tower supplies a reliable, safe, highly accessible water source that would be a great loss to the public safety of the community if lost. In addition to putting firefighters and structures at risk by loss of a reliable water source, the fire insurance rates for the area around Green Bank are much lower due to the availability of the Green Bank tower and the loss of it would result in immediate increase in insurance premiums.	Considerations for Document Analysis	Health and Safety		12/5/2017	
146	a	Tucker	Johnson		The green bank telescope should remain as close to fully funded as possible. Not only is it great for scientific research, but it is a great learning catalyst for high school and college student alike. It will be very saddening to see the telescope be gradually de-funded.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/4/2017	
147	a	Ryan	Dotson		Retirement or demolition of the Green Bank Observatory would be detrimental to the research conducted at West Virginia University and other universities across the world. Green Bank has been a very important tool to researchers working on different projects, and to lose that tool will cripple the community and the efforts of understanding space. In my experience, I worked on a project that involved using data collected from Green Bank. It would be a shame to see the observatory go, but I hope this issue will be resolved and Green Bank may continue its operations. The observatory is far too important to the scientific community.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/1/2017	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
148	a	Michael	Lam	Post-doc at WVU	I am writing in response to the Federal Register Notice of the Draft EIS evaluating potential environmental effects of proposed changes to operations at the Green Bank Observatory (GBO). I am glad that the NSF has chosen to continue supplying funding to the observatory. GBO has been and remains a unique institution nationally and internationally. It remains unique on a culture, scientific, and educational level and is economically important for the State of West Virginia. You have undoubtedly received many similar letters outlining its importance in these areas. I started my undergraduate career at a small, liberal arts college where the opportunities for astronomy research were very limited. In the summer of 2009 after my sophomore year, I worked at NRAO Charlottesville in Virginia for a Research Experience for Undergraduates program. Not only did I use data from the GBO (the then Green Bank Telescope, GBT), our entire group was given telescope time so that we could learn how to plan our own observations, carry them out, and perform data reduction and analysis. All of the members of the program were students from around the country who were given an incredible opportunity to learn radio astronomy and truly become radio astronomers because of the GBT. Almost all of the people that I know who have gone through that program have stayed in STEM research or industry fields, several in astronomy. For me personally, with that experience in hand, I ended up going to graduate school for astronomy at Cornell University and am now a professional radio astronomer, working as a postdoctoral fellow in West Virginia for the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), an NSF Physics Frontier Center. One of the major contributing factors for deciding to come to West Virginia was use of the GBO. Observational astronomers tend to go where telescopes exist and the entire astronomy side of the Department of Physics and Astronomy at West Virginia University (WVU) is here, as is the Center for Gravitational Waves and Cosmology, because of the GBO. It is a prime hub for NANOGrav because one of the GBO's key science goals is observing the low-frequency gravitational wave Universe. Astronomical research in West Virginia happens because the GBO is here. Grant money that is spent on funding personnel such as myself trickles down into the local economy because all of us live here. Scientific outreach and education that is performed here by us happens because the GBO exists for us to be here. The GBO is the premier science facility in West Virginia and any reduction in funding to the observatory destroy opportunities for West Virginians. However, the GBO does not merely impact Pocahontas County, West Virginia and it does not merely impact US single-dish radio astronomers. It has local, national, and international socioeconomic effects. It impacts scientists, students, and the general public all around the world. The GBO is not the facility that was reported in the 2012 NSF Portfolio Review. Its upgrades, both past and continued, make it a modern institution capable of achieving a unique set of scientific goals. No other observatory can compete with its combined sensitivity and range over the Northern sky. It is imperative to keep funding going for as much open-skies time as possible to continue the pursuit of broad scientific impacts. In the community, the GBO is essential for the local support it provides. The closure of recreational facilities such as the pool impacts local families and is an extremely minimal cost savings component. The houses to demolish could easily be sold but offer temporary guests of the observatory as they are perfectly livable; I myself have stayed in such housing. Support staff at the observatory work as volunteer firefighters, help in the local schools, and more. Providing as much funding to help the local community is important in such an impoverished area and helps not just with the small town but the county and that entire region of the state of West Virginia. Providing as much funding close to the current levels is absolutely critical. And with improved funding, instrumentation, and support, it could continue to thrive for many years to come. I request that the NSF considers the broad impact of damaging the US single-dish radio astronomy community, and pulsar timing array astronomy especially as we are in the very recent opening of the gravitational wave Universe. In close, I implore the NSF to continue funding this absolutely crucial observatory for its scientific and socioeconomic impacts on the community. For questions or further information, please do not hesitate to contact me.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/1/2017	
149	a	Billy	Cole	Student at WVU	Hello I am emailing in support of keeping the GBO fully operational and with sufficient funding. The GBO stemmed my deep interest in science and astronomy from a young age on a field trip and I am now pursuing a career in physics and astronomy because of this. Without the GBO I may have never found the outlet within WV to find my passion. I really hope you keep this observatory fully operational for the youth, current observations and to keep WV relevant in the science world	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	
150	a	Jamie	Avalos	Science teacher in Texas	I would like to offer my support of the Green Bank Observatory and its outreach programs funded by the National Science Foundation. I am a high school science teacher in Texas, and I had a chance to visit GBO last summer on a Research Experience for Teachers. This experience was pivotal for me. I had been teaching astronomy for the past year, but I had no actual experience in the subject nor any college work. Since then, I have felt more effective as an educator because of the work I did using telescopes and meeting with astronomers. While at GBO, we also got the chance to work with a group of incoming 9th grade students of underrepresented populations in STEM who were at the observatory for a two-week summer camp. I am pleased that the program reached out to girls and children of color, and I can see that many of these students are continuing to interact with the astronomers at Green Bank and take advantage of other programs funded by the NSF. In addition to my summer research experience, I and two of my brightest students have been working on the Pulsar Search Collaboratory. This is an ideal resource for those of us in rural, remote areas of the country as it is largely an online program. I get much needed professional development that my district cannot offer, and my students get to extend and explore a valid, interesting research experience while earning college credit. Please keep these amazing programs going. They really do change the trajectories of countless students.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	
151	a	Jarad	Forristal		I've recently heard about the planned funding reduction of the Green Bank Telescope, and I was hoping to share my experience with Pulsar Search Collaboratory, or as more people know it as, PSC. I have been a budding astronomer for a long time. The efforts that PSC have finally given me the opportunity to use a real telescope for a good cause -- Finding pulsars. I've been very heartbroken about this news, and I believe that the GBT should remain fully funded, if at all possible. It opens a lot of doors for armature astronomers such as I, and I believe that it is invaluable in terms of teaching.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	
152	a	Tommy	Veltri		Please keep the Observatory open. It's a great place!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
153	a	Katharine	Gage		I am a 9th grader at The Derryfield School in New Hampshire and a member of the Pulsar Search Collaboratory as a club at school. I heard that the Green Bank Observatory is needing to cut funds for some things, and I am writing to encourage you to not cut the Pulsar Search Collaboratory's funds or telescope time, because of the huge impact it has made on me and my fellow high school students. I came into PSC with an interest in science and astronomy, but I didn't even know what a pulsar is! In a few short weeks PSC has taught me a ton amazing information about Pulsars and other things in the sky. I really hope this continues! Thank you very much for your consideration!!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	
154	a	Doug	Currie		I am in my late 50s and have been interested in astronomy and space exploration all my life since I was about 5 years old and learned to read. Although I live in Canada I still strongly support science, especially astronomy and other basic science especially in the United States or Canada. One leading astronomical facility in the United States that I continue to be inspired to both in its characteristics and its past and potential future discoveries is the Green Bank Observatory Robert C. Byrd Green Bank Telescope (GBT). I continue to find the GBT a very impressive instrument with an unobstructed 100 meter diameter dish that is fully steerable and that it can view 85% of the astronomical sky. I am also impressed that it has recently upgraded sensitivity to radio signals over a wide range of radio frequencies from 0.1 to 116 billion Hz. However I am saddened about the possible danger that it could be forced to end or at least limit its science operations due to funding challenges at the National Science Foundation (NSF) that has an ongoing hearing to reduce NSF funding for science operations of Green Bank Observatory perhaps as soon as the end of this year. I think it is very important to continue to make use of this recently and continually upgraded leading astronomical observatory to maintain American leadership in astronomy or space related research and that at a total operating cost of only about \$10 million a year that is small change compared to the couple trillion dollars a year of the total US federal budget with many of those other items not having nearly as much profound or practical application per dollar spent. I also think it is important to continue science operations of GBT to take advantage of its unique setting of being in the centre of the United States National Radio Quiet Zone where there is a minimum of interference from other radio sources such as computer wi-fi, cell phones etc. that are very prevalent elsewhere in North America and many other parts of the world these days. It would be good to continue science operations of Green Bank in order to maintain the significant number of astronomy related science positions and employment at GBT as well as some of the tourist revenue focused on it as one of the leading active astronomical observatories in the world. Although it wasn't with the GBO Robert C. Byrd GBT, it was at GBO that in 1960 leading SETI astronomer Frank Drake conducted one of the first serious science Search for Extraterrestrial Intelligence (SETI) with Project Ozma from the star systems Tau Ceti and Epsilon Eridani. Although this search ultimately didn't find any relevant positive signals both those stars have since proven to each have some planets with some around Tau Ceti likely being terrestrial and at least close to being potentially habitable. I heard that GBO's 42 meter radio telescope was used by University of California Berkeley astronomer Donald Backer around 1993 to find evidence for a super-Jupiter planet around the double white dwarf and pulsar system PSR 1620 -26 that showed there could be gas giant as well as terrestrial planets around pulsars. I also heard that GBO was used for some time to conduct the Project Phoenix SETI search. One important area I heard the Robert C. Byrd GBT has conducted world leading research is in the discovery and gaining further information about interstellar organic or inorganic molecules including the first detection in 2008 of the first pre-biotic molecules and in 2016 of the first detection of a chiral or handed molecule in the interstellar media that are important for life on earth. I heard that GBT also continues to play a leading role with research in finding more information about pulsars including the cutting edge science area of how this could relate to some types of gravitational waves. I also heard GBT continues to have a leading and irreplaceable world role in the research areas of Pulsars and Compact Objects, Dark Energy, Evolution of Physical Constants, Galaxy Formation, Evolution of Galaxy Clusters, Black Holes & The Hubble Constant, Growth of Evolution of Galaxies, Star Formation, Solar System Studies and Interstellar Organic Chemistry. Will you please vote to allow GBT to continue these and other including open observing leading edge radio astronomy observing by voting for continuing science operations of GBT with collaborators such as University of West Virginia, Breakthrough Listen and the Gravitational Wave project and thank you for recently maintaining science operations of Arecibo that is sometimes in interferometry projects with GBT.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/27/2017	
155	a	Paul	Kamienski		This email is a follow up to the comments on the draft EIS for GBO that I submitted to NSF on 11/25/17. The recent article in the Pocahontas Times newspaper on 11/16/2017 described Senator Manchin's letter to the Director of the NSF indicating the importance of the GBO facility to the scientific community. He noted that cutting-edge scientific results continue to be obtained with use of GBO facilities, with over 30 scientific publications just in 2017 based on work at the Observatory. Recent research includes the groundbreaking work on gravitational waves. Two white paper articles by the scientific community that were referenced (J Bally et al, and FJ Lockman et al) described the uniqueness of the facility and how it is being used now and will be in the future for important and relevant scientific research. The Lockman white paper in particular indicated that the 2012 AST Portfolio Review, which in large part is the basis for the currently proposed actions on GBO / GBT, is dated, and does not reflect recent progress and improvements. It also points out that modest improvements in complementary equipment would make it an even more valuable and unique tool for astronomical research. Senator Manchin requested a separate public meeting or videoconference with the scientific community so that they can provide input on the importance of the facility and the impact on their research should the proposed changes be implemented. I fully support the concepts and recommendations in Senator Manchin's letter including the proposed public meeting with experts from the scientific community in order to ensure that any decision is based on current facts.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/27/2017	

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156	a	Paul	Kamienski		I have read with interest the Draft Environmental Impact Statement Report (EIS) for the Green Bank Observatory (GBO) released on 11/9/17 and I look forward to hearing more at the public information session scheduled for 11/30/17 in Green Bank. I was pleased to learn that the "Agency Preferred Alternative" is Action Alternative A: Collaboration with Interested Parties for Continued Science and Education-focused Operations with Reduce NSF Funding. I support continuing research at GBO as I strongly believe that this is the best alternative for the scientific community as well as for the residents in Pocahontas County and for West Virginia overall. Listed below are specific comments on the report and the alternatives that are under consideration. While some of these comments may not be directly relevant to the Draft EIS, I believe that they are important to the decision and need to be addressed and the results shared with the public prior to any final decision. 1. Draft EIS Report is Thorough and Well Written - In addition to assessing the usual, air, water and soil environmental issues, the draft EIS also considers historic preservation and socio economic issues. A significant amount of environmental data were obtained and documented, and input was solicited and collected from a wide variety of affected groups and agencies. The report was well organized, well written, and included the more detailed information in the appendices. 2. Overall the Environmental Results Were Positive - No major environmental issues that would require costly correction or remediation were identified (e.g. contamination of ground water or wells, excessive run, major soil contamination). This is particularly important for continuing research operations in Action Alternative A, as significant added costs would be problematic to continued funding options.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/25/2017	
156	b	Paul	Kamienski		3. NSF / AST Budget Considerations – A significant NSF / AST budget shortfall has been highlighted as the driving force for considering alternate approaches for future utilization of GBO as well as for conducting the current EIS. However, the reports that were referenced in the Purpose and Need (Section 1) indicated that the overall AST budget, while it would not meet the desired significant annual increases to fund proposed new facilities and programs, was projected to be flat in inflation adjusted dollars for the next decade, i.e. a slight increase in real dollars. The significant budget shortfall results largely from adjusting priorities with significant increases for some facilities and programs and significant reductions for others like GBO. I understand that the assessment of the various facility capabilities was done in 2012, while substantial enhancements have been made to the GBO since that time. Since the impact of discontinuing research at GBO which continues to operate effectively and produce solid scientific results with some unique capabilities as recognized by the scientific community would be significant, a reexamination of these budget reallocations and priorities based on current facility capabilities appears warranted. These updated results should be integrated into any collaborative funding plan, both in terms of the amount of reduced NSF funding and timing for implementation.	Considerations for Document Analysis	Purpose & Need	Written Comment	11/25/2017	
156	c	Paul	Kamienski		4. Action Alternative A to Continue Research with Collaborative Funding is distinctly different from the B, C D "going out of business" alternatives but it is not treated as such in the report. Alternative B for converting the facility to a technology or education park or museum is a significant change; but it is not clear if this has been thought through or how effective this would be. If research is no longer conducted and the scientific experts have moved on to other locations, the positive and direct impact that they have on students at local schools and WVU as well as in promoting STEM activities and careers in WV is lost. Experts can describe their work and accomplishments, inspiring bright students who are considering STEM careers, while docent tour guides cannot. This loss would be particularly acute in rural Pocahontas County but would impact WV overall. Alternative C, mothballing the site would be the next downsizing step but after a while the cost to maintain the facilities and the site would become prohibitive and lead to Alternative D dismantling and restoring the site. Also, continuing operations per Alternative A may involve changes in research program priorities, and cost savings initiatives depending upon future funding scenarios, but describing dismantling of facilities and timing for this implementation is premature at best.	Considerations for Document Analysis	Purpose & Need	Written Comment	11/25/2017	
156	d	Paul	Kamienski		5. Social and Economic Impact on the Community is Understated – The largely statistical analysis that was presented based upon data and trends for population, median income, unemployment, housing costs etc. was interesting but failed to capture the major intangible contributions that GBO and their employees have on the community. The statistical analysis was also limited to the local area because the small numbers would be dwarfed by extending it to the Region or WV overall, thereby making the impact even smaller. It made me wonder if the large number of public comments submitted to NSF and recorded at the public information sessions at GBO (and included in the appendix) were understood and used in the analysis especially since they are not discussed in the report. There were a total of 817 total comments submitted to NSF which strike me as a large number for such a rural and sparsely populated area. Most were supportive of continued operation and only 1 (one) comment supported closure with the reason that it would reduce electromagnetic waves which is a perceived sensitivity for some people. A large number of people attended and participated in the public information session at GBO. The contributions to the local and scientific communities that were described by many people was extensive and quite impressive. However, I did not find these reflected in the analysis or report. Most reasonable and objective people would consider discontinuing research at GBO a major impact.	Considerations for Document Analysis	Socioeconomics	Written Comment	11/25/2017	
156	g	Paul	Kamienski		6. Agency Preferred Alternative: Continued Operation and Collaborative Funding Approach A - While Approach A is designated as the "Agency Preferred Alternative" in the report, there is no explanation as to why this is the case and what this means. Something more than a parenthetical reference is needed. It does suggest that quality research is being conducted, good results are being obtained, and the facility has worthwhile assets to the scientific community, but it would be better if a short explanation were provided with a reference to more detailed information.	Considerations for Document Analysis	Purpose & Need	Written Comment	11/25/2017	

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156	e	Paul	Kamienski		7. Plan forward for Approach A is not clear - While Continued Operations and Research with Collaborative Funding could be an attractive alternative, no information is provided in the report on how this would be achieved, e.g., specific action items with responsibility for accomplishing these over time. These action items would likely involve a schedule for implementation, identification of potential third parties (with a process for GBO / AST working closely together in this effort), and potential targets for % NSF funding for GBO.	Considerations for Document Analysis	Purpose & Need	Written Comment	11/25/2017	
156	f	Paul	Kamienski		8. NRQZ Impact. Although none of the Action Alternative in the report would include elimination of the National Radio Quiet Zone (NRQZ) (Section 1.3.4), if current operations and research were discontinued the need for the NRQZ would be reduced or eliminated, and it is not difficult to imagine that if a "quiet zone" is no longer justified, cell towers or other adverse projects would be approved, the NRQZ would eventually be discontinued. Once the NRQZ was compromised it would be very difficult to recover.	Considerations for Document Analysis	Purpose & Need	Written Comment	11/25/2017	
157	a	Christy	McDowell		Why would you want to close Green Bank Observatory? This facility is a jewel of the East Coast. It is well maintained, well-run, close to major cities, but isolated in the Appalachian mountains. The area is perfect for space monitoring, with the absence of cell phones, radio "clutter" and other "noise". Please keep Green Bank Observatory up and running to make new discoveries in our solar system.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/17/2017	
158	a	Charles	Sheets	President of Greenbrier Valley Economic Development Corp. in Maxwelton, West Virginia	Whereas, the Greenbrier Valley Economic Development Corporation, A West Virginia Corporation representing Greenbrier, Monroe, and Pocahontas counties, fully supports the mission of the Green Bank Observatory in Green Bank, WV. The Green Bank Observatory is the world leader in advancing research, innovation and education in radio astronomy, which includes eight telescopes including the Robert C. Byrd Green Bank Telescope (GBT). The Green Bank Observatory currently employs 105 full-time and 50 part-time seasonal employees, with 55% of the staff being natives to Pocahontas County, WV. The Green Bank Observatory's vast educational programs included more than 3,500 student's participation last year. \$25,000,000 has been invested in the past five years by colleges, universities, the National Science Foundation and the state of West Virginia with 5-15 universities participating in the Site Technology Development Program at any given time. The Green Bank Observatory is visited by approximately 50,000 visitors each year. Whereas, the Greenbrier Valley Economic Development Corporation recognizes the past performances of the Green Bank Observatory dictates future results. The Green Bank Observatory partnership with the local school district would continue to provide a unique and comprehensive educational opportunity not found in any other rural locations. The Green Bank Observatory facility, along with knowledgeable staff, offers a multitude of opportunities for classroom, auditorium, conferences, and many other uses and functions. The GBT unique features have not been replicated by any other telescope: extreme low and high frequencies, combination of sensitivity and sky coverages for timing and finding pulsars. With this technology, more than 100 teachers and over 1,000 students from 18 states have participated in The Pulsar Search Collaboratory and identified 6 new pulsars. Whereas, the Greenbrier Valley Economic Development Corporation met for its regular scheduled meeting held on Thursday, November 16, 2017, and passed the following resolution. Now, therefore, be it resolved that, The Greenbrier Valley Economic Development Corporation renders a strong public opinion of continued operations and full NSF funding (Original No-Action Alternative) of the Green Bank Observatory facility in Pocahontas County, WV which has proven its endless assets to the state of WV and the nation in scientific research, education, and economic benefits. No alternative reducing operations beyond Alternative A in the Draft EIS should be considered.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public meeting comment)	11/17/2017	
159	a	Megan	DeCesar	Lafayette College	I am writing to urge the NSF to adopt either option A (Collaboration with interested parties for continued science- and education-focused operations with reduced NSF funding) or option E (No-Action Alternative: Continued NSF Investment for Science focused Operations). My preference would be for option E, as I think this option would lead to maintaining the most open skies time. I am a member of two pulsar timing array (PTA) collaborations, the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) and the International Pulsar Timing Array (IPTA). We rely on the GBO for our science. Gravitational wave (GW) science is just emerging as a new field in astrophysics with the recent kHz detections from LIGO. PTAs will open a new window on the GW spectrum, at nHz frequencies. While LIGO detects GWs from binary stellar-mass black holes and neutron stars, PTAs will detect GWs from binary super-massive black holes (SMBHs) at the centers of galaxies. The detection of nHz GWs, and measuring the shape of the stochastic GW background from SMBHs, will provide information about SMBH masses and environments, important for answering the long-standing questions of (a) how SMBHs form and evolve with their host galaxies, (b) whether the final parsec problem can be overcome, and (c) what environmental factors drive binary SMBHs to sub-parsec distances. Low-frequency GWs are also probes of cosmic strings and inflation-era astrophysics. GW science with PTAs thus has little overlap with science from LIGO. We expect to detect a stochastic GW background in the next few years, and to detect one or more nearby, individual SMBH binary systems within roughly ten years. We have long timing baselines (up to almost 13 years) built up for around 60 pulsars; these data will be difficult to use if we stop observing now. It is possible we would need to just start over completely if/when a new observatory becomes available. (We cannot use Arecibo for the pulsars that we time at Green Bank because Arecibo has much less declination coverage.) Of the three PTAs that make up the IPTA, NANOGrav is the most sensitive, contributes the most to the IPTA, and is likely to make the first detection. Losing the GBO would result in the US losing its leading role in the nHz-frequency GW community. In addition to these PTAs, I also use the GBO for other research projects, in particular pulsar searching (e.g., of Fermi-LAT sources, and in the large-scale Green Bank North Celestial Cap pulsar survey) and studies of pulsars in globular clusters. Much of this work could not be done without open skies time at the GBO. I have many colleagues who use the GBO for a variety of projects, for example high-frequency observations of star-forming regions, or to complement interferometric observations. Some people seem to have the impression that the radio community is moving to using solely ALMA and eventually the ngVLA, but in conversations with a number of people from different fields, it has become clear to me that the GBO continues to be an important observatory for a wide range of subjects in astronomy. For this reason as well, I feel that it is very important to keep enough open skies time.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
159	b	Megan	DeCesar	Lafayette College	I want to also point out the incredible amount of valuable, high-quality education that goes on at the GBO. I got my start in radio astronomy by attending a summer camp at the GBO as an undergraduate. Then as a graduate student, I helped with a similar research camp for undergraduates that was held at Green Bank. The students had a great time, learned a lot, and left the camp excited to pursue research at their home institutions. More recently, I've become involved with the Pulsar Search Collaboratory, in which high school and college students search for pulsars in Green Bank data, and additionally participate in a mentoring program. This program has expanded to many universities, and is reaching a lot of students, especially non-traditional students. A significant number of those high school students go on to major in STEM fields in college. A number of my colleagues are also involved in the twice-yearly observer training programs held at the GBO; while these are for observers, they reach a large number of students, because (at least in the pulsar community) so many students are involved in observing through their research projects, physics clubs, etc. I know there is a ton of other education and outreach that is also done at the GBO. This is something that would really be a shame to lose, because it is positively impacting so many students' lives right now. Finally I want to mention that within the NANOGrav collaboration, there has been a real push to improve the culture within our sub-field of astronomy. This means that we have addressed, and are continuing to address, issues like harassment, inclusivity, and diversity. If the GBO is lost, our collaboration will struggle a lot more and have to cut out things that are not seen as absolutely necessary. I worry that efforts like these to continue improving our working environment will fall by the wayside. In conclusion, I hope the NSF will choose either option A or E. I think it is really important to continue using the GBO toward the detection of nanohertz-frequency gravitational waves, and to maintain open skies time for all observers and all areas of astronomy.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
160	a	Bill	Mullin		Thank you for the opportunity to provide my comments regarding the National Science Foundation's Intent to Prepare a Public Impact Statement regarding the operation of the Green Bank Observatory in West Virginia. I retired from Merck and Co., Inc. after 37 years as the Vice President of Global Vaccines and Sterile Quality Operations and currently volunteer at the American Museum of Natural History in NY as an Explainer in the Rose Center for Earth and Space and a Tour guide and Docent hosting, in part, the five million visitors annually from all over the world. I have had a great interest in Science throughout my life and obtained a M.S. Degree in Astronomy as part of fostering a greater understanding of science in people of all ages in my retirement. I have visited the Radio Astronomy Operations in Green Bank, WV largely through a professional development program for college teachers that has been coordinated through the University of Dayton (Chautauqua) multiple times over the last 10 years. In my opinion the NRAO Green Bank Facility, now the Green Bank Observatory, remains a vital and premier scientific research facility with the largest steerable radio telescope in the world (GBT). Because of its unique capabilities, the Green Bank Observatory is well suited to complement the ALMA facilities in Chile for the US Scientific Community in pioneering research and I believe given the pioneering research at LIGO, where gravitational waves were discovered; the GBT is at the forefront of modern astrophysics with its research focus and capability in pulsar observations using nano-HZ gravitational radiation. Additionally, the field of radio astronomy remains at the cutting edge of astronomical research and China has recently completed the largest fixed dish radio telescope in the world; Green Bank remains the newest and largest movable dish in the world and also is sited in a radio quiet zone, which is a very unique feature for continuing pioneering research at Green Bank. Additionally, the Green Bank Observatory plays a vital outreach role in advancing Science, Technology, Engineering and Math with students of all ages coupled with the thousands of visitors they host annually. Their educational camps, courses, Science museum and staff set the right path and commitment to have a profound impact on all visitors and students at the Green Bank observatory Campus. To risk or compromise the presence of this world class facility in the middle of very rural West Virginia, in my opinion would also be a devastating blow to the local community and region which I cannot quantify. In carefully reviewing the five options provided in the Environmental Impact Statement, I urge you to continue full funding of the Green bank site. budgeting at 100% levels by NSF while actively pursuing partnerships with other groups to create new areas of interest while offsetting costs of operation. It saddens me to realize the NRAO Facility created in Green Bank West Virginia in the 1950's was executed to ensure the United States role in Radio Astronomy research would narrow the gap that existed in the US vs other countries. Indeed, the leaders at that time took a long view with respect to pioneering scientific research and the benefits that follow. For 60 years, the team at Green Bank and their pioneering spirit has made wonderful scientific contributions to increasing our knowledge of the universe and did it in a way that also benefits the local community and state of West Virginia. Because of the importance of this facility to scientific research in the United States, I will be providing copies of my comment to our elected officials from the region and other Congressional representatives on science and appropriations committees. I sincerely hope that we do not close the book on the Green Bank observatory, given the wonderful chapters they have written in modern astrophysics of radio astronomy and the intensity of their outreach in Science, Technology, Engineering and Math for students of all ages.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
161	a	Becky	Rabel		I am writing to you to submit my comments regarding the Green Bank Observatory. I attended the meeting for approximately an hour before having to leave to pick up my child and was unable to voice my concerns. First, let me say, I have had family who have worked at the observatory, in fact, my dad passed away while he was still an employee of the NRAO at that time. I have had a sister that has worked there years ago. I grew up in the NRAO family. However, I believe the Green Bank Observatory has outlived it's usefulness for the following reasons. And is more of a money pit going nowhere and holding back progress in our county. The work that is performed at Green Bank can be performed in other countries remotely at a cheaper cost. That has been proven for many years. Seems like the Green Bank observatory is more of a money pit now. Quazars and new planets do not affect my life however being able to find a job does and I really at this point do not care what planet is discovered. Let me explain: Due to the Green Bank Observatory we live in a quiet zone or dead zone for cellphones and difficulty to even get wi-fi, in fact, cannot get it from our phone company at all due to the observatory. This is probably the largest damaging aspect of having the observatory here. Businesses do not want to locate here because like it or not we all depend on our cellphones for daily living and business. The inability to have cellphone service and wi-fi hampers the ability to work from home or even take online classes. I have spoken to different officials with our telephone company who have told me off the record that when the speed of the internet is working good for individuals it affects the observatory and has had someone contact them from the observatory to slow it down. The employees at the observatory say it is not true but there have been too many phone company employees in management that I have spoken to through the years that say otherwise. I have experienced issues where I have been unable to complete online classes due to the internet. My husband was self employed and we had to obtain his workload from online constantly had issues. Our issues had nothing to do with our equipment because they were all new devices. It also affects our local doctor offices who are having to go paperless and have everything stored online all due to the observatory. This is not the first time that it has been mentioned closing the observatory. It was discussed back in the 70's and 80's however the difference was then the Navy said they would take it over. Now, the Navy wants nothing to do with it which in itself says it is no longer useful. Our children in this county are being held back from advancing into the outside world on the same level as other children outside of this area. Most other schools outside of this area are bookless and relay on the internet. However, our schools are not able to get up to date due to the observatory and not being able to have the wi-fi and go bookless. This is an injustice to our children. My husband and as well as many others have to work out of town all week giving up time with their families in order to have a job to support their families due to the fact that businesses do not want to locate here because of the limitations. I have heard that the Green Bank observatory employees over 100 local people. That is false. It employees people that have a local address but they are not locals. They are people that are brought in by the observatory to work but most do not own a home here and therefore do not support out economy and pay taxes. Most live in observatory company houses provided to them and travel outside the area the same as I do to get things needed from larger metro areas because we have very little here due to the fact that business will not locate here. I would much rather give up those few jobs in exchange for businesses to come in and provide jobs for our community and it's residents. I know it would be more than the few that we have currently at the observatory.	For Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
161	b	Becky	Rabel		Due to the no cellphone ban here and the wi-fi we seem to be attracting people that claim to be allergic to electricity. I can appreciate people that have illnesses and I sympathize and I have experience in the medical field, however my sympathy ends when they come to my community and proceed to tell the few stores owners that are here that they need to turn everything off such as lights so they can shop or get their hair done or even one guy told a fellow who had a saw mill on his property to turn it off because it bothered him. The people are coming here all because of the observatory and the quiet zone. And yes these things have happened. I believe the Green Bank observatory site would be more suited for a community college so our residents would not have to travel almost an hour in any direction in order to get an education and our children could get some of their education locally. For individuals like yourself and others that live outside the area it is a fun trip to come to an area like this but you are able to go back to your cellphones, work and wi-fi. I have lived here all my life and have no plans of moving and my family is still here. Why should I be penalized by an facility that has outlived its usefulness. Lastly, let me say, I do not want this area to become a city however, the observatory has hampered our advancement in todays world and our community needs to be competitive. I really do not care about what is in space at this point when it comes to our living our lives and providing for our families on a larger level that is more important.	For Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
162	a	Timothy	Dolch	Assistant Professor of Physics at Hillsdale College	In this letter, I write with significant concern about some of the proposals for the future of the Green Bank Observatory (GBO) outlined in the National Science Foundation's "Environmental Impact Statement for the Green Bank Observatory, Green Bank, West Virginia" released on 8-Nov 2017. As a third-year faculty member at Hillsdale College, a small liberal arts institution in rural Michigan, I've spent significant time and energy with a team of 21 undergraduate researchers. These bright young men and women have learned to remotely operate the Green Bank Telescope (GBT), making a fantastic contribution to our gravitational wave (GW) science collaboration, the North American Nanohertz Observatory for Gravitational Waves (NANOGrav). Hillsdale students were the first undergraduate observers in our nation to obtain regular timing data for NANOGrav, which is a long-term dataset that will result in the detection of long-period GWs. Their contribution has not gone unnoticed in the field, resulting in their co-authorship on NANOGrav publications. In addition to these 21 students, many other interested young people, both undergraduates and high school students, have come by to watch a live Green Bank observation. One such high school student who went on to become an undergraduate here at Hillsdale attended the Pulsar Search Collaboratory (PSC) at the GBO for a week in the summer. The PSC is an unparalleled effort from WVU to reach out to high school students allow them to observe and discover pulsars, and the experience was life-changing for him. In the wake of the LIGO Collaboration's announcement of the first direct GW detection, my students were thrilled to be part of the GW field. They are not unaware of some of the current proposals being put forward for the facility's future. Mothballing, deconstruction, or otherwise ramping down Green Bank's science-focused operations is perplexing to them, coming at the very moment when the GW sky has opened up. Unfortunately, all I can currently say is that I am as perplexed as they are. The result of these research experiences has been the formation of concrete plans for my students' future STEM careers. Some of them have successfully applied to graduate school in physics (one at MIT now); others want to incorporate their experiences into future teaching careers. Hillsdale College is amongst the lowest-tuition top tier liberal arts schools in the country. As a result, not a few students with whom I have interacted come from disadvantaged socioeconomic backgrounds.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	http://arxiv.org/abs/1210.5998
162	b	Timothy	Dolch	Assistant Professor of Physics at Hillsdale College	The experience of using a world-class radio telescope, as part of GW science, the most groundbreaking subfield of astrophysics, is simply irreplaceable. The irreplaceability of the GBT is even more apparent at Hillsdale College than at the other liberal arts colleges associated with NANOGrav. Our institution does not receive federal funding, and providing research experiences through individual AST grants is simply not an option. NANOGrav also observes with the Arecibo Observatory, but the GW detection effort requires both telescopes (http://arxiv.org/abs/1210.5998), and has had a long history of student involvement through the various ARCC (Arecibo Remote Command Center; later expanded to include the GBT) institutions, a list which now includes Hillsdale College. While our institution is a unique case with regard to federal grants, we are a living highlight of the fact that the GBT's benefits are society-wide, and not limited to those immediately awarded funding for research. Large radio telescopes are being built in other parts of the world – namely, the FAST telescope in China and the Square Kilometer Array (SKA) in South Africa. It has been at times pointed out that these telescopes could continue the GW detection effort. However, US involvement and access to data is not a given. Additionally, FAST is still years away from regular operation, and in the case of the SKA, the telescope's construction has become less certain due to austerity measures in Germany, one of its principal consortium members. Clearly, the socioeconomic benefits within the US have no parallel at these future telescopes, even if the uncertainties about these facilities were resolved. If anything, the case of FAST demonstrates a desire for nationalistic competition, sparked by the success of US radio astronomy, for which the GBT is the key facility. To summarize, the socioeconomic impact on society through student involvement with, and inspiration from, the GBO should not be underestimated. This is especially the case when, through the efforts of NANOGrav, the GBT has become a gravitational wave detector at the fraction of the cost of LIGO. Nationwide, it should not be forgotten that many students touched by GBO are from disadvantaged backgrounds or groups, and frequently from West Virginia itself. While other large radio telescopes are indeed being built around the world, it is very unlikely that students at many smaller US institutions like mine would have any chance of involvement. While the option of transitioning the GBT to an education focused role is admirable, the reality is that serious STEM education is only possible if students are truly involved in cutting-edge research such as pulsar discoveries and gravitational wave detection. The only feasible option is the No-Action Alternative.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	http://arxiv.org/abs/1210.5998
163	a	Diane	Schou	Resident of Green Bank	Please continue to support the Green Bank Observatory. Measuring and monitoring electromagnetic radiation is valuable in astronomy. Measuring and monitoring electromagnetic radiation also has value for identifying effects to animals, plants, soil, and humans in the Earth's environment. Being overexposed to non-ionizing radiation from a cellphone tower (base station) harmed me. Getting radiation sickness or microwave illness has become a growing problem around the world that is not dependably corrected by medicines, pendants, or brainwave training. An environment with no exposure is the proven cure. Indirectly, having an environment as a White Zone, helps people harmed by electromagnetic radiation. These people can help the observatory by detecting illegal frequencies and are willing to help the observatory keep the radio quiet zone quieter. To close the radio quiet zone will be assigning people to a life of painful headaches, heart problems, vision problems, memory problems, poor moral judgments and more. Please continue to support the Green Bank Observatory. The radio quiet zone environment is priceless. It can never be replaced.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
164	a	Ruthana	Beezley	Business Advisor, WV Hive	Please fully fund the Green Bank Observatory. It is an asset to our local, state, regional and national economies and educational systems. Economy and education are vital in our recovery, even more so here in Appalachia. Thank you for your consideration.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
165	a	Maura	McLaughlin	Eberly Family Distinguished Professor, NANOGrav Chair and PFC Co-Director, Dept. of Physics and Astronomy, WVU	I am writing in response to the Green Bank Observatory (GBO) draft environmental impact statement released on November 9th. I am heartened to hear that the Observatory will remain operational and urge you to fund the telescope at levels that will allow a majority of the time to remain available to open skies proposals. I have been a user of several telescopes at Green Bank for over 20 years and have taught at West Virginia University (WVU) for over 10 years. A severe reduction in the time available on the GBT for open skies observations would have serious and far-reaching consequences on the international astronomy community, but in particular for students in the state. Five of the six astronomy faculty in the Department of Physics and Astronomy at WVU use the GBT for their research, in addition to several faculty in the Department of Computer Science and Electrical Engineering. Together, we are members of the Center for Gravitational Waves and Cosmology, one of less than a dozen research centers on campus. We bring in well over \$1M in grants a year for work related to the GBT and involve roughly 15 graduate and 20 undergraduate students in research with the GBT. If we would lose access to the telescope, it could quite possibly signal the end of our research Center and these student opportunities, and would greatly diminish the overall research competitiveness of WV and the state as a whole (there are very few large research programs with comparable levels of federal funding). It is important to note that the telescope is far from the end of its scientific lifetime. It remains one of the most sensitive radio telescopes in the world and is becoming continually more so with NSF-funded instrumentation development. In addition, WVU has put considerable effort into developing outreach programs using the GBT. Together with GBO, we manage the Pulsar Search Collaboratory, which involves students in WV and throughout the US in searching for pulsars in GBT data. Over 2000 students have participated in this program since 2008! Evaluation shows that they gain self-efficacy and are far more likely to go into STEM careers because of their experiences. This is especially important for students in rural areas of WV who may not be exposed to hands-on STEM research at their schools. However, this outreach program is dependent on the GBT continuing to be available both for search data and for follow-up of possible pulsar discoveries. The program simply could not exist without the telescope. The experience of helping to operate the largest and most sensitive telescope in the US really cannot be underestimated! (Please see our documentary 'little green men' to see this firsthand!) Finally, we own a cabin and land in Pocahontas County and have gotten to know many local residents. I urge you to ensure that the swimming pool and recreation areas at GBO remain available to these community members. Keeping these facilities operational may seem like an unnecessary expense, but they are incredibly important for rewarding a community that makes significant sacrifices to support the telescope and the work being done there. The pool also provides summer jobs to students, encouraging them to come home, stay involved in their communities, and, maybe, eventually invest back into Pocahontas County.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
166	a	Ollie	Lehki		Hello. I would like to urge you to not close the Green Bank Observatory. It is a key telescope used in studying space-related phenomena and the closure of the telescope will mean the loss of years of future data and discoveries. West Virginia already lags behind the rest of the country in STEM-related studies and to take away the telescope would set West Virginia at an even larger disadvantage. Please consider Option A and continue funding the telescope with reduced costs to NSF.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
167	a	Teresa	Goddard		I am asking that the NSF to restore full (100%) funding and retain full ownership of the Green Bank Observatory. There is important work for this facility to do and it is a valued part of the Mountain State.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
168	a	Darrell	Smith		I am writing this note on behalf of my wife and myself to Advocate for restoration of full funding of the Green Bank Observatory by the NSF. This facility is a invaluable asset to the scientific community of the entire world due to its unique capabilities. Additionally it is of utmost importance to the educational opportunities of students and professionals that can conduct research that are provided through such programs as Open Skies, STEM, PING and OSRT programs. GBO and all the staff also represent our state with a view that counters the stereotype often attached to WV. The GBO generates much needed monetary resources and goodwill for all those who visit and/or learn about this facility. Over the years some of the most distinguished professionals have been part of its history. Please restore full funding to the GBO!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment		
169	a	Jan	Jonese	Resident of Green Bank	I am an English teacher for the Pocahontas County School District at Marlinton Middle School, and I am writing to reiterate the employment and educational importance of the Green Bank Observatory to our county and state. My husband and I have four children that we have raised in Green Bank, his family was employed at the NRAO throughout the 60's and 70's, and my grandfather was a machinist at the facility for many years, also retiring in the late 70's. Throughout high school, our children worked summer jobs at the GBO as lifeguards and groundskeepers. They learned many valuable skills in these positions and the income was extremely helpful for their college expenses. The facility has a wonderful history of providing much needed employment in our county as well as phenomenal education experiences for our children and now for my students. Each year, my colleagues and I bring our 8th grade students to the GBO for a field trip where they tour the facility, complete an educational scavenger hunt in the Science Center and participate in educational science games. The GBO also hosts the county Science Fair in which many of our students compete. These activities inspire our students to consider and often pursue higher education in STEM programs that they never would have if they had not had the opportunity to visit the GBO. This facility has so much potential for our young scientists, it would be such a waste to let it slip away! I urge you to please fully fund the GBO and give our future scientists and astronomers the opportunity to experience the largest movable telescope and the technology available at the site.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
170	a	Jim	Cordes		The Draft Environmental Impact Statement for the Green Bank Observatory implies that NSF's preferred option A is 'collaboration with interested parties for continued science and education-focused operations with reduced NSF funding.' It is also stated that this reduction comprises the purpose of the proposed action. The reduction is offered as a fixed, immutable boundary condition on the actions for the GBO. The Report describes the histories of reviews that have led to the current situation and it is stated that 'GBO's science capability is lower in priority than other science capabilities that NSF funds.' My view is that it is an enormous mistake to put the GBO's future in jeopardy by taking a rigid view about allocation of the NSF's resources as prescribed by reviews that took place some time ago. First, the initial review (the Senior Review) is now more than 12 years in the past. The scientific landscape has changed dramatically with the discovery of fast radio bursts (FRBs), whose study requires large collecting areas like the GBO (and Arecibo). Also, the GBO plays a key (that is, a necessary) role in NANOGrav's gravitational wave science and the sampling of the gravitational wave spectrum at frequencies inaccessible to other methods. NANOGrav was formed in the second half of last decade and has high visibility in the worldwide scientific community. Its operations under an NSF Physics Frontiers Center attest to the value put on this area of science by the science community. Data from the GBO are used by NANOGrav and also by the International Pulsar Timing Array Consortium, of which NANOGrav is a part. The GBO data represent a prominent contribution from NANOGrav to the IPTA and as a quid quo pro we gain access to similar timing data obtained with foreign telescopes. Reducing NANOGrav's access to GBO time will negatively impact NANOGrav's status within the IPTA. The Report also downplays the impact that reduced access to the GBO will have on the broader community both inside and outside West Virginia. Numerous students (high school to Ph.D. students) benefit from citizen science projects, workshops for teachers, training of students in telescope operations, data analysis workshops, and scientific meetings that take place at the GBO and that are successful because the GBT and other telescopes are present and are used in active, forefront scientific projects. Ph.D. students from around the country (and, indeed, worldwide) benefit from the hands-on training and from the data obtained at the GBO. This is certainly true for my Ph.D. and undergraduate students at Cornell University. The kind of training available at the GBO is qualitatively different from that obtainable at, say, the VLA and ALMA where there is no access to the hardware. Removing or reducing access to the GBO runs counter to infrastructure projects in other countries that are building large-aperture radio telescopes that at best will only match the capabilities of the GBT. The Chinese FAST telescope has a larger aperture, but with vastly reduced frequency coverage and pointing capabilities. The Chinese are also developing a GBT-class telescope that may match the broad specifications of the GBT but not for a number of years from now. U.S. scientists will likely have some access to these telescopes but nothing like they currently have with the GBT and Arecibo. Reducing access to the GBT will negatively impact the U.S. scientific community and is in the direction of making it less competitive in the global arena. The GBO is also a special resource because it resides in the Radio Quiet Zone. Jeopardizing the existence of the RQZ is the wrong direction to take. The GBO, and the GBT specifically, in the RQZ is simply too valuable an infrastructure resource to not make use of fully and efficiently.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
171	a	Mali	Minter		The EIS draft mentions that in 2006 an NSF study stated that the GBT was possible over funded. It is my understanding that the 2006 report had severely incorrectly reported the construction costs and a more extensive review was done. In addition, it was my understanding that the site was actually very underfunded. I cannot find the "more extensive" report" from the review anywhere. Could you please tell me what the results were? Also, where can I read this review?	Considerations for Document Analysis	Purpose & Need	Written Comment	1/8/2018	
171	b	Mali	Minter		The EIS draft mentions housing and the impact to the community. There will be a huge impact to the community and I believe the EIS was not using their facts correctly. Pocahontas county is the most rural county East of the Mississippi. It is roughly the size of the state of Rhode Island, but there are fewer than 9000 people. Yes, there are counties with less people, but not when you divide it by person per acre. If the NSF were to shut down or choose one of the options where most of the staff were let go the housing crisis would be terrible. Roughly 100 employees, about 3/4 living off site. So 75 homes up for sale? Not likely to work out well.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/8/2018	
171	c	Mali	Minter		In the same vein, I do not think the health and safety impact was taken into full consideration. Without the Green Bank Site the local fire house would not have the access to the water for their fire trucks nor would they have many of the people available to support the local fire station and EMS staff. The impact on the schools, the students, the businesses is catastrophic. The NSF needs to not only go back to full funding of the Green Bank Site, but more than full funding since apparently it has been underfunded.	Considerations for Document Analysis	Health and Safety	Written Comment	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
172	a	Joanna	Burt-Kinderman	Math Coach, Pocahontas County Schools	I am a math teacher and teacher educator for the Pocahontas County School District, and the mom of two budding scientists, 8 and 10. I have procrastinated writing this letter. I've been procrastinating because it would take too long to say all I want to say about the impact Sue Ann Heatherly, the education outreach director at GBO, has had on science teaching in this state and country, and on my own dreams. Her partnership has brought new possibilities to one of the most rural school systems where we have grown extraordinary math proficiency in one of the most poorly performing states in the country. Sue Ann and I are dreaming big together - working on projects to advance networks of first generation STEM scholars and dreaming proposals to train STEM teachers at GBO in the nest of real science. I have procrastinated because it would take too long to describe the possibilities software engineer Ray Creager has opened for our high school and students with his awesome commitment to teaching computer science on a weekly basis to teachers as well as kids, allowing our little district to be paving the way for new possibilities for students and for our entire region's economy. It would take too long to describe what it means to have a facility of this import in our back yard, where each year, we take an entire county's worth of 9th graders for an immersive day inside the workings and wonders of GBO, where we host our math field days and science fairs with real scientists. Our students, whose ancestors have sacrificed our forests and our mountains to the improvement of the country and the detriment of our own health, can imagine themselves as other without being gone. I'm not one to speak of the import of the telescope. You have plenty of people who can do that. But know that GBO is a dream-catcher and a dream-maker in a state that has given far too much - in coal and soldiers and chemicals - to the betterment of this great country. Where there is any question, the nation should return its debt to West Virginia. One of the best ways to do so is to ensure that resources are available to grow our own tomorrow. The best tomorrow that I can envision for my girls' future is one where science can help us grow industry that keeps our waters clean, and can sustain the vibrant community, culture and people in these hills, where we sit atop some of the most promising geothermal reserves, where we are a headwaters of seven major rivers and all water that is here comes from the sky, only to flow outward, where we are one of the few places relatively immune to climate change in the future. We deserve a chance to become other without being gone. Please fully fund the Green Bank Observatory, for a vibrant future for Pocahontas County, for West Virginia and for our country.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
173	a	Rachel	Tompkins		As a retired educator in Pocahontas County, I endorse these comments (referring to Joanna Burt-Kinderman). The benefits of the Observatory flow not just to science now but to the generations locally who benefit from this marvelous facility and the talented scientists who reside in our midst.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2017	
174	a	J.T.	Arbogast	Filmmaker	I am writing to voice my support for the continued NSF investment for science-focused operations in the Green Bank Observatory. While I grew up in Pennsylvania, most of my family still resides in Pocahontas County. My mother and father met at Green Bank High School and, growing up, most of my summers and all holidays were spent back "home" in Cass, WV, where my wife and I still have a residence. I grew up in the 80s at a time when space exploration was hugely popular. Every kid wanted to be an astronaut. And, as a child, I always thought of the observatory as this incredibly special and secret place in my family's backyard with "a telescope the size of a football field". It wasn't until it came up as part of the discussion in my 5th grade science class that I began to realize just how famous it was. I remember so many moments...seeing the flashing light at the top of the scope at night or noticing the position change or taking bike rides with my cousin down to the base of the telescope...each time looking up into the sky and thinking, "I wonder what they're hearing today?" At a time when more and more devices are forcing our children to look downward into a small screen, it's more important than ever to provide opportunities for them to look up...to think beyond the world that they see in front of their eyes. In today's world, as we prepare the next generation of citizens, it's become more important than ever for our students and teachers to experience science and technology in ways that textbooks will never offer. GBO continues to provide (not just to the students in our small community, but to the state and region as a whole) an incredible opportunity for students and educators to work directly with world renowned scientists and engineers on STEM projects that will inspire and prepare them for the opportunities, challenges and discoveries of tomorrow. Having had the chance to really get to know the team over there as an adult and hearing about the incredible things that they are doing, meeting some of the visiting scientists from around the world who chose this place to advance their research because of the tools and technology at their fingertips. I think that speaks volumes to the GBO's importance to the global science community. Having heard the comments from current students and scientists at the public hearing in November, I know that you will likely have more detailed comments from others on that front. But, it's more than that. The Green Bank Observatory is a vital part of the local community and the impact that closing this facility would have on the region from the loss of jobs, emergency services, educational programs, community organizations and development would be devastating to a state that has forever given its resources. Not to mention the economic impact of losing one of the areas most popular tourist attractions. Revenues generated from tourism in the state of West Virginia would suffer as over 45,000 people visit, purchase tickets, food, and fantastic gifts and educational resources in the gift shop – all purchases providing additional tax money to the bottom line for West Virginia's income. It is estimated that the Green Bank Observatory contributes close to \$30 million to the local and state economies. In reality, where the NSF debates cutting funding, it seems to me that, given the incredible history of the GBO, the current state of the world and the potential for continued development and discovery, the NSF should be considering increasing funding and support of additional GBO facilities and upgrades. As other countries around the world are increasing their investment in science and technology, we need to determine if we are going create opportunities for breakthrough discoveries and STEM education initiatives. I think we do. It is my opinion that the NSF must fully fund the Green Bank Observatory to allow for the continued groundbreaking research and discoveries by some of the world's greatest minds, for the continued growth and prosperity of a community nestled away in the mountains of West Virginia, and for the continued inspiration of every young person who sees that telescope for the first time and asks the question, "I wonder what they're hearing today?" Thank you for your consideration.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
175	a	Felix	Lockman		Comments on the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory (GBO). While the DEIS is rich in detail and covers a wide range of topics, it has two fundamental problems: 1. In several places it contains statements that the "community has repeatedly recommended NSF divestment from GBO..." This is at best incomplete, and at worst patently false. Most of the "recommendations" referred to are anodyne statements that the NSF should close old instruments. They do not explicitly refer to the GBT, which, in fact, is one of the NSF's newest telescopes. This also ignores statements of community support for the GBT, e.g., the recent "White Paper on Nuclear Astrophysics and Low Energy Nuclear Physics" (Arcones, A. et al. 2017, Progress in Particle and Nuclear Physics 94, 1) which states "Continued operation of the Green Bank Radio Telescope is also important for observations related to neutron stars and the nature of dense matter and its equation of state." Moreover, as the bias of the Portfolio Review becomes more and more evident, and as the community becomes aware of the enormity of the consequences of the Portfolio Review's recommendations, community pushback is growing (e.g. McLaughlin et al. 2017, Nature Astronomy, 1, 808). To claim, with confidence, that "the community has spoken", is false.	Considerations for Document Analysis	Purpose & Need	Written Comment	1/8/2018	Numerous articles
175	b	Felix	Lockman		2. The Agency Preferred Alternative A, is presented in a very misleading and incorrect way. In fact, it would be devastating for U.S. science. Alternative A imagines that there are Universities or other organizations who have enough money to fund operation of a radio telescope for astronomical research. The closure of one after the other University-based radio facilities shows that this is false: U. Mass, Univ. Michigan, BIMA, the CSO and now CARMA are examples. In fact, the NSF began support of radio astronomy because the facilities were beyond the means of any individual University to support (see the documents reprinted in in "Because It Was Fun: The first forty years of radio astronomy at Green Bank, 2007, NRAO). The DEIS does not give a single example of a University that could fill the funding gap caused by the reduction in NSF support, and that is because there are no examples. This leaves use of the GBT by commercial interests, acting either on their own or as contractors to the Federal Government. Here again, the consequences would be devastating for science. The requirements for an antenna to be useful for open skies radio astronomy are vastly more stringent than use for satellite tracking, for example. The tolerances on pointing, frequency stability, ability to integrate down for many hours, etc., are not similar to those of commercial operations. It takes a dedicated, high-level scientific and engineering staff to make a radio telescope accessible to non-specialists, as is the requirement for the GBO. This staff would be of no use to a commercial contractor who would have their own scientists and engineers, located elsewhere from Green Bank.	Considerations for Document Analysis	Purpose & Need	Written Comment	1/8/2018	Numerous articles
175	c	Felix	Lockman		As a practical matter, use of a large fraction of GBT time for commercial or government purposes would render much of the GBO staff redundant and would result in a reduction in employees of probably 50%, not zero as indicated in the DEIS. It would also make it very difficult, if not impossible, for the GBT to serve the needs of the U.S. scientific community. There is no known example of an antenna whose primary mission is for commercial/government purposes but is still a first-rate instrument for radio astronomy. The implication in the DEIS that such a path forward is viable — the Agency Preferred Alternative — is false, and seems merely an indirect way to close the facility.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/8/2018	Numerous articles
176	a	Caitlin	Witt		My name is Caitlin Witt, and I am a first year graduate student studying astronomy at West Virginia University. I am writing to express my support for option A proposed in the Draft Environmental Impact Statement. I support continued NSF funding of the Green Bank Observatory in the highest capacity, and hope that any collaborating organizations that the NSF collaborates with will make sure to continue the "open skies" policy currently supported by the NSF. For many of us in the astronomy department at WVU, the GBO is crucial for the continuation of our research. Many students have built their careers on data taken by the GBT, and they would struggle to continue their valuable research without the availability of the telescope. As a member of NANOGrav, I've also begun using a large dataset that is strongly dependent on regular pulsar timing observations with the GBT, in order to detect gravitational waves. In addition to it's extremely valuable impact to science worldwide, the GBO also provides incredibly valuable impact on the non-academic community. The outreach done at GBO for the community is world-class, and much more far reaching than just the surrounding areas. I teach an introductory astronomy lab here at WVU, in which most of the students are in non-STEM fields. However, most of them have heard of the Green Bank Telescope, and outreach from the observatory is often one of their first introductions to astronomy. Through the SkyNet robotic telescope program, my students are able to observe with the 20 meter telescope at GBO, giving them unparalleled hands on radio astronomy experience that they simply cannot experience without the continuation of the GBO. This experience is incredibly inspirational to the students, who, before this experience, never believed that they had the skills to take and analyze astronomical observations. Without the GBO, these experiences would simply be impossible.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public meeting comment)	1/8/2018	
177	a	Daniele	Michilli		Here is my statement for the DEIS. Observations with the Green Bank Telescope (GBT) were central in a study recently published on Nature by Michilli et al. named "An extreme magneto-ionic environment associated with fast radio burst source FRB 121102". GBT was essential in confirming the discovery thanks its large bandwidth and sensitivity. This result will also be part of my doctorate thesis to be presented in the Netherlands in September.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/8/2018	Nature by Michilli et al. named "An extreme magneto-ionic environment associated with fast radio burst source FRB 121102"

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
178	a	Robert	Wilson	Mechanical and Aerospace Engineering WVU	My name is Robert Casey Wilson and I am an undergraduate at West Virginia University. I am writing you today to ask that you please consider the positive effects that the Green Bank Observatory has had on not only my life, but on the lives of countless other residents of the Mountain State when making your final decision for observatory funding. As a lifelong resident of West Virginia, I am proud to share my state with the most sensitive steerable radio telescope on Earth. Because of the observatory I have had the opportunity to follow my dream of doing work in astronomy. I attribute this opportunity to the leading researchers at West Virginia University who are there, in large part, because of the Green Bank Telescope. Furthermore, I fear that without the semblance of technological progress the observatory brings to the state that West Virginian students will be less likely to pursue careers in the STEM fields. I also worry that without it, opportunities in the state to succeed in these fields may suffer. The Green Bank Observatory is a shining star of hope in a state long known for low-tech, industrial jobs the likes of which the future frowns upon. Maintaining it, and its world-renowned Green Bank Telescope is of paramount importance for future generations of West Virginian students who, like myself, look to the heavens with curiosity and determination. I end with the following image – my family and I (far right, a bit bashful) standing in front of the Green Bank Telescope. That telescope, a brand new scientific and engineering marvel when this picture was taken, makes me proud to call West Virginia my home.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	Photo of family at GBO
179	a	Libby	Strong	Resident of West Virginia	As a native West Virginian, there are a few things that come to mind when I think of why I am proud of my state. One of these is that we are home to the Green Bank Observatory. I grew up a couple of hours from the observatory and my family would visit there from time to time. I remember thinking how marvelous it was that research was being done at the observatory that could help us understand the universe better. This realization was long before I decided to become a science teacher. One day I would actually use the 40 foot telescope while attending the "Investigating the Universe" teacher workshop held at the observatory. With other teachers, we learned not only astronomy, but also how real science is done in the field. It was a worthwhile and memorable experience for me that has been shared with students and teachers over my years as an educator. To this day, the observatory serves as a site for teacher professional development as is evidenced by the Earth and Space Science Passport program through Fairmont State University. My husband and I have visited there to present at this workshop for the last two years. Another generation of West Virginia teachers are benefitting from the resources available at Green Bank Observatory. The telescopes at Green Bank Observatory contribute to the collection of knowledge about the universe around us. The Green Bank telescope is the largest fully steerable off axis single dish radio telescope in the world. It continues to be utilized by scientists from all over the world. Recently the Green Bank Telescope "looked" at the interstellar asteroid that had been discovered to gain more information about this mysterious object. Historically, the work of Frank Drake and early SETI research at the facility is also noteworthy. Along with the science center, the infrastructure at the Green Bank Observatory allows an avenue to learn, explore, and contribute to the collective knowledge of mankind. The science center and the research facility go hand in hand to showcase Green Bank Observatory as a world class research facility, educational mecca, and a tourist attraction in a rural area of West Virginia. As residents of the area have no doubt emphasized, Green Bank Observatory is the heart of Pocahontas County, and is definitely deep in the hearts of native West Virginians. This facility should not be moth balled. It should not be re-developed. Please consider all means necessary to keep this West Virginia gem in the heart of Pocahontas County for generations to appreciate.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
180	a	Joe	Swiggum	NANOGrav PFC Postdoctoral Fellow	I am writing to provide brief comments on the draft environmental impact statement (DEIS) concerning the Green Bank Observatory (GBO). I strongly urge the NSF to consider a "no-action alternative" (E), continuing investment to support science-focused operations and open skies at the observatory. As a graduate student and postdoc, I have worked closely with GBO staff and WVU faculty to promote STEM and related career paths among high school students in West Virginia (and now throughout the US) through a program called the Pulsar Search Collaboratory. A significant inspirational component of this program involves using the GBT to follow up on students' pulsar candidates and study their discoveries. In my years as a graduate student at WVU, this program had a significant impact on the gender diversity of incoming physics majors and many PSC students pursued degrees in physics at WVU, several participating in astrophysics-related research projects as undergrads and going on to attend graduate school. The GBO's open skies policy that would be severely limited by other DEIS options would hamper the effectiveness of outreach programs like the PSC and reduce the observatory's impact on our next generation of scientists.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
181	a	Gregory	Dunaway	Dean of Eberly College of Arts & Sciences WVU	I am the Dean of the Eberly College of Arts and Sciences, the largest college at West Virginia University (WVU) in Morgantown, West Virginia. WVU was founded in 1867, and is the flagship land-grant, doctoral degree-granting research university in West Virginia. Today, WVU consists of 15 colleges and schools offering 185 bachelors, masters, doctoral, and professional degree programs to approximately 30,000 students, and as the only West Virginia institution classified by the Carnegie Foundation as doctoral-granting, Highest Research Activity, the university occupies a unique position within the state. I am writing this letter in response to the National Science Foundation (NSF) invitation for public comment on the draft environmental impact statement (DEIS) for the Green Bank Observatory Operations, in Green Bank, West Virginia. I implore you to consider the following information before proceeding with further action. As our nation becomes increasingly dependent on technology, there is a critical need for skilled workers with backgrounds in science, technology, engineering, and mathematics fields. The Green Bank Observatory (GBO) is of critical importance to the scientific and education community in West Virginia, the United States, and the world. The GBO is an exemplar of STEM education. The GBO hosts multiple STEM-related opportunities for teachers and students, including: residential teacher institutes, eight-week summer experiences for middle and high school teachers, and the Pulsar Search Collaboratory (PSC), a national program that makes the chance for first discovery of new pulsars a possibility for middle and high school students, which then informs the NanoGrav consortium laboratory for nano-Hertz gravity wave detection. Of the over 2,100 high-school students that have participated in the PSC, an NSF funded collaboration between the National Radio Observatory and WVU. 99% are either attending college or plan to attend college, and 68% intend to pursue post-secondary education. Approximately 50% of those students are underrepresented minorities. The education programs of the Green Bank Observatory are impacting countless children across a state that is in desperate need of scientific role models. There are few NSF supported STEM outreach programs across the nation that have a comparable impact in a region with an acute lack of alternatives for STEM engagement.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

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181	b	Gregory	Dunaway	Dean of Eberly College of Arts & Sciences WVU	Further, since 2012, via a highly competitive peer-reviewed evaluation process, the NSF has awarded WVU researchers over \$13.3M in eight separate awards for scientific efforts that depend critically on their access to a fully functioning GBO. The observatory has been instrumental in recent astronomy discoveries, such as work on the direct detection of gravitational waves, and because of its location in the National Radio Quiet Zone (NRQZ), it is the only instrument capable of continuing research at redshifts to constrain the expansion rate of the Universe and the nature of Dark Energy. These are just a few examples of the work that would be difficult or impossible to make with any other telescope. The economic impact of the Green Bank Observatory should not be overlooked as well. Over the fiscal years of 2014 to 2016, the entire state of WV collected a mere 0.24% of the entire NSF research budget, placing the state only 46 th overall in NSF support. A continued investment in the GBO is critical to demonstrating NSF's sincere commitment in geographic diversity in the NSF mission: 'To promote the progress of science; to advance the national health, prosperity, and welfare'. The Green Bank Observatory is at the economic heart of Pocahontas County as the fifth largest employer in the county with over 110 full-time jobs and an annual payroll of more than \$9M. Green Bank and Arbovale have the greatest preponderance of jobs in the management, business, and science fields in the county—all attributable to the influence of the GBO; whereas, 18% of the population in West Virginia falls under the poverty threshold. The high-quality GBO jobs are of vital importance to the economic sustenance of the community. Since 1958 when it was established by the FCC, the citizens of Pocahontas County abided by the restrictions of the National Radio Quiet Zone (NRQZ). At the time of its inception, the restriction meant that the local community did not have access to most commercial radio. 60 years later, the NRQZ now precludes the use of cell phones, Wi-Fi, and even microwave ovens, a significant sacrifice that most Americans would not even consider. Nevertheless, the local population has consistently abided by these constraints, which have limited more diversified regional development and long-term economic growth. They did so as part of a long-term covenant with the NSF to preserve the region for state-of-the-art radio astronomy and for the economic, educational, and cultural benefits of the GBO. It is imperative that the NSF continues to maintain its commitment to the citizens of Pocahontas County in exchange for the long-term economic isolation engendered by the NRQZ. In short, the Green Bank Observatory partnerships advance discovery and understanding while promoting teaching, training, and learning to underrepresented groups, while also enhancing the infrastructure for research, education, and economic development. The DEIS raises many concerns. The recommendation to maintain operations with new partners, leaves unaddressed the identification of the new partners, the process for identifying new partners, and the relationship and obligations between those new partners and the NSF. Deep concerns about the future of the facility are entirely valid given these uncertainties. The DEIS itself, notes that anything less than current operations will result in "adverse, long-term" impacts on the Green Bank and Arbovale communities. Therefore, it is for these reasons that I strongly encourage that before any further action is taken that may disrupt current operations, the NSF and Associated Universities, Inc. identify future partners and share the details of the partnership and partner obligations to maintain the GBO as currently staffed and organized.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
182	a	Rebecca	Cooper		The Green Bank Observatory is a very important part of WV and the educational services it provides. There are many opportunities provided to students, teachers, and the public to increase scientific knowledge about astronomy and how research is done. Radio telescopes are not readily available and the location of such a device is critical to allow it to even work properly. Having experienced an opportunity to study at the Observatory proved to be invaluable as an Earth and Space Science teacher. It also provides a premier destination for places to visit in West Virginia. Not every state has a notable Observatory! The Skynet Junior Scholars program allows students all over to use various telescopes around the world for education in addition to the radio telescopes available at the Observatory. It is wonderful that students have access to this technology for stem education. Please allow this to continue!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
183	a	Deana	White		As also stated in my written comments for the Draft Environmental Impact Statement, I would like to reiterate that the NSF choose the "No Action Alternative: Continued NSF investment for science-focused operations" and further that the NSF restore full funding to the Observatory such that they can continue and grow their important mission of NSF-funded "Open Skies" science and education focused operations. Additionally, it is imperative that the NSF continue to have ownership such that the primary focus of the Green Bank Observatory falls under the NSF mission of Open Skies scientific research and education. The retention of ownership and restoration of full funding of the GBO by the NSF in effect minimizes and/or eliminates all "Adverse Effects" as identified in the Conclusion of the "Proposed Changes to Green Bank Observatory Operations: Historic Properties Assessment of Effects".	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
183	b	Deana	White		I have read over the Historic Properties Assessment of Effects, and while I do not have a background in the National Historic Preservation Act or the resulting actions to be taken given an adverse designation assigned to eligible historic properties, I do have some concerns and information I would like to share regarding each of the options and suggested actions there-in. Also, I would like to propose that the 20-Meter be re-evaluated to be a contributing resource to the GBO Historic District due to its participation in the early VLBI experiments and in the tectonic plate measurements it also performed.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	
183	c	Deana	White		I understand that the designation of the "Adverse Effect" finding under Section 106 as stated for each of the Action Alternatives A, B, C, and D in the Conclusion due to the possibility that historic properties that contribute to the NRHP-eligible historic district could be demolished, requires that the impact be avoided, reduced, or mitigated as long as it is Federally owned and negotiated if the property is sold. It is important that the adverse impact is understood fully. Also, there were no stated reasons why each of these historic properties were identified as 'could be demolished' other than a generic statement of "any structures not needed to meet the anticipated operational goals". I would like to request that a specific reason be given for each of the structures identified as 'could be demolished' in the Historic Properties Assessment since there has been some determination that they are "not needed to meet the anticipated operation goals", such that the public can evaluate and provide comment as necessary about those reasons in case additional information not known by the Agency can be provided in order for them to make the best decision. Further, I would like to provide comment on several of the historic structures listed as "could be demolished".	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
183	d	Deana	White		The 300-foot Telescope Control Building is designated as a Historic property that could be demolished under Alternative A, B, and D and mothballed under Alternative C. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. As known, the 300-ft. telescope collapsed, but the control room still exists. The 300-ft. had many historic milestones including the detection of the Crab pulsar and the control room is the only remnant of it left. There are not only historic implications to this structure, there is also an educational component to this structure and could be used in multiple ways including a public tour destination to demonstrate the previous technology and the research accomplishments made at this site.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	
183	e	Deana	White		The Interferometer Range (Telescope 85-1 (Tatel Telescope) and 85-1 Control Building; Telescope 85-2; Telescope 85-3; Interferometer Control Building) is designated as a Historic property that could be demolished under Alternative A, B, C, and D. As mentioned above, I request that a reason be stated as to why these structures have been identified as “not needed to meet the anticipated operation goals”. Obviously, the Tatel Telescope is of historical significance as it participated in the first ever SETI search by Frank Drake, among other discoveries it was used for, and it and the 85-1 Control Building are part of the SETI tour available on-site that is highly sought after. The whole Interferometer Range is of historical significance due to it being the model for the JVL. Again, these structures not only have historic implications, but also a huge impact on education and potentially could be restored to operate in an educational/research function that would suit the operation goals of Alternatives A and B.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	
183	f	Deana	White		The Calibration Horn is designated as a Historic property that could be demolished under Alternative A, B, C, and D. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. The Calibration Horn is of historical significance because it was used to perform early absolute flux measurements of Cassiopeia A and used by the early radio astronomy community as a standard reference point to measure other hydrogen sources. Recently, there have been proposals to restore it to service to use to look for Fast Radio Bursts (FRBs), a newly detected and exciting field of research. The Calibration Horn thus has significance for science and education focused operations.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	
183	g	Deana	White		The Recreation Area is designated as a Historic property that could be demolished under Alternative A, B, and D and mothballed under C. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. The Recreation Area, in addition to being of historic value, provides multiple benefits to the surrounding community including a location for Red Cross Swimming lessons and community exercise and gathering resources that are not available in the nearby area. Demolishing the Recreation Area would remove a resource that is pertinent to health and safety education of the community.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	
183	h	Deana	White		The Nut Bin is designated as a Historic property that could be demolished under Alternative A, B, and D and mothballed under C. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. The Nut Bin served as the Lab Building in 1958 until the Jansky Lab was completed in 1959 and is thus of historic significance. It currently serves as an employee residence and thus still needs to be retained.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	
183	i	Deana	White		The listed houses in Table 3, Table 4, and Table 5 are designated as Historic properties that could be demolished under Alternative A, B, C (for the Beard House), and D and mothballed for all houses listed other than the Beard House for Alternative C. As mentioned above, I request that a reason be stated as to why these structures have been identified as “not needed to meet the anticipated operation goals”. The housing listed is available for use for researchers and students alike to be onsite or close to onsite to accomplish their goals. Many who come for extended study do not have access to vehicles and thus the close proximity of housing is imperative for them to be able to efficiently accomplish their goals, especially being flexible to be onsite and varying hours through the day and night for their research. Thank you to the Agencies involved for the historical research that has been done to date and for considering my comments. My family and I are working hard to help the NSF assemble allies to ensure that the NSF retain ownership and restore full funding to the Observatory such that they can continue and grow their important mission of NSF-funded “Open Skies” science and education focused operations. Thank you for your consideration of our comments and please let me know if we can provide any additional information.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
184	a	Barbara	Rudnick	EPA	In accordance with the National Environmental Policy Act (NEPA), Section 309 of the Clean Air Act, and the Council on Environmental Quality (CEQ) regulations, 40 CFR Parts 1500-1508, the U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory (Green Bank). The DEIS has been prepared by the National Science Foundation (NSF) in order to analyze the potential environmental impacts associated with potential funding changes for Green Bank Observatory in Green Bank, West Virginia. The purpose of this proposed action is to reduce NSF funding due to a constrained budgetary environment. Neither the merits of the science and education activities at Green Bank nor NSF's budgetary decisions are the focus of this review. Several reviews conducted by the Advisory Committee for the Directorate for Mathematical and Physical Sciences, the National Research Council, and the Astronomy and Astrophysics Advisory Committee have recommended that there are opportunities for operating Green Bank more efficiently and that reductions in operations at Green Bank be sought or that divestment of several facilities be made. The DEIS identifies four Action Alternatives. Alternative A involves collaboration with interested parties for continued science- and education-focused operations with reduced NSF funding, which is the Agency-preferred Alternative. Under this Alternative, NSF could transfer or retain the property, though NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades. Action Alternative A would involve the lease change to the current facility and would retain the Robert C. Byrd Green Bank Telescope, other appropriate telescopes, and appropriate supporting facilities for education and research. Any structures not needed to meet the anticipated operation goals would be safe-abandoned, mothballed, or demolished, as appropriate. As a way of evaluating NEPA projects, EPA has developed a set of criteria for rating Draft Environmental Impact Statements. The rating system provides a basis upon which EPA makes recommendations to the lead agency. Based on this rating system, EPA has the DEIS for the project as a Lack of Objections (LO). This rating means that our review has not identified any potential environmental impacts requiring substantive changes to the preferred alternative. Our review, however, did disclose some general observations for the potential decommissioning of facilities at the Green Bank Observatory and identifies minor areas where clarifications may improve the study documentation; our comments are below. A copy of our rating system can be found here: http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria... EPA appreciates the opportunity to review the NSF study for Green Bank.	General	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria
184	b	Barbara	Rudnick	EPA	1. If any of the alternatives specified in the DEIS will influence certain aspects the National Radio Quiet Zone (NRQZ), we suggest the EIS outline how this may impact the size, boundaries, management, or intent of the NRQZ.	Considerations for Document Analysis	Purpose & Need	Written Comment	1/8/2018	http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria
184	c	Barbara	Rudnick	EPA	2. Alternatives A and B include collaboration with other entities. Given no entities have been identified in the EIS, it is difficult to determine how the preferred alternative will be carried out. If more is known about a potential agreement, we recommend this information be included in the Final EIS. More detail describing the process would help clarify these Alternatives. If additional analysis in compliance with NEPA is anticipated at a later phase, we suggest that the Final EIS describe the process.	Considerations for Document Analysis	Purpose & Need	Written Comment	1/8/2018	http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria
184	d	Barbara	Rudnick	EPA	3. It would be helpful if the EIS described how Traditional Cultural Properties were identified.	Considerations for Document Analysis	Cultural	Written Comment	1/8/2018	http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria
184	e	Barbara	Rudnick	EPA	4. The Stormwater Pollution Prevention Plan and Groundwater Protection Plans that will be prepared and implemented as part of the Construction Stormwater General Permit from the West Virginia Department of Environmental Protection (WVDEP) should be approved prior to start of construction/demolition. Any information that is available regarding protection planning could be included in the EIS, or in later NEPA analysis.	Considerations for Document Analysis	Water	Written Comment	1/8/2018	http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria
184	f	Barbara	Rudnick	EPA	5. Several sections of the EIS reference a field investigation conducted in November 2016 and some of the analyses in the EIS are based on this investigation. It would be helpful to document in the EIS the methods used in data collection during the investigation and who conducted it. We recommend the EIS state if the findings of minimal impact to wetlands were based on this investigation or by reviewing U.S. Fish and Wildlife Service National Wetlands Inventory maps.	Considerations for Document Analysis	Biology	Written Comment	1/8/2018	http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
185	a	Deana	White		Thank you for allowing us to provide feedback in this public comment period. It has been brought to my attention that many sections, such as section 3.1.4 Threatened and Endangered Species and 3.1.5 Migratory Birds, rely heavily if not solely on an Information for Planning and Conservation (IPaC) Report for the species which need to be addressed for the Green Bank Observatory area. Further, this document is not available in the appendices nor is a link given to this document. After exploring the U.S. Fish & Wildlife Service webpage (https://ecos.fws.gov/ipac/), it appears that this document is a computer generated document. Along with this, at the beginning of any IPaC the following disclaimer is given in bold red: "This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Document page. "Yet, an official species report is not referenced for this EIS. Not only this, IPaC reports are not stored by the U.S. Fish & Wildlife Service. IPaC reports are also subject to change depending on when they are produced. Therefore, we request that at the minimum - the IPaC report generated for the NSF for the Green Bank Observatory is added to the appendices in its entirety, including the disclaimer, to ensure that all species that were listed are addressed in this EIS report. Also, since this is an Environmental Impact Statement and the Endangered Species identification is an integral part to this evaluative report, and since the IPaC report has the above stated disclaimer, an official species report should be generated and added to the appendices as well. Again, thank you for the opportunity to provide comments on the Draft Environmental Impact Statement.	Considerations for Document Analysis	Biology	Written Comment	1/8/2018	https://ecos.fws.gov/ipac/
186	a	Gordon	Gee	President of WVU	As President of West Virginia University, I write to submit for the public record West Virginia University's stance on the critical importance of the continued operations of the Green Bank Observatory - the iconic symbol of West Virginia and the heart and soul of the university's renowned astronomy research and STEM outreach programs. While the fate of Green Bank hangs in the balance, ironically, many of its core competencies are incorporated in the National Science Foundation's (NSF) recently unveiled "Big 10 Ideas," which lays forth your agency's priority areas for future investments at the frontiers of science and engineering. For example, as you are aware, West Virginia University is one of the academic partners of the NANOGrav collaboration which received a competitive \$14.5 million NSF Physics Frontier Center award in 2015. The NANOGrav team is on the verge of discovering low-frequency gravitational waves through observations of pulsars with the Green Bank Telescope. This work will be part of the revolutionary expansion of the gravitational wave spectrum and falls completely in line with NSF's recent announcement of its "10 Big Ideas": Windows on the Universe: The Era of Multi-messenger Astrophysics. Additionally, Green Bank is making significant advances in key science goals for astronomy identified in the recent National Academy study "New Worlds, New Horizons: A Midterm Assessment." The scientific landscape has changed dramatically since the time GBO divestment recommendations were made in 2012. In light of recent developments, I would urge NSF undertake a thorough re-evaluation of Green Bank's essential role in the gravitational wave discovery spectrum before issuing a final Environmental Impact Statement (EIS).	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
186	b	Gordon	Gee	President of WVU	The Green Bank Observatory also embodies another one of NSF's "10 Big Ideas": "Enhancing STEM through Diversity and Inclusion." As British writer Graham Greene once wrote, "There is always one moment in childhood where a door opens and lets the future in." As you read in so many of the personal letters that were submitted last year as part of the Initial Environmental Impact Statement process, Green Bank has served as "that moment" for countless students, teachers, researchers, and citizens of the United States. At West Virginia University, we have seen firsthand the power of "that moment" at the GBO and its instrumental role in building a STEM pipeline in West Virginia and throughout the U.S. Through our NSF-funded Pulsar Search Collaboratory outreach program, over 2,000 high school students from across the United States have been engaged in searching for pulsars with the GBT, which have resulted in the exhilarating discovery of seven pulsars. With support from the NSF INCLUDES program, West Virginia University is working with a number of West Virginia stakeholders to increase the STEM degree completion rate of first generation college students in West Virginia. Every summer, the top two science students from each state participate in the National Youth Science Camp where they witness first hand recent advances in astrophysics achieved at the Green Bank Observatory. Among the distinguished camp alumni are WV native and Northrop Grumman President/CEO Wes Bush and Orbital Sciences Corporation CEO David Thompson. These are only a few of the many examples how Green Bank is inspiring the next generation to consider STEM careers. And, of course, because of the state's population or economic standing, to have opportunity to fully contribute to our nation's scientific enterprise and train our students in a variety of high technology techniques required for gravitational wave detection and exploration but applicable in more conventional venues as well. Going forward, it is the collective hope at West Virginia University that NSF will pursue a more thorough and transparent exploration of government, private sector, academic, non-profit, and even international partners. It has been five years since NSF made its announcement about the potential divestment in Green Bank. Since that time, very little has been revealed about NSF's efforts and progress. While the DEIS recommends maintaining operations with new partners, it offers little insight about so-called partners, as well as a whole host of issues including the criteria, process, and timeline. As you can imagine, the continued uncertainty about the fate of Green Bank has been unsettling for the GBO science community and GBO staff who have devoted so much of their academic and professional careers to the advancement of astronomy research. Likewise, the lack of clarity rests heavily on the shoulders of the citizens of the Green Bank and Arbovale communities. For the past 60 years, they have selflessly given up most modern day conveniences to maintain the Radio Free Zone for sake of the Green Bank Observatory's operations. In return for their economic isolation, they have enjoyed many economic, educational, cultural, and recreational benefits which, if not replaced, will have severe long-term repercussions on the future viability of these communities. West Virginia University looks forward to our continued partnership with the Green Bank Observatory for the advancement of scientific discovery and inspiring the next generation to pursue STEM careers. Thank you for the opportunity to present West Virginia University's views and know that the university is an all-in partner when it comes to the GBO's future viability.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
187	a	Daryl	White		I am writing as a 20+ year resident of WV to express my support for full NSF funding, investment, and ownership for science focused operations at the Green Bank Observatory. I have had the privilege of visiting the National Radio Observatory starting in the late 90s as a young couple marveling at the facility. As our family has grown we have continued to visit the facility. The facility provides activities to attract and educate our populous from the age of 4-5 to the ripe age of 90 or so. I have had the opportunity to volunteer in the facility's yearly open house activities and have seen the same awestruck reaction of the young and those with "mileage". One interaction was with a retired gentleman from Bell Laboratories. He lives locally and now is active in photography; some of his best works contain the grounds of the observatory. The facility attracts brilliant minds both for employment and for the sheer enjoyment of its purpose. It is inspirational, motivating, and instills pride. It reminds me of the Field of Dreams line..."If you build it they will come"... Robert Byrd believed this and procured funding and constructed the GBT for \$95,000,000. The same scope today would cost ~171,000,000 (Bureau of Labor Statistics website). As a result the facility continues to attract talented machinists, electricians, scientists, engineers, astrophysicists, university professors, high school stem teachers, politicians, artists, professionals, and proud residents of West Virginia. The NSF should be choosing between full funding or expanded funding, not reduced funding based on this facility's footprint in science, education, and regional/community enrichment. Our family has benefited from the education opportunities and have been a part of its continuum of learning. My daughter in particular has developed a love for science and technology that has been fueled directly by her experience at the Green Bank Observatory. She has engaged with more professionals by the age of 18 than I did while in college by the age of 21. This engagement has allowed her to participate in projects at the facility which have driven her passion and helped her by inspiring her to pursue a career in engineering and likely astrophysics/astrobiology studies. Likewise my son has also benefited from the experience of controlling the 40 foot telescope and has a true sense of accomplishment and confidence building as a result. He has also benefited by his interactions with the computer programming staff by understanding the role a "computer geek" plays at this facility. These opportunities would not be possible without the full NSF funding of science/education focused operations. My daughter and son are 2 of many (3,500 per year) students that are introduced and potentially motivated to pursue a career in science and technology fields through the outreach programs offered at the observatory. These programs include Radio Astronomer for a Day, Skynet Junior Scholars, Physicists Inspiring the Next Generation, Pulsar Search Collaboratory, First Two, Research Experience for Undergraduates and Research Experience for Teachers. Motivating our youth today to engage in science and tech fields is a challenging prospect and should take a front seat in our nation's funding efforts. Green Bank Observatory provides the country with an environment of learning from a staff that provide excellent role models... driven, enthusiastic, intelligent and engaging staff. They have an educational experience that allows the student to receive written, kinesthetic, visual, as well as an auditory immersion in the workings of an extremely complex scientific operation. Educational activities are designed to offer the individual an experience that allows the learner to progress at their pace while challenging them at the same time. It is a wonderful process to observe. I hope other families have the opportunity to experience what ours has... I wouldn't trade it for the world. Again I appreciate your time and effort in reviewing this one of many letters showing support for the Green Bank Observatory. I advocate for the no action alternative that restores full 100% funding to the Green Bank Observatory that allows science focused operations to enrich our state, nation, and world.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
188	a	Karen	O'Neil		Below are a number of questions/concerns I have in reading through the draft Environmental Impact Statement report. ES-2: The reports quotes a statement in the 2006 Senior Review which recommends a cost review for Green Bank, and uses this as one basis for the current divestiture. The cost review that happened (by LMI) resulted in two items, both of which contradict the quotation given: (1) the basis used to recommend the review was incorrect. \$75M was initially used as the construction cost for the GBT, which was (a) the incorrect amount (actual full telescope cost of \$100M-\$110M) and (b) did not take inflation into account; (2) The LMI review state that the operational cost of the GBT was in fact reasonable and not too high. ES-2: Two other points should be considered in using the 2006 senior review as a justification for cutting the GBT budget: a) The 2006 Senior Review actually recommended the GBT be part of AST division's base budget, but a reduction in costs of GBT be considered after review (the results of which stated the operation cost was reasonable) b) The GBT has already gone through a cost reduction since that time (e.g. staffing reduced from 145 year-round to 105 year-round employees), and so, in effect, the cost reductions are already in place, as a \$8M-\$10M annual operational cost *for the GBT alone* was recommended, which is less than the NSF is currently paying.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
188	b	Karen	O'Neil		Pages 3-46, 4-83, 4-86: I do not believe the numbers used here for housing are correct, if you are looking at year-round housing. These estimates appear to include, e.g., temporary hunting cabins and similar housing.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/8/2018	
188	c	Karen	O'Neil		Page 4-53: There is a contradiction in between this page and an earlier statement. Specifically, this page states, "The number of personnel at GBO is expected to be less under Action Alternative A;..." Yet in all other places in the document, it states the number of personnel is expected to remain the same under Alternative A (e.g. in the Executive Summary, on ES-6, it states "Operations after implementation would be similar to current operations, and operation staffing levels would be expected to stay the same.") This contradiction should be removed.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
188	d	Karen	O'Neil		Page 4-61: States the local fire/emergency services departments (BFD) could use local streams to fill tanker trucks. This is simply not correct, as the local streams are seasonal and are not considered a reliable water source. Further information on this can be found through either contacting the local emergency services personnel or consulting the county water board.	Considerations for Document Analysis	Health and Safety	Written Comment	1/8/2018	
188	e	Karen	O'Neil		Page 4-72: The wording here is unclear. I suspect the intent is "95 or fewer demolition workers," that is, people there specifically for demolition, and not including the staff. This should be clarified. Pages 4-72, 4-82: The number of demolition workers needed change throughout the document, and this should again be clarified/better defined.	Considerations for Document Analysis	Transportation	Written Comment	1/8/2018	
188	f	Karen	O'Neil		Page 4-90: This listing of educational programs is incomplete and does not match what was sent to the consulting firm. This should be corrected.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/8/2018	
188	g	Karen	O'Neil		One additional concern I have is with the description of instruments needed for Alternative B, which states only that the 40-ft. telescope would be used for educational programs. Both the 20-m telescope and the GBT play a large role in our educational programs, and the loss of those two instruments to the education programs should be considered in this alternative.	Considerations for Document Analysis	Socioeconomics	Written Comment	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
189	a	Joyce	McConnell	Provost and Vice President for Academic Affairs WVU	<p>As Provost of West Virginia University, I am writing this letter in response to the NSF request for public comment on the Draft Environmental Impact Survey for the Green Bank Observatory. Given the long standing, significant and on-going engagement between WVU and the GBO, I strongly argue for continued NSF support to maintain the exceptional research and educational outreach for which the facility is known. At the time of the commissioning of the Robert C. Byrd telescope in 2001, WVU had no significant effort in radio astronomy, but with the extremely fortuitous recruitment of Professors Maura McLaughlin and Duncan Lorimer, the Department of Physics and Astronomy has undergone a transformation and is now recognized as one of the premier radio astronomy programs in the United States, if not the world. The astrophysics group has grown from the original two to six faculty concentrating on radio astronomy and gravitational wave physics. In 2016 WVU launched a new Center for Gravitational Waves and Cosmology, which includes faculty in Mathematics, Computer Science and Electrical Engineering. With a current core of 10 interdisciplinary faculty investigators, the Center's goal is to further gravitational wave astrophysics and cosmology through research in radio astronomy, receiver development and computation. These faculty currently contribute to two world-leading gravitational-wave collaborations: LIGO and NANOGrav. The proximity of the GBO to WVU makes the GBO a unique resource for training students, doing outreach and networking with other scientists. As you well know, the astrophysics group has been highly successful in garnering NSF funding, with a highly prestigious Physics Frontier Center, as well as a Partnership for International Research and Education to its credit, as well as numerous individual awards to smaller PI teams, overall totaling more than \$13M in funding since 2012. In October of 2017, the NSF report commended the group for "making great scientific progress" and noted that the team is "significantly ahead of their projected schedule." The external reviewers were "impressed with how well the different groups have come together to collectively advance the NANOGrav goals" and commented on the "extremely strong publication record," the "educational impacts for students and postdocs [which] are impressive... this was particularly evident among the undergraduates" and the outreach "program [which] is broad and carefully motivated." The report concluded that "NANOGrav is a clear and visible leader in the field and well ahead of once comparable efforts in Europe and South Africa and Australia." Now this success is jeopardized by the uncertainty of the GBO's future. The DEIS raises many concerns. The recommendation to maintain operations with new partners leaves unaddressed who those new partners will be, what the process shall be to find those new partners, and the relationship and obligations between those new partners and the NSF. Deep concerns about the future of the facility are entirely valid given these uncertainties. The DEIS itself notes that anything less than current operations will result in "adverse, long-term" impacts on the local communities. Moreover, as Provost at WVU, I can attest to the adverse and long-term negative impacts on WVU should the facility contract. WVU has only recently become an Research 1 institution according to the Carnegie classification. This is a significant accomplishment for a land grant institution in an EPSCoR state with our historic economic and societal challenges. The GBO has played a significant role in helping us achieve R1 status, not only in research dollars, but also through its extensive outreach programs that motivate students to pursue STEM degrees at WVU. For the FY14-16 period, the entire state of WV collected a mere 0.24% of the entire NSF research budget, placing the state only 46th overall in NSF support. A continued investment in the GBO is critical to demonstrating the NSF's sincere commitment to geographic diversity as articulated in the NSF mission: to promote the progress of science; to advance the national health, prosperity, and welfare. It is essential that before any actions are taken that disrupt the current operations of the GBO, the NSF and AUI identify future partners and share the details of the partnership and partner obligations to maintain the GBO as currently staffed and organized. WVU is proud to be a partner with the GBO to advance science and promote learning not just regionally, but nationally. The university has made significant investments of people and facilities to advance those missions. We look forward to continuing our strong collaboration into the future and respectfully urge the NSF to make a full commitment to continuing their investment as well.</p>	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
190	a	Francis	Federighi	Professor of Physics and Astronomy at Oberlin College in Ohio	I write to strongly support continued science- and education-related activities at the Green Bank Observatory. As a professor at a liberal arts college and as someone who has used and been inspired by the telescopes at the Green Bank Observatory for more than 40 years, I believe that the GBT has a long and bright scientific future ahead of it. I encourage the panel to not only look at the narrow scope of the EIS, but to factor in the inspirational impact of the science done at Green Bank within a part of the country with few other world-class science installations. My own involvement with Green Bank goes back to 1974 when I was a summer student at the NRAO, based in Charlottesville, VA. Each summer student was assigned a week of public outreach work at Green Bank as part of their service to the Observatory. I vividly remember the enthusiasm that the visitor's showed as we told them about the telescopes, demonstrated a simple radio telescope with which we could detect emission from the Sun, and introduced them to the excellent and varied science being done on the site. Since then I have used almost every telescope currently at the GBO including the GBT, the 140-ft. and 300-ft. telescopes and some of the smaller dishes, too. In my many years of dealing with colleagues at the GBO I have been consistently impressed at the way the GBO serves as a beacon for science and technology to the people of Pocahontas County, the citizens of West Virginia, and to knowledgeable people throughout the US and around the world. It truly is one of the great and enduring radio observatories on the planet. Premature curtailment of activity on the site would be short-sighted and detrimental both to the larger scientific community and to the public for which the GBO is synonymous with big and inspiring scientific research. Throughout the years I would estimate that I have introduced at least 20 Oberlin College students to observing with GBO instruments. And, as part of the NANOGrav collaboration seeking to open the next frontier in gravitational wave physics with the Green Bank Telescope, my scientific interest in the GBT remains strong and forward-looking. I hope to continue to use the telescope, both as part of NANOGrav and as a smaller-scale user interested in the interstellar medium, for many years. In closing I want to applaud the NSF for its many years of forward-looking support for the Green Bank Observatory and the top-notch scientific and engineering support staff that operates the facility. It remains a vital and world-class observatory. I hope that through the EIS process the NSF will recognize just how much scientific and important EPO life is left in the Observatory. A few words about my own background may be in order since they may be relevant to your assessment of my letter. After graduating from Williams College with a B.A. in physics and astronomy in 1976, I earned a Ph.D. in astrophysics from Cornell in 1982. In 1985, after a three-year postdoctoral position at the National Radio Astronomy Observatory, I was invited to join the Princeton Physics Department as an Assistant Professor working with Joe Taylor. In 1990 I moved to the Oberlin College faculty as an Associate Professor of Physics and Astronomy. Since 2004 I have held the Francis D. Federighi Professorship of Natural Science at Oberlin. For five years (2008 – 2013) I served as department chair of our seven person Physics and Astronomy Department. I have supervised more than 100 research students during my career and taught and interacted with a very large number of other students, including numerous graduate students through our NANOGrav collaboration.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
191	a	John	Stenger	WVU	I am writing to express my support for continued funding of the Green Bank Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
192	a	David	Fraye	Scientist at GBO and Adjunct Professor of Physics & Astronomy at WVU	Thank you for soliciting public input associated with the draft NSF Environmental Impact Statement (EIS) for the Green Bank Observatory. I am very dishearten to see that the option of "Continued NSF investment for science-focused operations (No-Action Alternative)" was not given serious attention in your draft report. The GBT is by far the most sensitive single-dish telescope on the planet over the frequency range of 8--115 GHz. The draft EIS report (section ES.2) reports that the 2006 AST Senior Review noted the apparent high operating costs of the GBT in comparison to the VLA and ALMA, but this is not reality. The 2006 review reports the GBT operational cost as 10M/yr., while the VLA operational cost was quoted as only 11M/yr. The number for the GBT was the full Green Bank Observatory budget, which included funding staff and activities in Charlottesville at the time, while the VLA value quoted likely just reflects operations at the VLA site and not all of the associated activities at the AOC (software, scientists, archive, etc...). If one compares bare-bones GBT operations (i.e., costs down at the warehouse, GBT control and equipment room, and maintenance) and ignore EPO, software, science, and other site activities, the GBT operations cost is about 4 M/yr. while similar activities for the VLA costs about 12M/yr. If you were to build the GBT today, it would cost about 200M, factoring in the increase cost of steel and the current level of instrumentation. I would argue that 8M/yr. is required for reasonable science operations of the GBT (not the site budget), and for a telescope worth 200M this represents only a 4% operations expense ratio (very efficient), not the 12% operations expense ratio previously quoted in the 2006 report. NSF/AST could save many millions per year by cutting administration and management costs at NRAO. NRAO was bloated in 2006, and the situation has just gotten worse over the last decade. The NSF/AST has enabled this and is responsible for the budget mess they have created. Anybody who takes a critical eye at the total budget for all of the AUI observatories will find that less than 50% of the total budget is spent on running the actual facilities and science operations. There are huge savings that could be made without shutting down telescopes.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	https://library.nrao.edu/public/memos/gbt/GBT_294.pdf
192	b	David	Fraye	Scientist at GBO and Adjunct Professor of Physics & Astronomy at WVU	The draft EIS report (at the end of section ES.2) states "the scientific community evaluations cited previously indicate that GBO's science capability is lower in priority than other science capabilities that NSF funds". This is a false/misleading statement. The NSF did not carry out a proper review in 2012 that actually looked at the full scope of scientific priorities for the community. It was based on the 2010 decadal survey which was a wish list of future science that could be done if given an unreasonable amount of money to build new facilities. The 2010 survey did not compare the priorities of ongoing research with current facilities with future science opportunities that could be done with new facilities. Most astronomers (and nearly all observational astronomers) would choose to keep the current user facilities in comparison to something like the LSST for which they will never have the opportunity to use. The GBO/GBT facility is an essential scientific resource for America and the entire world. In previous decades, there were many options within the US for obtaining hands-on research experience with public-access radio/mm facilities, including the CSO, FCRAO, NRAO-12m, NRAO-140ft, OVRO, BIMA, and CARMA. All of these facilities were once NSF supported, and none exist anymore. The only remaining US radio/mm facility with public access that permits hands-on observing is the GBT.	Considerations for Document Analysis	Purpose & Need	Written Comment	1/8/2018	https://library.nrao.edu/public/memos/gbt/GBT_294.pdf

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
192	c	David	Fraye	Scientist at GBO and Adjunct Professor of Physics & Astronomy at WVU	Hands-on observing is key for training the next generation of scientists. The technical experience gained is crucial for supporting the success of future facilities. The NSF's new Strategic Plan, Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014 - 2018 highlights the importance of STEM education. The GBO does an amazing job at STEM education and the training students ranging from middle-school to postdocs in astronomical research. I would challenge anybody to find an organization that does a better job with the hands-on astronomical research experience than the GBO. I have worked at many places, and the GBO is by far the best.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	https://library.nrao.edu/public/memos/gbt/GBT_294.pdf
192	d	David	Fraye	Scientist at GBO and Adjunct Professor of Physics & Astronomy at WVU	As part of this process, it appears that the NSF does not want to consider the scientific merits of the GBT or discuss the issues associated with the 2012 Portfolio Review. Every astronomer I have talked to about this review has said that the process was deeply flawed, including members on the committee that carried out the review. The 2012 Review implied that the Bonn telescope could carry out the science being done by the GBT at high frequency (e.g., >20 GHz). Nobody with any knowledge on the subject would consider this claim credible, including our colleagues at Bonn who found this absurd and irrational. The 2012 Review also claimed that the VLA could be used in phased-array mode to replace many of the science programs currently being done with the GBT. Anybody with knowledge of the capabilities of the VLA and GBT would know that this is not practical (e.g., GBT Memo 294 from the NanoGrav group: https://library.nrao.edu/public/memos/gbt/GBT_294.pdf). When discussing the science being done by the VLBA, the 2012 Review highlighted the importance of the "HSA", and the GBT is crucial for providing the necessary sensitivity for the HSA. In short, the GBT is unique and no current facility or any planned facility would be able to come close to matching its capabilities into the foreseeable future. As stated within the recent GBT High-Frequency community report (Bally et al. 2016, arXiv:161009014B): "No other observatory has the capabilities of the GBT, and none has open access for US investigators to the degree offered by the GBT. Adequately instrumented, the GBT would be a pillar for 20 -- 115 GHz science in the US and the world." The White Paper written by Lockman et al. 2016 (arXiv:1610.02329) argues why the 2012 review is no longer relevant with respect to the GBT. Below is the abstract from this paper: "The National Science Foundation (NSF) Astronomy Division's Portfolio Review of 2012 is no longer relevant to the Green Bank Telescope (GBT) of 2017 for two principal reasons, one instrumental and the other astrophysical: 1) The GBT has begun significant operations in the 3mm band, giving it unrivaled capabilities for spectroscopy and continuum studies over 67-116 GHz. It is now an instrument that is unique worldwide and is a critical complement to ALMA for the U.S. scientific community. These capabilities had not been implemented at the time of the review. 2) The detection of gravitational radiation by LIGO in 2015 places the GBT's work on pulsar observations of nano-Hz gravitational radiation at the forefront of modern astrophysics.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	https://library.nrao.edu/public/memos/gbt/GBT_294.pdf
192	e	David	Fraye	Scientist at GBO and Adjunct Professor of Physics & Astronomy at WVU	The Green Bank Telescope of 2017 is not the GBT that was reviewed by the Eisenstein-Miller committee in 2012, a review that was specific to the NSF Astronomy portfolio. The GBT serves a wide spectrum of science areas including physics, chemistry, and planetary studies as well as astronomy. Besides its well-documented intellectual merit, it thus has a significant broader impact. The GBT is making significance advances in our understanding of gravitational waves, the equation-of-state of nuclear matter, the mass of supermassive black holes, the value of H0, and the physics of star-formation, all key science goals for astronomy identified in a recent National Academy study "New Worlds, New Horizons: A Midterm Assessment". In the era of ALMA and LIGO, other countries have bolstered their mm-wave and cm-wave facilities; it is critical that U.S. scientists have ready access to a large filled aperture to remain at the forefront of research." Representatives from NSF-AST have basically stated to the astronomical community that the 2012 Review report represents all of the needed input from the scientific community (i.e., this box has been checked off for NSF bureaucrats). I urge the NSF-AST to reconsider and to take into consideration the advice from scientists all over the world. For the NSF to blindly accept the recommendations of the 2012 Review with the knowledge of its shortcomings is not responsible. Many astronomers would agree with the statement recently published in Physics Today (January 2018) with regard to the NSF divesting from the GBT and Arecibo: "AST appears to be basing its course of action not on merits of the science or benefits to society but on other considerations, such as the personal preferences of managers and the desire to deflect attention from past mistakes. Thus the process changes from evaluation of scientific and societal merits to a political fight. The science and broader impacts are clear. AST has ignored them and has damaged its own interests and those of other fields of science served by the observatories." The GBT is currently being used to carry out key science programs for astronomers from all over the world (the GBT userbase is approximately 1000 and has been growing with the new instrumentation at high frequency). The loss of the GBT is not replaceable, and decreasing the amount of time available for science would drastically affect the recent progress being made at high-frequency. I, likely many other astronomers, care deeply about the science enabled by the GBT. If the NSF values science, then I encourage it to choose "Continued NSF investment for science-focused operations (No-Action Alternative)".	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	https://library.nrao.edu/public/memos/gbt/GBT_294.pdf
193	a	Michael	Holstine	Business Manager at GBO	Thank you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory (GBO) in Green Bank, West Virginia. Following are comments referenced to Section numbers and Page numbers as pertinent. Comments that are related to several Sections within the report may only be referenced once and not repeated for every instance within the report. SECTION/Page No. COMMENT ES.1/ES-1 The report states that there will be reduced NSF funding "in light of a constrained budgetary environment". How has the budget changed since 2012? Is there increased funding of the NSF since that time and has the need for this process changed based on the renewed budgetary environment? ES.2/ES-2 The operations cost model referenced in the report is an unreasonable measure of cost/efficiency. While the effort to support ALMA is a smaller percentage of the initial capital cost of the project, the science and effort to support this science is essentially the same as that required at GBO. It appears that the rational take-away from this type of accounting is to ensure that the capital cost of construction for any future project should be as high as possible so that the operations costs fall within the rule-of-thumb limit. This in no way ensures protection of the taxpayer. ES.5.1/ES-5 Action Alternative A is stated to be the Agency-preferred Alternative. What specifically does this mean? The caveat noted follows. ES.5.1/ES-6 Since this alternative would meet the purpose of "reducing the funding required" there is no discussion as to what the funding level will be, therefore at what level are collaborators needed? What is the break point at which these alternatives will be reviewed?	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public meeting comment)	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
193	b	Michael	Holstine	Business Manager at GBO	ES.7/ES-11 A Stormwater Protection Plan (SWPP) and Groundwater Protection Plan (GPP) already exist for the GBO site. Any additional modifications to these documents should only address additional demolition activities by the contractor.	Considerations for Document Analysis	Water	Written Comment (also public meeting)	1/8/2018	
193	c	Michael	Holstine	Business Manager at GBO	ES.7/ES-12 As the GBO facility is federally-owned sections 19 and 2 of Public Law 91-596 provides no jurisdiction of the OSH Act to the facility. GBO has developed its own safety plan in accordance with the Law. Contractors hired by the NSF may abide by the Act.	Considerations for Document Analysis	Health and Safety	Written Comment (also public meeting comment)	1/8/2018	
193	d	Michael	Holstine	Business Manager at GBO	1.2/1-5 As previously mentioned the method of operations to construction cost ratio is unreasonable. 1.2/1-7 The purpose is to "substantially" reduce NSF's contribution. Please define "substantially".	Considerations for Document Analysis	Purpose & Need	Written Comment (also public meeting comment)	1/8/2018	
193	e	Michael	Holstine	Business Manager at GBO	2.2/2-3 Statement should read "...and operation staffing levels would be expected to stay approximately the same".	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	f	Michael	Holstine	Business Manager at GBO	Table 2.6-1/2-9 Telescope 85-1 is considered historic, as is the Control Building. The Interferometer Range Barns are utilized for storage of materials. As operations continue, storage will be necessary. Also note that painting is an integral part of the operations and elimination of the Paint Shop Building would be detrimental to the operation. Additionally, all housing on site is utilized for both scientist and employee need, but also for the support of educational activities. Elimination of any housing would have a devastating effect on the operation.	Considerations for Document Analysis	Cultural	Written Comment (also public meeting comment)	1/8/2018	
193	g	Michael	Holstine	Business Manager at GBO	Table 2.6-1/2-10 The 20-meter Telescope is utilized for educational and science programs and is a source of external income.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	h	Michael	Holstine	Business Manager at GBO	The 43-meter Telescope (140-foot Telescope) is not only historic but is utilized for scientific missions and is a source of external funding.	Considerations for Document Analysis	Cultural	Written Comment (also public meeting comment)	1/8/2018	
193	i	Michael	Holstine	Business Manager at GBO	Table 3.1-3/3-5 The Golden Eagle is not listed in the table. The GBO participated in a Golden Eagle research project with the National Forest Service and Green Bank Elementary Middle School as part of an educational program. Golden Eagles are migratory in this area.	Considerations for Document Analysis	Biology	Written Comment (also public meeting comment)	1/8/2018	
193	j	Michael	Holstine	Business Manager at GBO	3.3/3-13 Although it is mentioned in various places within the report and appendices, according to the U.S. Army Corps of Engineers original site map the GBO site consists of approximately 2655 acres, not 2200.	Considerations for Document Analysis	Visual	Written Comment (also public meeting comment)	1/8/2018	
193	k	Michael	Holstine	Business Manager at GBO	3.8.1/3-32 Sixth line should read either "...which are equipped with radar transmitters" or "which are equipped with a radar transmitter".	Considerations for Document Analysis	Health and Safety	Written Comment (also public meeting comment)	1/8/2018	
193	l	Michael	Holstine	Business Manager at GBO	3.11/3-39 The northern half of GBO surrounds the unincorporated community of Arbovale and the southern half of GBO consists of the unincorporated community of Green Bank. Additionally, the Sugar Grove facility to the northeast is in partial private ownership. The upper base is still federally-owned.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	m	Michael	Holstine	Business Manager at GBO	3.11.1/3-45 A 58% vacancy rate seems unreasonable unless Snowshoe Resort, hotels, and seasonal camps, etc. are included in the calculation. The seasonable camps, etc. would NOT be available for use by employees, visiting scientists, or contracted personnel.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	n	Michael	Holstine	Business Manager at GBO	3.11.1/3-45 Also, the GBO Housing Units numbers seem incorrect. The GBO holds 28 rental housing units, a Residence Hall with 16 hotel-style rooms and 4 apartments, and one Dormitory/Bunkhouse with space for 60 people and 2 supervisor rooms. 3.11.1/3-46 As noted, the GBO includes over 28 individual houses or townhouses, not 30.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
193	o	Michael	Holstine	Business Manager at GBO	4.7.1/4-53 While noble in thought, there are no recycling facilities/programs in Pocahontas County beyond paper/cardboard sorting. These activities are already performed and various recycling programs on an individual basis/effort have been performed in the past.	Considerations for Document Analysis	Solid Waste	Written Comment (also public meeting comment)	1/8/2018	
193	p	Michael	Holstine	Business Manager at GBO	4.8.1.1/4-59 Although the statement "Nonetheless, the characterization of NEOs could continue at other observatories" is theoretically true, no other observatory is capable of the resolution of the GBT.	Considerations for Document Analysis	Health and Safety	Written Comment (also public meeting comment)	1/8/2018	
193	q	Michael	Holstine	Business Manager at GBO	4.11/4-80 This table contradicts Post-Implementation statement in Section 4.7.1 page 4-53, "the number of personnel at GBO is expected to be less under Action Alternative A...". This table indicates no change in workforce levels, therefore purposefully minimizing the socioeconomic impact.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	r	Michael	Holstine	Business Manager at GBO	Tables 4.11-2&3/4-81 To maintain levels of science activities, research and education, no housing can be demolished. Table 4.11-3 cannot be realistic in numbers served without housing to accommodate the programs involved.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	s	Michael	Holstine	Business Manager at GBO	4.11.1.1/4-82 The percentage of housing stock vacancy is unreasonable for year-round availability. Is this number a snapshot in time?	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	t	Michael	Holstine	Business Manager at GBO	While the report is thorough in its research it is not reflective of the cultural nuances of the communities or County. Housing availability, employment rankings, etc. are season-dependent. The stability of the employment numbers of the GBO serve to stabilize the economy and the programmatic products reinforce the social fabric of the community. The cultural diversity of the area will be adversely affected by lessened NSF involvement and/or lowered employment numbers. This is not reflected in the statistics.	Considerations for Document Analysis	Socioeconomics	Written Comment (also public meeting comment)	1/8/2018	
193	u	Michael	Holstine	Business Manager at GBO	It is also worrying that the level of NSF involvement is not specified. At what level is external funding required to ensure that the chosen alternative will succeed? At what level will the NSF funding continue? Should the levels of either fail to be achieved what is the result? Will the next level Action Alternative be automatically instituted? Each successive level will lower the GBOs chances of success as the funds and employees available will become smaller, and this would appear to ensure failure of the program.	Considerations for Document Analysis	Purpose & Need	Written Comment (also public meeting comment)	1/8/2018	
193	v	Michael	Holstine	Business Manager at GBO	It is also noted that the 2006 report referenced is done so in an unclear manner. It is known that the GBO portion of that review recommended increased funding for Green Bank, not reduced funding, and every audit and review found that the Green Bank site operated extremely lean and efficient. Lastly, there is no mention of the funding to be used for the various activities recommended in the Alternatives. Where will this funding originate and what are the costs associated with each? How do these costs compare to the costs of operation?	Considerations for Document Analysis	Purpose & Need	Written Comment (also public meeting comment)	1/8/2018	
193	w	Michael	Holstine	Business Manager at GBO	It is also unclear, under Section ES.5.5 Page ES-8, why the narrative subtly indicates that the EIS's purpose intends to ensure some action. It would seem that the true purpose of an EIS would be to review all possibilities and to then recommend that alternative which would have the minimum, or no, effect on the factors reviewed. Instead of dismissing the obvious, the EIS report should recommend implementation of the No-Action Alternative as it is the only Alternative that would have no adverse affects on the environmental factors reviewed. Supposed funding constraints of the NSF have no role in the determination of environmental effects.	Considerations for Document Analysis	Purpose & Need	Written Comment (also public meeting comment)	1/8/2018	
193	x	Michael	Holstine	Business Manager at GBO	Due to the impact on science, research, educational programs, the community at-large, socioeconomic factors, and STEAM availability within this rural area of the State I highly recommend that NSF continue to fund the GBO at full levels. As noted in the DEIS, the No-Action Alternative is the only alternative that would have no impact on the entire gamut of factors researched and included in the report. It is hoped that the NSF will adopt the recommendation that has no impact and continue full funding of GBO. Thank you again for this opportunity. I look forward to the full resolution of this issue.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public meeting comment)	1/8/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
194	a	Loren	Anderson	Associate Professor of Physics & Astronomy WVU	I am writing to communicate the importance of the Green Bank Observatory, and to stress to the NSF that it should be kept available for the maximum amount of science possible. From the environmental impact statement options, I support option A, collaboration with interested parties for both science and education with reduced NSF funding. I am an astronomer at West Virginia University (WVU), studying star formation and the structure of our Milky Way Galaxy. I first visited the Green Bank Telescope (GBT) in graduate school, and it has continued to be the most important scientific instrument that I utilize. For radio astronomers, there simply is nothing as powerful and flexible as the GBT. I imagine that you are receiving many letters stating how wonderful the GBT is for science, but I want to also stress how important it is for the state of West Virginia and for WVU. A decade ago, WVU had no research-active astronomy faculty. Since then, we have hired eight full-time tenure track astronomers, and built ourselves into a premier institution, specializing in radio astronomy. Our success is due almost entirely to our proximity and close connection to the GBT. Our astronomy faculty use the telescope heavily, and we regularly send students to the GBT site to be trained in radio astronomy techniques. We have together bought in millions of dollars of federal funds tied directly to research done with the GBT. If the available scientific time on the GBT decreases significantly, I fear that all of our successes will be erased. Our faculty were hired with the understanding of a continued close working relationship with the GBT, and reducing its scientific work increases the likelihood that the faculty will move to other institutions. The close ties with the GBT are a strong draw for recruiting graduate students, and without this added benefit to joining WVU, they will attend other universities. The scientific and outreach potential of the GBT makes our grants more competitive, as our recent successes demonstrate, and with reduced scientific potential we will not be as successful at winning federal awards. In short, our program is in jeopardy, but the NSF can mitigate the potential impact by choosing to maintain as much of the GBT's scientific time as possible.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/8/2018	
195	a	Eugene	Cilento	Dean of Benjamin M. Statler College of Engineering and Mineral Sciences at WVU	There are several points to consider in response to the NSF Draft Environmental Impact Survey (DEIS) for the Green Bank Observatory (GBO) located in Greenbank, WV. Let me state first that the GBO should be considered a real national resource that has and can continue to provide scientists the ability to do valuable scientific studies. The critical investment has already been made and the operational resources are a small cost to pay to allow good science to continue at this site. The GBO also is a great place to develop and train the next generation of scientific workforce that will contribute to the science database that will allow America to remain competitive on a global level. Please consider what the GBO has provided for West Virginia, the NSF overall mission, and national competitiveness in radio astronomy. Regional Impact: The GBO is at the economic heart of Pocahontas County as the 5th largest employer with more than 100 full time jobs with an annual payroll of more than \$9 million. These high quality GBO jobs are of vital importance to the economic sustenance of the community, and especially in a state where 18% of the population falls under the poverty level. Since the GBO was established the citizens of Pocahontas County have abided by the restrictions of the National Radio Quiet Zone (NRQZ). This meant the locals went without most commercial radio, and now 60 years later, the NRQZ precludes use of cell phones, Wi-Fi and even microwave ovens. There are not many places in America today that would never consider such restrictions yet the local population has consistently agreed to such as part of its long-term covenant with the NSF to preserve the region for state-of-the-art radio astronomy. This has limited diversifying the local economy and the NSF should maintain its commitment to the citizens of this County in exchange for this long-term economic isolation. GBO staff are actively engaged in the broader community, serving as coaches, science mentors and volunteer personnel. The GBO has on site a swimming pool, tennis courts, and playing fields that are regularly accessed by the local community. Any changes to staffing and investment in the GBO would severely impact the local community. Impact on Scientific Research Efforts and STEM Education: The GBO is a great resource for supporting STEM education initiatives. With 50,000 visitors annually, many of them children, it is valuable to kids in West Virginia and excites them to pursue science and engineering careers. Every year the GBO hosts STEM related opportunities for teachers and students, such as residential teacher institutes and eight-week summer experiences. The popular Pulsar Search Collaboratory is a national program allowing middle and high school students the chance to discover new pulsars. This program feeds into the NanoGrav Consortium Laboratory for nano-Hertz gravity wave detection. To date over 2,000 HS students have participated in NSF funded collaborations between the observatory and West Virginia University with 99% of those student planning to attend college and 50% being from underrepresented groups. There are few other NSF supported STEM outreach programs that have comparable impact in an area with an acute lack of alternatives for STEM engagement.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3			

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
195	b	Eugene	Cilento	Dean of Benjamin M. Statler College of Engineering and Mineral Sciences at WVU	The NSF Portfolio Review Committee (PRC) issued a report in 2012 reiterating the GBO divestiture first recommended in 2006 by the AST Senior Review Committee, based on the rationale of "lower priority" science. However, since then, the NSF has awarded over \$13.3M competitively in eight separate scientific awards to West Virginia University researchers that depend critically on access to a fully functioning GBO. NSF must reconcile this apparent inconsistency with an aging report. The same PRC report stated that "the capabilities provided by the short-wavelength and pulsar-timing instrumentation on the GBT, as well as the spectroscopic capabilities for characterizing complex molecules and the potential for large-format heterodyne arrays and millimeter continuum imagers, would be significant losses to the scientific community. Concerns about the Review Process: The DEIS includes a recommendation to maintain operations with new partners but leaves unaddressed who those new partners, the process to identify those new partners, and the relationship and obligations between those new partners and the NSF. Concerns about the future of the facility are valid given these uncertainties, and the DEIS notes that anything less than current operations will result in adverse, long-term impacts on the community. Before any further actions are taken that disrupt current operations, the NSF should identify future partners and share partnership details and obligations to maintain the GBO. If implemented, any adverse effects would be borne by the citizens of Pocahontas County and West Virginia University researchers, but they had no oversight role in the fiscal and organizational management of the facility. In conclusion, West Virginia is a small rural state that needs to have such resources to build awareness and capacity for doing high technology research. The GBO provides that opportunity and is also a great source of pride for the state. In the 2014-16 time frame the state received only 0.24% of the NSF research budget, ranking only 46th overall. Continued investment in the GBO is a sincere commitment by NSF to support geographic diversity in its mission "to promote the progress of science; to advance the national health, prosperity, and welfare". Therefore, I encourage further careful and full evaluation of the overall impact and potential the GBO has for providing a national resource to continue exciting research and education.	Considerations for Document Analysis	Purpose & Need			
196	a	Bill	Hartman	Delegate for West Virginia	As a member of the West Virginia House of Delegates that represents Pocahontas County, I want to thank you for the opportunity to comment on the DEIS concerning changes in funding and operations of the Green Bank Observatory (GBO). GBO has been an important part of the scientific community, Pocahontas County, and West Virginia for over 60 years. The research conducted there has been important to the scientific community, it has become more important as we reach farther in space. The OPEN SKIES policy as has allowed anyone with a merit based proposal to have access to the Green Bank Telescope (GBT). This policy alone has made GBO a most valuable and vital part of the scientific community. The Green Bank Telescope (GBT) is the largest fully-steerable telescope in the world and is the center of GBO operations. GBT is the only radio free zone in the country and three to four hours of time is requested for each hour of time available for science on the GBT. GBO has reached out to many colleges and universities over the past years for both financial and research support and these efforts have been both financial and research support. These efforts have been well received and have become an integral part of GBO operations. This demonstrated the very wise use of scarce funding and the good judgement exhibited by the GBO staff. Annually there is 50,000 visitors that come to GBO to take part in the many tourist and teaching opportunities offered at GBO. People from around the world participate in activities which is available. The support by the GBO staff and employees to the community immeasurable. There is no activity in the area that does not have leadership and participation from the folks at GBO. Due to the GBO and radio free zone, Green Bank is one for the most unique communities in the country. The economic contribution to the county and state has been estimated at \$30 million annually. As GBO moves forward in their efforts to cooperate with many other educational. institutions and the emphasis for the need for STEM education countrywide, GBO can make additional significant contribution to society. Now is not the time to limit their ability to continue their most important work. I fully support the DEIS finding in the Preferred Alternative (A) and I do not understand how the importance of GBO work can be ignored. Thank you for the objective way this matter has been handled.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/4/2017	
197	a	Charles	Sheets	President of Greenbrier Valley Economic Development Corp. in Maxwelton, West Virginia	As a resident of Green Bank, WV, member on the Greenbrier Valley Economic Develop Authority representing Pocahontas County and on record of writing a letter of support of the Green Bank Observatory (GBO) dated November 23, 2016, I want to thank the NSF for returning to GBO and inviting the public to comment on the Draft Environmental Impact Statement (DEIS) as a result of the previous hearing about one year ago. I am happy that the NSF has acknowledged the importance to the scientific community of GBO in its scientific discoveries over the past 60 years. In light of the constrained budgetary environment, NSF says it must provide a balanced research portfolio with the largest scientific return for tax payer dollar. In looking up NSF 2018 budget request to Congress, in its continued long standing commitment to support basic research and education across all field of science and engineering, is \$6.653 billion, which is a decrease of 11.2 percent over FY 2016. The total West Virginia governmental budget for 2017-2018 is \$4.5 billion, for a population of 1.8 million people. This is NSF's only research facility of this type in WV, and GBO working in conjunction with West Virginia University, is providing a scientific research curriculum for students to obtain a PHD in astronomy, the only curriculum in WV. This was evidenced by the WVU students in attending of last years' NSF/GBO public hearing. I would support Sen. Manchin's offer to NSF Director to have a public hearing with the scientific community of the importance of continuing funding to maintain GBO in scientific research and the successful STEM programs. I support the DEIS findings in preferred alternative (A) which keeps GBO opened with reduced NSF funding. Since the agency has acknowledged the importance of GBO to the scientific community, I trust that NSF will continue funding of GBO at the current level and not engage in a Slow Strangulation of funding so that GBO can no longer operate. Thank you for the opportunity to submit my comment, and we trust that they will be taken seriously.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment (also public meeting comment)	11/30/2017	
198	a	Robert	Rappold	Mayor of City of Beckley	The Green Bank Observatory has served as an inspiration to untold thousands of young people interested in STEM opportunities in West Virginia and elsewhere. Attracting about 50,000 visitors each year, the Observatory has been the catalyst for research and development of classes in astronomy in our colleges and universities. Southern West Virginia is justifiably proud and thankful to have this world class facility within a short driving distance, in a beautiful rural setting. My plea would be that the NSF continue to operate and fund the Observatory at current levels, recognizing the value it brings to West Virginia and the entire nation. Thank you for the good work you and the NSF do on behalf of all Americans and best wishes for continued success in 2018.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		12/27/2017	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
199	a	Lawrence	Cameron	Resident of West Virginia	Read the DEI; but not the foregoing NSF report. Has there been any re-consideration of recommendations since Arecibo was damaged? Also what affect has the 500 m telescope in China had on current NSF thinking?	General	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2017	
200	a	Lounie	Bailey		Include me as a proud West Virginian that believes the Green Bank Observatory should be fully funded, and not scraped or underfunded. This world-class observatory is a great symbol for the state. It demonstrates West Virginia supports both progress and science. It helps to show we West Virginians are not a bunch of "hicks" or ignorant "hillbillies." But beyond being a tremendous icon for the state, it still provides a means to help answer the BIG questions of existence: more about our universe, more about possible extraterrestrial life, and makes our future a more glorious place to be. Is there a public fund to support Green Bank? I would happily donate to this worthy cause!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment		
201	a	Mayuresh	Surmis		I am a post-doc studying pulsars and fast radio bursts based at WVU. As an active researcher, I would like to keep working on the GBT data for doing cutting edge research. My main concern though is about the educational impact of the GBT on high school students. As a part of the Pulsar Search Collaboratory (PSC). I have experienced the fascination and wonder on the students faces after coming on the GBO site. After spending a week at the GBO site, it was clear that the students, even though, would not all be scientists, had seen and learned about the natural wonder of doing science and the scientific methodology. It is with this target audience that I have a concern. with the GBT losing funding over time, we would be letting go of a critical tool in inspiring future scientists and including scientific temper. I would like to request the NSF to keep supporting GBT with open-skies in the future to keep doing the leadership role in training future researchers. Even if the NSF does not find enough funds to support the GBT, I would like to urge them to seek suitable partners who are interested in keeping open-skies on this iconic telescope.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment		
202	a	Phyllis	Law		I am writing to you on behalf of the Greenbank Observatory in West Virginia. I am 77 years old and my earliest memory of an amazing sight and historical science event was when my parents took me to Green Bank to see the dishes and I learned all about them and the possibilities they might achieve. I have always looked with pride at this marvelous scientific marvel. I urge you to do everything in your power to keep this wonderful establishment in West Virginia and to keep it in working order. Surely, you can accomplish this for the United States and the citizens of West Virginia. Many of our current students enrolled in high school, elementary, middle and college STEM classes or careers owe the love of these classes or fields of study to the Observatory. Do Not close or tear down the Observatory.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/8/2017	
203	a	Kenneth	Woods	Secretary of Rotary Club of Marlinton, West Virginia	The Rotary Club of Marlinton, without any reservations, recommends the full operation of the Green Bank Observatory (GBO) with support from NSF science focused operations and capitalizing upon additional support through collaboration with interested parties for science and education-focused operations. Hopefully, reduced funding can be avoided by NSF and/or other parties. This Rotary Club believes these viable efforts will be most beneficial for GBO, Pocahontas County and the States of West Virginia. The Rotary Club of Marlinton recognized the invaluable contributions that the GBO contributes to Pocahontas County and West Virginia's economic and educational well-being. The GBO has approximately 100 full-time employees and approximately 40 part-time summer employees. Additionally, the GBO has approximately 50,000 tourists visiting the facility annually. With a payroll over \$ 14 million and tourist spending over \$7.5 million, Pocahontas County and West Virginia receive millions of dollars to support education, health, human services, public safety, highways and other public services. The GBO offers numerous educational opportunities for education K-12, post-secondary and post-graduate levels for local, state, national and international institutions and students. As a result, all West Virginia school systems have opportunities to participate through field trips, teacher training programs, science camps and other hands-on educational activities. The GBO provides exceptional opportunities for the educational development of future scientists. In closing, the Rotary Club of Marlinton endorses the full operation of GBO through NSF and collaborating parties. The GBO is an invaluable facility for Pocahontas County, State of West Virginia and the Nation. In fact, the GBO is represented as this Rotary Club's banner, being presented to visiting Rotarians from various State, National, and international locations.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	12/19/2017	
204	a	Tommy	Melko	Resident of Green Bank	I strongly support the continued full operation of the Green Bank Observatory. It's contributions to the local community are immense - and so are its contributions towards the nation. There is a world class science and research facility staffed by some of the most dedicated, educated, and talented people I have had the honor of knowing. As a multi-year volunteer at the annual "space race rumpus", I have seen first hand just what great staff is here and how well they serve our community. Recall that this is only one of many civic minded endeavors. Ground breaking research, mentoring to young minds, serving as a tourism magnet, and civic responsiveness. These are just a few of the reasons this facility should continue full operations! Moth balling or demolition are not acceptable alternatives. Years ago, the NSF was instrumental in the creation of this facility and its subsequent contributions to science. What it also created was unique intertwining between the facility staff and the local community. This intertwining has resulted in a "one of a kind" happy fusion of economic, social, and scientific interests that could not be replaced. So I ask the NSF to do everything in its power to fusion alive, well, and vibrant. Thank you!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	11/30/2018	

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Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
205	a	Susan	Howard	Resident of Green Bank	I am grateful for this opportunity to further comment on an extremely important Environmental Impact issue. As a person who has developed Electohypersensitivity (EHS) later in life, I am grateful beyond measure to have found a safe place to live and thrive in Green Bank, WV. I am putting down roots within the 10 mile protected radius around the Green Bank Telescope and plan to spend the rest of my life here. I rarely travel out of the area, but when I do, I am painfully aware and reminded of just how special a place Green Bank is, and am always eager to get home. I have noticed a remarkable improvement in my health since moving to Green Bank two years ago. After the November 30th, 2017 public meeting, I spoke briefly with one of the NSF panel members. Although I felt like he was very attentive, I am concerned that he does not fully understand the magnitude of the problem for those of us living with EHS. HE told me that we would continue to be safe because of Sugar Grove, within the National Radio Quiet Zone. But that is simply not so. An example would be how Snowshoe Resort and Marlinton, 15 miles and 26 miles away respectively, both have cell towers. Local farmers just outside of the 10 mile protected radius are repeatedly approached by cellphone carriers and asked to put up towers on their farms. If the GBO were ever to close those towers and antennas, I would, no doubt, be activated in a matter of weeks. I shutter to think of what would happen to the ever growing EHS community and individual EHS people who are struggling to seek out a life. Many of whom have already lost so much; family, friends, careers, communities, and dignity. Enclosed is a link to a documentary which features the lives of 5 of the many people with EHS living in Green Bank. We are the lucky ones. More and more people are getting sick, and more and more people are coming to Green Bank for refuge. I would ask that you please imagine for a moment the very real possibility that you may someday develop EHS and need to be protected by the 10 mile radius around the GBT. Thank you very much.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/2/2018	https://rtd.rt.com/films/wi-fi-refugees/
206	a	Bert	Hoopes		Please keep funding the Green Bank Observatory, and maintain the Open Sky Program. My family and I were able to spend an evening on a real radio telescope! These types of treasures need to be kept for years to come, please!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
207	a	Jennifer	Johnson		Greetings and thank you for taking the time to read this. I ask for humble that you consider continuing funding from the NSF to Green Bank, specifically so "Open Skies" can continue. For graduate, undergraduate, and other students and researchers, we need "Open Skies". To continue "listening" may save our planet, our lives. Please don't limit further the "Open Skies". Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
208	a	C	Buckelew		Please fund Green Bank Observatory to 100%! Keep Green Bank open!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
209	a	Sarah	Buckelew		Please fund Green Bank Observatory to 100%! Keep Green Bank open!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
210	a	Elaine	Skouch		Please choose "No action alternative: continued NSF Investment for science focused operations." #GoGreenBankObservatory	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
211	a	Larry	Kalaskey		Please support GBO for the future of this world and kids growing up. For the possibility of finding extraterrestrial life in outer space. There is so much research going on at GBO. The government needs to support this research.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
212	a	Ian	Hoopes		I would like to request that the NSF maintains funding for the Green Bank Observatory the benefit of this facility is undeniable.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
213	a	Zoe	Hoopes		Please restore funding to the GBO and retain ownership of the wonderful GBT. Funding for the Open Sky Program opens up precious time to look at the sky for groups who can not pay the full amount (typically young scientists). Even groups who can pay will use a free telescope over a costly one! I would like to see scientific breakthroughs occur in my own state!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
214	a	John	Miesner		The important work at Green Bank and its unique setting in which to allow significant scientific research to occur needs continued funding. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	

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215	a	Ingrid	Ferrell		The Green Bank Radio Observatory is such a fantastic resource for the U.S. and the state of WV. It is so important to support science and learning and what bigger question is there than what the observatory is trying to answer. Please keep funding the Green Bank Observatory!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
216	a	Rachel	Hoopes		Please restore funding to the GBO and retain ownership of the wonderful GBT. Funding for the Open Sky Program benefits all and the following generations. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
217	a	Chris	Kiefer		In regards to the Green Bank Observatory, I hope the NSF will choose the "No Action Alternative" with continued 100% funding and investment for science-focused operations such as continued operating budgets supporting future science goals (New World Historians Program), STEM educational programs and research, and especially guaranteed open skies science observing time. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
218	a	Ron	Buckalew		Please fully fund Green Bank Observatory to 100%!!!	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
219	a	Kim	Rossi		Please consider restoring funding to the Green Bank Observatory! It is crucial to continue to research SETI and Open Skies. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
220	a	Chris	Batog		Please choose "No action alternative: continued NSF Investment for science focused operations and restore full 100% funding to GBO. Thank you.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
221	a	Shannon	Foatche		Please please help us keep Green Bank Observatory funded 100%	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
222	a	Carol	Buckalew		Please restore funding to 100% for Green Bank Observatory	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
223	a	Debbie	Ervine		When I heard about the proposed changes to the Green Bank Observatory, my first thoughts, of course, are on the impact to our community. If we lost the observatory, our community would be devastated!!! We have a very unique & wonderful community here in the Green Bank area. The observatory is the center of our community. If the center is gone, the rest will fall apart. Economically & financially, the observatory contributes a tremendous amount of money into our community, county & state. I have lived in the Green Bank area for all of my life. I am the branch manager of the bank that is across the street from the observatory. My husband owns Trent's Store in Arbovale. Both of these businesses, along with other businesses in Pocahontas County, depend heavily on the observatory. I can't even begin to think what would happen if the observatory were to close. The employees at the observatory contribute to our fire & rescue departments, churches, local radio station, schools, and other organizations in our community. Without the help from the GBO and the GBO employees, most of these organizations would no longer exist in our community. What would our community do???? I think about the doctor's offices, dentist office & hospital. These could very easily have to close without the GBO in our community. The GBO contributes greatly to the education of the students in our county, state & nation. When I went to the meeting that was held on November 9 at GBO, I was so amazed at what the students & professors from WVU had to say about how the GBO had impacted their lives. The GBO has made a difference in our community, county, state, nation & world!! !!!! It would be a tremendous loss to lose this facility!!! I strongly believe that option number 1, which is the No-Action Alternative, is the absolute best option for everyone concerned. If you have any questions about anything I have said in this letter, please feel free to contact me.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3	Written Comment	1/8/2018	
224	a	Christine	Plumley		I would like to comment on the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory (GBO) in Green Bank, West Virginia. I believe the No-Action Alternative should be chosen but want to address comments referenced to Section numbers and Page numbers as follows. Section ES.2/ES-2- The SR found that the GBT operations costs of \$10M (\$15M burdened) to be conspicuously large, especially as it is several years since the instrument was commissioned. The former figure is 12 percent of the construction cost, much larger than the seven percent rule of thumb and large in comparison with the proposed running costs for Atacama Large Millimeter Array (ALMA) (six percent of capital costs minus the component set aside for new instrumentation). Because ALMA is partnered with other International Organizations were these other Non-NSF Funds used in both the calculation for new construction as well as for the operational costs prior to the comparison? Were the upgraded and improved capabilities of the GBT added to the original construction cost? If not the calculations would not be valid.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	

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224	b	Christine	Plumley		ES.5/6 ES-5.1 Action Alternative A is stated to be the Agency-preferred Alternative. Since this alternative would meet the purpose of "reducing the funding required" What is that level of funding to be reduced and how much will be required for collaborators? When will this be determined? Action Alternative A would involve collaborations with new stakeholder(s) who would use and maintain GBO for continued science-and education-focused operations. NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades. If the Observatory is still being utilized for "Open Skies" will the percentage utilized for this purpose not be supported at the same percentage level for related maintenance and related upgrades?	Considerations for Document Analysis	Purpose & Need		1/19/2018	
224	c	Christine	Plumley		Table 2.6-1/2-9 All housing on site is utilized for both scientist and employee need, as well as for the support of educational activities. Elimination of any housing would have drastic effect on the operation as well as reduce program income. Table 2.6-1/2-10 The 20-meter Telescope is utilized for educational purposes as well as a source of external income. The 43-meter Telescope is also utilized and is a strong source of external funding.	Considerations for Document Analysis	Socioeconomics		1/19/2018	
224	e	Christine	Plumley		3.11.1/3-45 A 58% vacancy rate seems extremely high unless Snowshoe Resort is included in the calculation which is seasonal. Does this include private hunting camps only occasionally used and not available for use by employees, visiting scientists, or contracted personnel?	Considerations for Document Analysis	Socioeconomics		1/19/2018	
224	f	Christine	Plumley		Due to NSF involvement not being specified or unknown does this tend to lend itself to a shortfall of staff, tougher recruiting of qualified people, lack of infrastructure improvements or less development? Is so this appears to set up even Action A Alternative for the possibility of failure. With this said and the impact on science, research, educational programs, the community at-large, socioeconomic factors, and STEM availability I highly recommend NSF to continue to fund the GBO at the No-Action Alternative level.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
226	a	Unknown	Unknown	High School student from Huntington High School	I write this letter hoping to persuade you to take a step towards a better future for America, its economy (and that of its states), its youth, and its development as a leading technological power. The Green Bank Observatory is not only an invaluable asset for the country, but a beacon of scientific opportunity for its people. 50,000 visitors as well as 3,500 students frequent the observatory each year to learn and be inspired by major, groundbreaking scientific achievements in fields such as quantum mechanics, the study of gravity, and the search for extraterrestrial life. Achievements that would not be possible without this facility. The observatory also serves as a high-tech job opportunity for more than 900 astronomers and technicians in the state of West Virginia, a state that I'm sure you know is not in an economically auspicious position, and needs the \$30 million of benefits that the observatory provides. It is also worth noting that the potential cuts will limit the use of the facility or possibly even result in complete deconstruction of the telescope. These cuts come during a time when many other advancing countries are already catching up to the US in the continuous race for scientific and technological leadership between rapidly developing countries across the globe. Please, err on the side of scientific progress, instead of regression. Not only does that Green Bank Observatory benefit West Virginia and the United States in the short and long-term, but it continues to spark inspiration for those who have the potential to pursue scientific careers. and make incredible change in the world. Cutting funds would handicap the US and West Virginia, as well as discourage the best and brightest minds that the country has to offer from choosing a path that may very well affect every person on the planet. So for the sake of my state, our country, science, and the future of mankind, advocate to your fullest ability the complete funding of the observatory. Thank you for reading.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
227	a	Davia	Harris	High School student from Huntington High School	I am writing on behalf of the Green Bank Observatory. It is in danger of being closed, and there are so many things that people have learned while using it. My name is Davia Harris. I am a freshman at Huntington High School. More than 3,500 students have participated in Green Bank's educational programs within that last year. Students really enjoy the program, and it would be devastating for them to no longer learn from it. The Green Bank Telescope cost \$95,000,000 to build, and more than \$25,000,000 has been invested in the GBT in the past five years by colleges, universities, the NSF, and the state of West Virginia. If the Green Bank Observatory gets shut down, it would be a huge amount of money wasted. The Green Bank Observatory employs 105 people on the Green Bank Site year-round, and 140-150 people during summer months. If the GBO would happen to close, it wouldn't be good for the employees. They have to find new jobs, and sometimes it's not easy. If we stop funding this Telescope, then we wouldn't be able to get a new one. Please take this into consideration. I hope the National Science Foundation continues to fund Green Bank.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	

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228	a	Sydney	Wiles	High School student from Huntington High School	As you know, the Green Bank Observatory is in danger of closing. However, I am writing you to object the closing of the telescope. You most likely also know that the telescope only uses three percent of the National Science Foundation's astronomy budget and only around 0.1 percent of the overall National Science Foundation budget. To preserve the closing of Green Bank, budget cuts, even if they are not from Green Bank, should be taken. Obviously try not to close other things that take up different portions of the budget but do make some cuts. That should surely be more helpful than shutting anything down. The Green Bank Observatory is a telescope that inspires young people and gives them an amazing career in astronomy. That is incredible for a place like West Virginia where there is hardly any opportunity. It deserves to stay in the National Science Foundation budget.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
229	a	Elizabeth	Thomas	High School student from Huntington High School	I am writing this letter in regards to the full funding of the Green Bank Observatory. A recent decrease in funding from the National Science Foundation for the Green Bank Observatory will limit the amount of open science available. The Green Bank Observatory each year has over 50,000 visitors and 3,500 students visiting to learn more about science and technology. This facility remains at the cutting edge of astronomy. Studies at the observatory including pulsars, gravitational waves, star formation, asteroids, astrochemistry, and the nature of high density matter have led to ground breaking discoveries. Losing funding of this observatory would take away from a future of other federal scientific facilities and discoveries. Although the Green Bank telescope still remains the largest and most technologically advanced, foreign counties are beginning to invest in radio astronomy. This could mean the US and West Virginia's leadership in this crucial field could be threatened. Many new breakthroughs of science technology could provoke fate. The Green Bank Observatory has discovered many mysteries in space. The observatory has made very important contributions to the science research and the funding is a necessity to continue to operate in the future. The telescope could become the best path to unlock understanding of the world and universe.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
230	a	Cynthia	Short	High School student from Huntington High School	It has come to my attention that the Green Bank Observatory could possible be torn down. The Green Bank Observatory has been a learning experience for over 50,000 visitors each year. Green Bank Observatory first telescope was built in 1959 so that means that over 2,900,000 people has visited the Green Bank Observatory. Many people are a part of this operation and would be gravely affected if the Green Bank Observatory was destroyed. The telescopes located at this facility are valued for being the engine of discovery so far. The newest large telescope called the GBT has made discoveries such as quantum mechanics, the study of gravity, and searches of life beyond Earth. Imagine what else could be discovered in this operation that might soon be destroyed. In the past 12 months, 54 groups have stayed overnight using 40 foot radio telescope as part of their hands-on educational experience. Education, jobs, and unforgettable experiences are made at the Green Bank Observatory in the last fifty-eight years. How will destroying of one West Virginia's prideful building be anything but disappointing? I would like to ask that the National Science Foundation fully fund the Green Bank Observatory. The Green Bank Observatory would only be 0.1% of the total amount of National Science Foundation budget. Saving this operation would allow the opportunity for more people to visit the Green Bank Observatory and also make new discoveries about the world we live in.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
231	a	Tess	Bowen	High School student from Huntington High School	Hello, my name is Tess Bowen and I am a 9th grader at Huntington High School. The reasoning for this email is concerning the Green Bank Observatory. The Green Bank Observatory is in desperate condition of needing help to stay running. The National Science Foundation as a team, needs to step up and continue funding them money. If you guys don't continue to fully fund them then they will have to shut down. People use this over view as an advantage and some people really do enjoy it. Students that are interested in astronomy and want to go into that field, look forward to seeing this one day to further interest their future. There isn't really a valid reason to shut it down and I think it would serve well in the future. I feel as if they should advertise more about it so people will know. I had no clue about the Green Bank Observatory until my science class discussed it and after that I became very interested. I hope to one day visit the observatory, but if they close it I won't be able to fulfill that dream. This observatory serves well and I feel like it would be better to stay up and running rather than closing down.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
232	a	Lakeisha	Mitchell	High School student from Huntington High School	I am writing to you on behalf of hearing in science class that the Green Bank Observatory is being closed and the National Science Foundation can help. In science class we talked about the telescope and watched videos about it, and I even wanted to visit it. I have always been interested in science and it seemed like a good field trip opportunity or somewhere to visit with my family, but then our teacher told us it was closing down. I was very upset about this until she told us that we could help prevent it from closing. She told us if we wanted to help stop it from shutting down we could write a letter. I read that the telescope was one of the NSF's newest large telescopes and remains at the cutting edge of astronomy. The telescope has made groundbreaking discoveries, so why wouldn't you fully fund the telescope? Over 50,000 visitors and 3,500 students visit Green Bank every year and they are influenced by the science and technology from this telescope. I'm sure that their trip there inspired so many people or at least made them think about pursuing further in the science field. Shutting this down would stop many more students and visitors from experiencing it.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
233	a	Tucker	Denning	High School student from Huntington High School	I am a 9th grade student at Huntington High School in Huntington, WV. Recently I learned that the National Science Foundation may cease to fully fund the Green Bank Observatory. As a future scientist, I feel that this may not only hurt my education, but the education of thousands of students who visit the Green Bank Observatory each year. The Green Bank telescope is one of the National Science Foundation's newest large telescopes and remains the cutting edge of astronomy. Radio astronomy is a growing field. Many other countries are investing in radio astronomy. If the Green Bank telescope is not funded, the United States may fall behind in the field of radio astronomy. Many of the breakthroughs that we are on the edge of discovering in radio astronomy could be lost forever. The Green Bank telescope only accounts for 3% of the astronomy budget for the National Science Foundation, and only 0.1% of the total National Science Foundation budget. If the Green Bank Observatory is not funded, over 900 astronomers, many who are just entering the field, could be negatively affected and over \$30 million in economic benefits could be wiped out to the state of West Virginia. The Green Bank Observatory is a vial resource to scientists all over the world. The use of the telescope has made groundbreaking discoveries in the field of quantum mechanics, the study of gravity as well as the search for life beyond earth. Please keep funding the Green Bank Observatory so that future scientists, like myself, can only day make discoveries that no one ever dreamed could be made.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
234	a	Elise	M	High School student from Huntington High School	I am writing this letter to ask you to continue fully funding the Green Bank Observatory. The Green Bank Observatory is located in West Virginia, a relatively small state with little scientific achievement to call its own compared to many of the other states located in the United States. This state is well known for its hardships, and the people in this state are constantly looking for a distraction or hidden hope to blind their struggles. One of the ways people may do this is by visiting the Green Bank Observatory. This scientific feat is the world's largest fully steerable radio telescope and groundbreaking research is conducted at this facility every year. The local people are being always inspired by this scientific tool to pursue careers in science and dream bigger than their current hardships. One may think that a large telescope won't do much for the community, but the Green Bank Observatory proves this no longer fully funded, there would indefinitely be decreased interest in science studies in the area of West Virginia. Many young science dreams and accomplishments are dependent upon the Green Bank Observatory, and its deconstruction would certainly dent the hopes of many wishing to develop a future career in science. Although this may be difficult, the continuation of full funding towards the Green Bank Observatory would greatly help those with a passionate yearning for science in the state of West Virginia.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
235	a	Thomas	Plumley		This letter is in reference to the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory (GBO) in Green Bank, West Virginia. As a retired Educator in the State of West Virginia, I believe the best alternative is the No Action Alternative. I have personally witnessed the impact the Observatory has had on educating the children in our State as well as many others. The existence of the GBT itself is enticing and I truly believe it existence lays the ground work in leading our children to STEM careers. Thus due to the impact on science, research, educational programs, the community at-large, socioeconomic factors, and STEM availability within rural area I highly recommend that NSF continue to fund the GBO at full levels or the No-Action Alternative.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
236	a	Lowell	Lannert		I apologize about being a little late on this, but it was just brought to my attention. Admittedly, we relocated to this specific area of the country to avoid wireless communications. Despite my extensive background in this area and my occupation therein, my wife is adversely affected (just as millions around the globe are) by advancing wireless technology. To evaluate the 'impact', regardless of type, requires stepping back with another perspective. Let's face it; the bottom line is 'funding'. While most perspectives is how can money be 'given' to the observatory, I focus more on how can the observatory make more. Here are a few of my ideas: 1. A thriving community with a tax base to assist the observatory would be one way of softening the impact of reduced funding. Greenbank has the unique distinction of being one of the only areas in the world with the distinction of reduced wireless technology. As the knowledge of health ramifications accelerate and begin to hit the masses in greater magnitude, people are left with 'where do I go to be safe and/or feel better?'. With the proper local government, Greenbank can thrive; simply by embarking on a campaign to say 'we are that place'. It's quite interesting that one of our primary constitutional rights is to bear arms. The reason; to protect our freedoms, our health, and our possessions. In some states citizens are allowed to protect themselves and their property to great lengths. Shouldn't this same right be extended to 'pervasive' technologies? Furthermore, we as humans 'categorize' everything and allow 'accommodations' to those meeting certain criteria. 'Handicapped' people get better parking. Blind people get 'braille' signs and internet requirements mandating an audio interface. Some people hear differently. Some people see differently. Some are overweight. Some are tall. My point is quite simple; who has the right to question if a person 'feels' things the majority of the population can not. We are all different. Imagine 'Greenbank' as the capital of the world for pervasive free technology. To me that is major dollars. Much more than, say 'permitting' wireless.	Alternatives Considered	Alternatives		1/19/2018	
236	b	Lowell	Lannert		2. The observatory should embark on a patent reinforcement/sales strategy. I'd be shocked if this has not already been put into play. But if not, I'm sure there are more observatories around the globe which would gladly solicit technology developed at the observatory. And why not go further? Why not extend 'consulting' at a price? 'Contract' services out. I realize there's a meshed science community, but again, in the end, 'finances' will be the end of the observatory. This, of course, will require a marketing campaign. But the ROI should be fairly short.	Alternatives Considered	Alternatives		1/19/2018	
236	c	Lowell	Lannert		3. Holographic distribution. While a tad premature, imagine kiosks allowing 'Greenbank' inter-special discoveries in 3D. Now is the time to start that development. Or, at the very least, keep abreast of what's out there. Soon people will be paying to sit in a holographic chamber to visit the Parthenon, or the Great Pyramids, or the Great Wall of China. Imagine then how much more fascinating it would be to be on a space ship near a habitable planet. Or even on the planet.	Alternatives Considered	Alternatives		1/19/2018	
236	d	Lowell	Lannert		4. Let's face it. The driving force of a trillion dollar cellular industry is hard to stop. We won't be able to derail it, but we can 'supersede' it. Despite my livelihood being in cellular technology, my passion is 'safe living'. To that end I've conceptualized a 'better' alternative to cellular technology in the home. The cellular network is a mesh of wireless and high speed wired technology. A home should be a micro example of the same. Very low wireless technology in each room (not able to extend beyond that room) with a high speed wired network within the home extending onto a fiber optic residential grid. This year I will be building our home to demonstrate that concept. If 'Greenbank' adopted a building code to meet the same, we would begin to see the community emerge.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3		1/19/2018	
236	e	Lowell	Lannert		5. I read where a group of local high school students uniquely benefited from knowledge at the observatory. Maybe an educational program could attract students from all over the country. Of course, with it comes tuition. I'm sure this already exists for doctoral level students, but opening that door wider to the 'young' is a means for a 'continued' audience of future donators.	Alternatives Considered	Alternatives		1/19/2018	

Green Bank Observatory -Written NSF Public DEIS Comments

Comment Number	Segment Letter	First Name	Last Name	Affiliation	Comment	Category	Key Topic as Presented in the Following Response Documents	Comment Source	Date Comment Received	Attachments
236	f	Lowell	Lannert		6. Ride the pigtailed programs where funding is being increased. NASA is beginning to ramp up funding. I'm sure the observatory can play a bigger role in what they do. I know the observatory shares the same passion as I to maintain, sustain, and retain their unique contributions to the world. I also know I'm a very small interested party. Hopefully, more can find the same passion as I have. Thanks for considering these suggestions. Good luck to your continued endeavors.	Alternatives Considered	Alternatives		1/19/2018	
237	a	Carolyn	Thomas	Resident of West Virginia	Green Bank Observatory is a unique and valuable resource for West Virginia and science students in across the state and the country. As a middle school science teacher I have been fortunate to work and study with my students at Green Bank. I know these experiences have expanded my professional knowledge and skills for teaching science and have enriched the lives of my students by providing them incredible interactions with scientists and science equipment. Here is an interesting (but small data) set. I took 5 students to a pulsar research summer program in 2012. Out of those 5 students, all pursued science degrees in college and two studied physics and astrophysics. I have no doubt that their experience at Green Bank shaped their decisions. As a citizen of West Virginia, I treasure the presence of science research in my state. The Green Bank Observatory is a source of tremendous state pride which brings internationally renowned scientists as well as tourists to an economically disadvantaged part of the country. It is important that West Virginia represent the future of science and our exploration of the universe.	Against Closure/Reasons Why	Not Applicable-addressed in Section 5.3			

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Alternatives

Received from:

118 Jay Cole (Senior Advisor to the President WVU), 12/21/2018

236 Lowell Lannert, 1/19/2018

Comments:

118a I am e-mailing to suggest that the National Science Foundation work with the National Park Service to make the Green Bank Observatory (as well as the Arecibo Observatory and the Jansky Very Large Array) a national historic park. This would help to preserve these historically significant facilities, promote their educational mission, and permit cutting-edge research to continue. After about a decade of study and planning, a November 2015 Memorandum of Understanding between the secretaries of Interior and Energy established Manhattan Project National Historical Park. Operated jointly by the U.S. Department of Energy and the National Park Service, this park consists of three sites: Hanford, Washington; Los Alamos, New Mexico; and Oak Ridge, Tennessee. Each of these sites played an integral role in the development of the atomic bomb and the impact of atomic energy on America since the 1940s. This park represents a new model and is different from many other national historical/historic parks in at least two ways: (1) the park's focus on science and technology; and (2) the coordination among three very disparately located sites. I outline briefly this background on Manhattan Project National Historical Park because I believe it can serve as a useful template for the establishment of a similar park focused on radio astronomy. A Radio Astronomy National Historic Park would also focus on science and technology and could also include three sites: Arecibo, Puerto Rico; Green Bank, West Virginia; and the Plains of San Agustin, New Mexico. Each of these sites has played, and continues to play, a vital role in exploring the cosmos and improving the science and technology behind radio astronomy. If the National Park Service were willing to consider another multi-site, science-and-technology-oriented park, I believe one dedicated to radio astronomy would be a great fit and promote public awareness of a very important scientific endeavor with the potential to transform our future...Inspired, then, by Manhattan Project National Historical Park, I believe it is reasonable to think about Arecibo, Green Bank, and the Plains of San Agustin as three sites making up an "Exploring the Cosmos" National Historic Park. There have already been steps taken down this path: the Arecibo Observatory is on the National Register of Historic Places, and the Grote Reber Radio Telescope at Green Bank is designated as a National Historic Landmark. This idea would call for the NPS to continue the experiment begun with Manhattan Project National Historical Park and embrace new elements in its mission at a time of worsening budget constraints. It would also require NPS and NSF to work together, much as the Departments of Energy and Interior did to create the Manhattan Project NHP.

236a I apologize about being a little late on this, but it was just brought to my attention. Admittedly, we relocated to this specific area of the country to avoid wireless communications. Despite my extensive background in this area and my occupation therein, my wife is adversely affected (just as millions around the globe are) by advancing wireless technology. To evaluate the 'impact', regardless of type, requires stepping back with another perspective. Let's face it; the bottom line is 'funding'. While most perspectives is how can money be 'given' to the observatory, I focus more on how can the observatory make more. Here are a few of my ideas: 1. A thriving community with a tax base to assist the observatory would be one way of softening the impact of reduced funding. Greenbank has the unique distinction of being one of the only areas in the world with the distinction of reduced wireless technology. As the knowledge of health ramifications accelerate and begin to hit the masses in greater magnitude, people are left with 'where do I go to be safe and/or feel better?'. With the proper local government, Greenbank can thrive; simply by embarking on a campaign to say 'we are that place'. It's

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quite interesting that one of our primary constitutional rights is to bear arms. The reason; to protect our freedoms, our health, and our possessions. In some states citizens are allowed to protect themselves and their property to great lengths. Shouldn't this same right be extended to 'pervasive' technologies? Furthermore, we as humans 'categorize' everything and allow 'accommodations' to those meeting certain criteria. 'Handicapped' people get better parking. Blind people get 'braille' signs and internet requirements mandating an audio interface. Some people hear differently. Some people see differently. Some are overweight. Some are tall. My point is quite simple; who has the right to question if a person 'feels' things the majority of the population can not. We are all different. Imagine 'Greenbank' as the capital of the world for pervasive free technology. To me that is major dollars. Much more than, say 'permitting' wireless.

236b 2. The observatory should embark on a patent reinforcement/sales strategy. I'd be shocked if this has not already been put into play. But if not, I'm sure there are more observatories around the globe which would gladly solicit technology developed at the observatory. And why not go further? Why not extend 'consulting' at a price? 'Contract' services out. I realize there's a meshed science community, but again, in the end, 'finances' will be the end of the observatory. This, of course, will require a marketing campaign. But the ROI should be fairly short.

236c 3. Holographic distribution. While a tad premature, imagine kiosks allowing 'Greenbank' inter-special discoveries in 3D. Now is the time to start that development. Or, at the very least, keep abreast of what's out there. Soon people will be paying to sit in a holographic chamber to visit the Parthenon, or the Great Pyramids, or the Great Wall of China. Imagine then how much more fascinating it would be to be on a space ship near a habitable planet. Or even on the planet.

236e 5. I read where a group of local high school students uniquely benefited from knowledge at the observatory. Maybe an educational program could attract students from all over the country. Of course, with it comes tuition. I'm sure this already exists for doctoral level students, but opening that door wider to the 'young' is a means for a 'continued' audience of future donators.

236f 6. Ride the pigtails of programs where funding is being increased. NASA is beginning to ramp up funding. I'm sure the observatory can play a bigger role in what they do. I know the observatory shares the same passion as I to maintain, sustain, and retain their unique contributions to the world. I also know I'm a very small interested party. Hopefully, more can find the same passion as I have. Thanks for considering these suggestions. Good luck to your continued endeavors.

Responses:

118a, 236a, b, c, e, and f: Thank you for the suggestions for alternate uses of the GBO facility. Under CEQ Guidelines, 40 CFR Section 1502.14, an EIS is required to examine all reasonable alternatives to the proposal. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense. The suggestions for alternative uses provided in these comments require the exercise of authority by other federal agencies and/or increased funding, which, at this juncture, are neither practical nor feasible for NSF to viably consider. Alternatives A and B are designed to include possible partnerships, and NSF is actively seeking partners from the private and public sectors. Under the preferred agency alternative, NSF would establish partnerships that maintain active use of GBO. GBO offers out-of-classroom and STEM-related educational initiatives for students. If a future collaborator is identified, it is possible that the existing educational initiatives could continue. No changes to the document have been made with regard to these comments.

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Biology

Received from:

184 Barbara Rudnick (EPA), 1/8/2018

193 Michael Holstine (Business Manager at GBO), 1/8/2018

185 Deana White, 1/8/2018

Comments:

184f 5. Several sections of the EIS reference a field investigation conducted in November 2016 and some of the analyses in the EIS are based on this investigation. It would be helpful to document in the EIS the methods used in data collection during the investigation and who conducted it. We recommend the EIS state if the findings of minimal impact to wetlands were based on this investigation or by reviewing U.S. Fish and Wildlife Service National Wetlands Inventory maps.

193i Table 3.1-3/3-5 The Golden Eagle is not listed in the table. The GBO participated in a Golden Eagle research project with the National Forest Service and Green Bank Elementary Middle School as part of an educational program. Golden Eagles are migratory in this area.

185a Thank you for allowing us to provide feedback in this public comment period. It has been brought to my attention that many sections, such as section 3.1.4 Threatened and Endangered Species and 3.1.5 Migratory Birds, rely heavily if not solely on an Information for Planning and Conservation (IPaC) Report for the species which need to be addressed for the Green Bank Observatory area. Further, this document is not available in the appendices nor is a link given to this document. After exploring the U.S. Fish & Wildlife Service webpage (<https://ecos.fws.gov/ipac/>), it appears that this document is a computer generated document. Along with this, at the beginning of any IPaC the following disclaimer is given in bold red: "This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Document page." Yet, an official species report is not referenced for this EIS. Not only this, IPaC reports are not stored by the U.S. Fish & Wildlife Service. IPaC reports are also subject to change depending on when they are produced. Therefore, we request that at the minimum - the IPaC report generated for the NSF for the Green Bank Observatory is added to the appendices in its entirety, including the disclaimer, to ensure that all species that were listed are addressed in this EIS report. Also, since this is an Environmental Impact Statement and the Endangered Species identification is an integral part to this evaluative report, and since the IPaC report has the above stated disclaimer, an official species report should be generated and added to the appendices as well. Again, thank you for the opportunity to provide comments on the Draft Environmental Impact Statement.

Responses:

184f: As described in Section 3.5.1, "Wetland locations were evaluated by reviewing USFWS National Wetlands Inventory (NWI) maps (USFWS, 2016b) and the results of the field investigation conducted for this EIS in November 2016 to ground truth the information provided on the NWI maps." A biologist conducted the November 2016 field investigation and, as stated in Section 6.0, List of Preparers, is the author of the Water Resource section. No changes were made to the FEIS as a result of this comment.

193i: The Golden Eagle was not identified as a migratory bird for Pocahontas County in the IPaC report generated on March 5, 2017. However, the Golden Eagle was added to the list based on this comment.

185i: NSF conducted an informal Endangered Species Act Section 7 consultation with USFWS, which confirmed that there are no potential impacts to threatened and endangered species. If the facility were

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to be transferred out of federal control, NSF would reinitiate the Section 7 consultation with USFWS. This process was described in Section 4.1, and the documentation was included in Appendix 3.1-B.

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Cultural

Received from:

193 Michael Holstine (Business Manager at GBO), 1/8/2018

183 Deana White, 1/8/2018

9 Sue Ann Heatherly (Education Officer at GBO), 11/30/2017

20 Bob Sheets (Pocahontas County Historical Landmark Commission), 11/30/2017

142 Robert Sheets (PCHLC & PCBC Member), 12/13/2017

184 Barbara Rudnick (EPA), 1/8/2018

Comments:

193f Table 2.6-1/2-9 Telescope 85-1 is considered historic, as is the Control Building. The Interferometer Range Barns are utilized for storage of materials. As operations continue, storage will be necessary. Also note that painting is an integral part of the operations and elimination of the Paint Shop Building would be detrimental to the operation. Additionally, all housing on site is utilized for both scientist and employee need, but also for the support of educational activities. Elimination of any housing would have a devastating effect on the operation.

183c I understand that the designation of the "Adverse Effect" finding under Section 106 as stated for each of the Action Alternatives A, B, C, and D in the Conclusion due to the possibility that historic properties that contribute to the NRHP-eligible historic district could be demolished, requires that the impact be avoided, reduced, or mitigated as long as it is Federally owned and negotiated if the property is sold. It is important that the adverse impact is understood fully. Also, there were no stated reasons why each of these historic properties were identified as 'could be demolished' other than a generic statement of "any structures not needed to meet the anticipated operational goals". I would like to request that a specific reason be given for each of the structures identified as 'could be demolished' in the Historic Properties Assessment since there has been some determination that they are "not needed to meet the anticipated operation goals", such that the public can evaluate and provide comment as necessary about those reasons in case additional information not known by the Agency can be provided in order for them to make the best decision. Further, I would like to provide comment on several of the historic structures listed as "could be demolished".

183e The Interferometer Range (Telescope 85-1 {Tatel Telescope} and 85-1 Control Building; Telescope 85-2; Telescope 85-3; Interferometer Control Building) is designated as a Historic property that could be demolished under Alternative A, B, C, and D. As mentioned above, I request that a reason be stated as to why these structures have been identified as "not needed to meet the anticipated operation goals". Obviously, the Tatel Telescope is of historical significance as it participated in the first ever SETI search by Frank Drake, among other discoveries it was used for, and it and the 85-1 Control Building are part of the SETI tour available on-site that is highly sought after. The whole Interferometer Range is of historical significance due to it being the model for the JVLA. Again, these structures not only have historic implications, but also a huge impact on education and potentially could be restored to operate in an educational/research function that would suit the operation goals of Alternatives A and B.

183i The listed houses in Table 3, Table 4, and Table 5 are designated as Historic properties that could be demolished under Alternative A, B, C (for the Beard House), and D and mothballed for all houses listed other than the Beard House for Alternative C. As mentioned above, I request that a reason be stated as to why these structures have been identified as "not needed to meet the anticipated operation goals". The housing listed is available for use for researchers and students alike to be onsite or close to onsite to

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accomplish their goals. Many who come for extended study do not have access to vehicles and thus the close proximity of housing is imperative for them to be able to efficiently accomplish their goals, especially being flexible to be onsite and varying hours through the day and night for their research. Thank you to the Agencies involved for the historical research that has been done to date and for considering my comments. My family and I are working hard to help the NSF assemble allies to ensure that the NSF retain ownership and restore full funding to the Observatory such that they can continue and grow their important mission of NSF-funded "Open Skies" science and education focused operations. Thank you for your consideration of our comments and please let me know if we can provide any additional information.

9c With regard, regarding historic properties, the 43-meter was listed as one that should be kept, but yet the table telescope was listed as one that could be potentially demolished and I thought that was odd. That's the first one here. That's the one that Frank Drake used, so I don't know what, you know, what rationale went into that but I'd like to see a response to that.

20a The thing I would like to say is I would like to commend the group, as Carla did earlier, for the work they did in the historical section with at least one thing that Sue Ann brought up earlier, the 85-1 Tatel telescope should definitely be on there as an historical landmark. It was the first dish here and it's where Frank Drake went first here in West Virginia in his search for extraterrestrial signals and I think that's something that should be upgraded in the report. I'll address it in written comments later on. The other thing I would like to do in this period as I'm talking to you is encourage those of you that are local and have been here for a while, like Mr. Harold Crist, and have knowledge that we may not have -- and these folks may not have.

20b As I said, they did a good job with the history -- but there are some things out there that we may not be aware; for instance, on the original encouraged action, the Hannah House is preserved but in the next, it is demolished. And that house was the home to George Burner, and Mike Holstein and I serve on the bicentennial commission here and George Burner was one of our first county commissioners. He was a delegate to the Virginia legislature for two terms back in the 1820s, and we would hate to see that historical landmark go away. He took up arms at one point, that was called the Civil War. His father took up arms at one point, it was called the Revolution and he was at Valley Forge with Georgia Washington. So there are some historical components here that these folks may not know about. I think they've done a good job with what they had to work with. But those of you in the community, if you have stories, if you have knowledge, if you have information, please convey them in the written comment period, get in contact with me, Jason Bauserman, we need to add the rich historical legacy that we do have here and make it part of the ongoing record. Thank you.

142a I have two historical concerns related to placement of significant properties at GBO. One is the future of the Tatel Telescope or 85-1. It is currently included in the Interferometer grouping for possible deconstruction. Dr. Frank Drake began the search for ET signals on this instrument and as that now continues with SETI around the world, I believe it is worthy of preservation.

142b My second concern is the future of the Hannah House, also listed for possible deconstruction. This house belonged to and was occupied by Mr. George Burner, one of first Pocahontas County Court members in 1821. He served two terms in the Virginia Legislature as a Representative of the County. As we are preparing to celebrate Pocahontas County's Bicentennial in 1821-22, this house takes on a special significance. I believe it is also worthy of protection. These concerns are shared by Pocahontas County Historical Landmarks Commission and the Pocahontas County Bicentennial Commission. I would hope that these change in status will be evident in the final draft.

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183b I have read over the Historic Properties Assessment of Effects, and while I do not have a background in the National Historic Preservation Act or the resulting actions to be taken given an adverse designation assigned to eligible historic properties, I do have some concerns and information I would like to share regarding each of the options and suggested actions there-in. Also, I would like to propose that the 20-Meter be re-evaluated to be a contributing resource to the GBO Historic District due to its participation in the early VLBI experiments and in the tectonic plate measurements it also performed.

183d The 300-foot Telescope Control Building is designated as a Historic property that could be demolished under Alternative A, B, and D and mothballed under Alternative C. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. As known, the 300-ft. telescope collapsed, but the control room still exists. The 300-ft. had many historic milestones including the detection of the Crab pulsar and the control room is the only remnant of it left. There are not only historic implications to this structure, there is also an educational component to this structure and could be used in multiple ways including a public tour destination to demonstrate the previous technology and the research accomplishments made at this site.

183f The Calibration Horn is designated as a Historic property that could be demolished under Alternative A, B, C, and D. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. The Calibration Horn is of historical significance because it was used to perform early absolute flux measurements of Cassiopeia A and used by the early radio astronomy community as a standard reference point to measure other hydrogen sources. Recently, there have been proposals to restore it to service to use to look for Fast Radio Bursts (FRBs), a newly detected and exciting field of research. The Calibration Horn thus has significance for science and education focused operations.

183g The Recreation Area is designated as a Historic property that could be demolished under Alternative A, B, and D and mothballed under C. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. The Recreation Area, in addition to being of historic value, provides multiple benefits to the surrounding community including a location for Red Cross Swimming lessons and community exercise and gathering resources that are not available in the nearby area. Demolishing the Recreation Area would remove a resource that is pertinent to health and safety education of the community.

183h The Nut Bin is designated as a Historic property that could be demolished under Alternative A, B, and D and mothballed under C. As mentioned above, I request that a reason be stated as to why this structure has been identified as “not needed to meet the anticipated operation goals”. The Nut Bin served as the Lab Building in 1958 until the Jansky Lab was completed in 1959 and is thus of historic significance. It currently serves as an employee residence and thus still needs to be retained.

193h The 43-meter Telescope (140-foot Telescope) is not only historic but is utilized for scientific missions and is a source of external funding.

184d It would be helpful if the EIS described how Traditional Cultural Properties were identified.

Responses:

193f, 183c, 183e, and 183i: The Facility Disposition list in the DEIS is provided for analysis purposes only. As stated in Section 2.1, "However, it must be emphasized that a collaboration may not require the full extent of demolition, safe-abandonment, or mothballing activities analyzed and could involve none or only a subset of the activities list in Table 2.6-1. The Agency Preferred Alternative and this DEIS does not mandate the demolition or removal of specific buildings and infrastructure, even if specific buildings are

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identified in the various Alternatives. Because of this, this DEIS should not be viewed to preclude a proposed activity or use of infrastructure." In the event that demolition is determined to be the course of action for any of the resources of historic significance within GBO, NSF must follow the process specified in the PA. As specified in the PA, demolition is treated as a last resort, and efforts to preserve the information from historic resources would be made. The FEIS has been updated to include the stipulations in the PA and the PA is included as an appendix to the FEIS.

9c, 20a, 20b, 142a, 142b, 183b, 183d, 183f, 183g 183h, and 193h: These comments were considered during the National Historic Preservation Act Section 106 Process and development of the Programmatic Agreement, which was finalized on August 3, 2018, and is provided in Appendix 4.2-A.

184d: The following sentences have been added to the FEIS to describe how Traditional Cultural Properties are identified: "The U.S. Department of the Interior National Park Service recommends that Traditional Cultural Properties are identified by consulting directly with members of a traditional community. During the scoping process, 16 Native American tribes were sent scoping invitation letters and followed up via telephone to confirm their receipt of the letters."... "The Oneida Nation notified NSF by email on November 9, 2016, that it was not interested in participating as a consulting party in the Section 106 process."... "The Eastern Band of Cherokee Indians responded via email that the project falls outside the traditional aboriginal territory of the Cherokee and referred the project to the Shawnee."... "The Delaware Nation responded via email that they would like to continue as a Consulting Party in the Section 106 process."

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Health and Safety

Received from:

193 Michael Holstine (Business Manager at GBO), 1/8/2018

145 Dennis Egan (Assistant Fire Chief BFD Fire and Rescue), 12/5/2017

171 Mali Minter, 1/8/2018

188 Karen O'Neil, 1/8/2018

Comments:

193k 3.8.1/3-32 Sixth line should read either "...which are equipped with radar transmitters" or "which are equipped with a radar transmitter".

193p 4.8.1.1/4-59 Although the statement "Nonetheless, the characterization of NEOs could continue at other observatories" is theoretically true, no other observatory is capable of the resolution of the GBT.

193c ES.7/ES-12 As the GBO facility is federally-owned sections 19 and 2 of Public Law 91-596 provides no jurisdiction of the OSH Act to the facility. GBO has developed its own safety plan in accordance with the Law. Contractors hired by the NSF may abide by the Act.

145a In the EIS Draft Report for the Green Bank Observatory, your comments under section 4.8.3.1 Public Safety on page 4-61 state "the water tank would no longer be in operation, but the fire department would be able to refill tanker trucks from numerous streams in the area," inferring the loss of the water tower to be insignificant with regards to the department's water supply. Whoever was consulted for this opinion is not familiar with the challenges of drafting from the small variable streams in our area. Unlike areas with larger streams or rivers, the streams in our area are not consistent. They can often be walked across without getting your feet wet. In winter, the large deep holes required for drafting are often frozen over. If stream water is available, to access a stream for firefighting water requires an engine, a deep hole with a small lift (height from water surface to the pump) near a road. If this type of site is not available or an engine is not available, slower portable pumps can be set and hoses rigged but again it takes manpower and time. Drafting water from streams is not only time consuming, it requires additional personnel, an asset in short supply in our area. The type of dynamic streams in our area can change from one large storm to the next such that a past fill site is no longer appropriate. Sending a tanker and pumping team in search of a fill site can take real time and result in the loss of a home. In short drawing water from a stream is unreliable and costly in both time and manpower, and should be avoided when possible. The Green Bank water tower supplies a reliable, safe, highly accessible water source that would be a great loss to the public safety of the community if lost. In addition to putting firefighters and structures at risk by loss of a reliable water source, the fire insurance rates for the area around Green Bank are much lower due to the availability of the Green Bank tower and the loss of it would result in immediate increase in insurance premiums.

171c In the same vein, I do not think the health and safety impact was taken into full consideration. Without the Green Bank Site the local fire house would not have the access to the water for their fire trucks nor would they have many of the people available to support the local fire station and EMS staff. The impact on the schools, the students, the businesses is catastrophic. The NSF needs to not only go back to full funding of the Green Bank Site, but more than full funding since apparently it has been underfunded.

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188d Page 4-61: States the local fire/emergency services departments (BFD) could use local streams to fill tanker trucks. This is simply not correct, as the local streams are seasonal and are not considered a reliable water source. Further information on this can be found through either contacting the local emergency services personnel or consulting the county water board.

Responses:

193k: The grammatical/typographical error has been corrected.

193p: There are other observatories such as Arecibo and NASA's Goldstone 70-meter telescope that can characterize NEOs by monostatic radar observations. The high-resolution imaging capability afforded by the GBT in a bistatic configuration in concert with these observatories enhances the characterization of NEOs. However, the loss of this capability due to a change in scope of GBO operations would have a negligible impact on public safety, because the probability of an NEO striking the Earth is very low. No changes were made to the FEIS as a result of this comment.

193c: The referenced section refers to demolition workers; consequently, they would have to abide by OSHA regulations.

145a, 171c, and 188d: The onsite water tower would no longer be in operation in Alternatives C and D. While refilling the water tanks from streams may not be an option during the winter, nearby Shavers Fork Fire Rescue at Snowshoe Resort has access to 9,000 gallons of water per minute from the resort's lakes for snowmaking during the winter. This fire department responds to mutual aid calls from surrounding communities. The FEIS has been updated to include this information.

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Purpose & Need

Received from:

156 Paul Kamienski, 11/25/2017

39, 193 Michael Holstine (Business Manager at GBO), 1/8/2018

224 Christine Plumley, 1/19/2018

184 Barbara Rudnick (EPA), 1/8/2018

143 Carla Beaudet (Engineer at GBO), 12/11/2017

175 Felix Lockman, 1/8/2018

171 Mali Minter, 1/8/2018

192 David Frayer (Scientist at GBO and Adjunct Professor of Physics & Astronomy at WVU), 1/8/2018

195 Eugene Cilento (Dean of Benjamin M. Statler College of Engineering and Mineral Sciences at WVU),

25 Marty Bloss (Staff at GBO), 11/30/2017

Comments:

156b 3. NSF / AST Budget Considerations – A significant NSF/AST budget shortfall has been highlighted as the driving force for considering alternate approaches for future utilization of GBO as well as for conducting the current EIS. However, the reports that were referenced in the Purpose and Need (Section 1) indicated that the overall AST budget, while it would not meet the desired significant annual increases to fund proposed new facilities and programs, was projected to be flat in inflation adjusted dollars for the next decade, i.e. a slight increase in real dollars. The significant budget shortfall results largely from adjusting priorities with significant increases for some facilities and programs and significant reductions for others like GBO. I understand that the assessment of the various facility capabilities was done in 2012, while substantial enhancements have been made to the GBO since that time. Since the impact of discontinuing research at GBO which continues to operate effectively and produce solid scientific results with some unique capabilities as recognized by the scientific community would be significant, a reexamination of these budget reallocations and priorities based on current facility capabilities appears warranted. These updated results should be integrated into any collaborative funding plan, both in terms of the amount of reduced NSF funding and timing for implementation.

193d 1.2/1-5 As previously mentioned the method of operations to construction cost ratio is unreasonable. 1.2/1-7 The purpose is to “substantially” reduce NSF’s contribution. Please define “substantially”.

193u It is also worrying that the level of NSF involvement is not specified. At what level is external funding required to ensure that the chosen alternative will succeed? At what level will the NSF funding continue? Should the levels of either fail to be achieved what is the result? Will the next level Action Alternative be automatically instituted? Each successive level will lower the GBOs chances of success as the funds and employees available will become smaller, and this would appear to ensure failure of the program.

224b ES.5/6 ES-5.1 Action Alternative A is stated to be the Agency-preferred Alternative. Since this alternative would meet the purpose of "reducing the funding required" What is that level of funding to be reduced and how much will be required for collaborators? When will this be determined? Action

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Alternative A would involve collaborations with new stakeholder(s) who would use and maintain GBO for continued science-and education-focused operations. NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades. If the Observatory is still being utilized for "Open Skies" will the percentage utilized for this purpose not be supported at the same percentage level for related maintenance and related upgrades?

193w It is also unclear, under Section ES.5.5 Page ES-8, why the narrative subtly indicates that the EIS's purpose intends to ensure some action. It would seem that the true purpose of an EIS would be to review all possibilities and to then recommend that alternative which would have the minimum, or no, effect on the factors reviewed. Instead of dismissing the obvious, the EIS report should recommend implementation of the No-Action Alternative as it is the only Alternative that would have no adverse effects on the environmental factors reviewed. Supposed funding constraints of the NSF have no role in the determination of environmental effects.

156f 8. NRQZ Impact. Although none of the Action Alternative in the report would include elimination of the National Radio Quiet Zone (NRQZ) (Section 1.3.4), if current operations and research were discontinued the need for the NRQZ would be reduced or eliminated, and it is not difficult to imagine that if a "quiet zone" is no longer justified, cell towers or other adverse projects would be approved, the NRQZ would eventually be discontinued. Once the NRQZ was compromised it would be very difficult to recover.

184b 1. If any of the alternatives specified in the DEIS will influence certain aspects the National Radio Quiet Zone (NRQZ), we suggest the EIS outline how this may impact the size, boundaries, management, or intent of the NRQZ.

143a In my verbal comments to the committee during the November 30th public meeting, I simply thanked them for doing a good job on the socioeconomics section of the DEIS, because I believe they did. However, as a GBO employee who has been suffering this process since its inception, something unarticulated was bothering me, and I've since identified it: The DEIS nicely inventories the assets and (some of the) accomplishments of GBO; it lays out there for neat inspection all of what we have and do here. And while our assets are laid bare in this process, NSF is playing its game close to the vest. Actually, the hand was tipped very slightly by identifying Action Alternative A as the agency's preferred course of action, but even if Alternative A is selected, the only resulting clarification is the elimination of Alternatives B through D, since the vagueness of Alternative A leaves the GBO staff with many of the same questions we had at the start of this process. Action Alternative A "would involve collaborations with new stakeholder(s) who would use and maintain GBO for continued science- and education-focused operations. NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades". Action Alternative A makes it sound like none of this has happened yet. But NRAO has been seeing a dwindling operations budget from NSF since 2010. To an employee who daily feels the effects of staff attrition, and our facility consistently being asked to do more with less, the question arises: CAN this observatory continue to operate with a further budget reduction? It does not seem likely; auditors all report a very lean operation, but I didn't need them to tell me that. Action Alternative A makes it sound like GBO has not yet found any new operating partners. However, we have already been quite successful in that regard. Since the Portfolio Review of 2012, partners Breakthrough Listen, WVU and NANOgrav have come on board, and are currently consuming 28% of GBT time, and providing a similar proportion of its operating budget. Do these partners count as "new"? How many (if any) additional partners are needed? What percentage of the operating budget does NSF expect such partnerships to pay for? How much Open Skies time on the GBT is NSF willing to relinquish? Does "continued science- and education-focused operations" exclude military or commercial ventures? Clearly there are more questions than answers, even if Alternative A is chosen. After being as

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helpful and forthcoming as we at GBO have been throughout this extremely stressful process, we would like to see a clearer picture of the NSF's plans for us. Will NSF heed Senator Manchin's request and commit to finding additional science and education focused operations partners for GBO before any further reduction in funding our operations? Or, in light of the community outcry inspired by the 2012 Portfolio Review, is NSF just choosing Alternative A to save face, when in fact it will allow GBO to die the death of a thousand cuts, and end up at Alternative C by default? Alternative A, in all its ambiguity, allows for any outcome in the spectrum of these options. Would it be too much of an embarrassment for the NSF to admit that key areas of science were perhaps deemphasized in the 2012 Portfolio Review? Would it be too humbling to admit that LIGO's observation of gravity waves has upended the priorities and instrumentation requirements of the astrophysics community? In spite of a tightening budget since the Portfolio review of 2012, the GBT has become an even better instrument than it was then with the arrival of multi-pixel and W-band receivers. There is now, and always has been, oversubscribed demand for the science we are capable of doing. Would it not make sense, at this juncture, to reconsider the 2012 decision altogether? If NSF will not reconsider its 2012 decision, it needs to step forward with a commitment to our facility that allows us to make plans and move forward. The environment of uncertainty is a constant source of stress and low employee morale, and makes it more difficult for our facility to attract and retain talent. If it were not for a core of dedicated staff here, there would be no GBO. It's time for the NSF to match that commitment by committing some definition to Alternative A so we can ALL aim at a successful outcome.

156c 4. Action Alternative A to Continue Research with Collaborative Funding is distinctly different from the B, C D "going out of business" alternatives but it is not treated as such in the report. Alternative B for converting the facility to a technology or education park or museum is a significant change; but it is not clear if this has been thought through or how effective this would be. If research is no longer conducted and the scientific experts have moved on to other locations, the positive and direct impact that they have on students at local schools and WVU as well as in promoting STEM activities and careers in WV is lost. Experts can describe their work and accomplishments, inspiring bright students who are considering STEM careers, while docent tour guides cannot. This loss would be particularly acute in rural Pocahontas County but would impact WV overall. Alternative C, mothballing the site would be the next downsizing step but after a while the cost to maintain the facilities and the site would become prohibitive and lead to Alternative D dismantling and restoring the site. Also, continuing operations per Alternative A may involve changes in research program priorities, and cost savings initiatives depending upon future funding scenarios, but describing dismantling of facilities and timing for this implementation is premature at best.

156e While Continued Operations and Research with Collaborative Funding could be an attractive alternative, no information is provided in the report on how this would be achieved, e.g., specific action items with responsibility for accomplishing these over time. These action items would likely involve a schedule for implementation, identification of potential third parties (with a process for GBO / AST working closely together in this effort), and potential targets for % NSF funding for GBO.

175b 2. The Agency Preferred Alternative A, is presented in a very misleading and incorrect way. In fact, it would be devastating for U.S. science. Alternative A imagines that there are Universities or other organizations who have enough money to fund operation of a radio telescope for astronomical research. The closure of one after the other University-based radio facilities shows that this is false: U. Mass, Univ. Michigan, BIMA, the CSO and now CARMA are examples. In fact, the NSF began support of radio astronomy because the facilities were beyond the means of any individual University to support (see the documents reprinted in "Because It Was Fun: The first forty years of radio astronomy at Green Bank, 2007, NRAO). The DEIS does not give a single example of a University that could fill the funding gap caused by the reduction in NSF support, and that is because there are no examples. This leaves use of

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the GBT by commercial interests, acting either on their own or as contractors to the Federal Government. Here again, the consequences would be devastating for science. The requirements for an antenna to be useful for open skies radio astronomy are vastly more stringent than use for satellite tracking, for example. The tolerances on pointing, frequency stability, ability to integrate down for many hours, etc., are not similar to those of commercial operations. It takes a dedicated, high-level scientific and engineering staff to make a radio telescope accessible to non-specialists, as is the requirement for the GBO. This staff would be of no use to a commercial contractor who would have their own scientists and engineers, located elsewhere from Green Bank.

184c 2. Alternatives A and B include collaboration with other entities. Given no entities have been identified in the EIS, it is difficult to determine how the preferred alternative will be carried out. If more is known about a potential agreement, we recommend this information be included in the Final EIS. More detail describing the process would help clarify these Alternatives. If additional analysis in compliance with NEPA is anticipated at a later phase, we suggest that the Final EIS describe the process.

39b The information on the reports of which this whole EIS, sort of, is based, I was a participant in those review committees. I'm a little concerned that the actual summaries given by those review committees is not truly reflective of what was stated on the Green Bank operations at the time; however, those reports are not available that I can find. So I will be either happy to speak to you later about trying to get those summary reports or I will reflect my personal observations of what was truly said as a result of those reviews. I will state for the record that in no review that I have ever participated in, by either NSF or operating in AUI or any third-party consultant, has Green Bank ever come out to be too expensive, and, in general, has been stipulated that we needed more funding and we were operating too lean. So I'd really like to figure out where that came from.

171a The EIS draft mentions that in 2006 an NSF study stated that the GBT was possible over funded. It is my understanding that the 2006 report had severely incorrectly reported the construction costs and a more extensive review was done. In addition, it was my understanding that the site was actually very underfunded. I cannot find the "more extensive" report" from the review anywhere. Could you please tell me what the results were? Also, where can I read this review?

175a Comments on the Draft Environmental Impact Statement (DEIS) for the Green Bank Observatory (GBO). While the DEIS is rich in detail and covers a wide range of topics, it has two fundamental problems: 1. In several places it contains statements that the "community has repeatedly recommended NSF divestment from GBO..." This is at best incomplete, and at worst patently false. Most of the "recommendations" referred to are anodyne statements that the NSF should close old instruments. They do not explicitly refer to the GBT, which, in fact, is one of the NSF's newest telescopes. This also ignores statements of community support for the GBT, e.g., the recent "White Paper on Nuclear Astrophysics and Low Energy Nuclear Physics" (Arcones, A. et al. 2017, Progress in Particle and Nuclear Physics 94, 1) which states "Continued operation of the Green Bank Radio Telescope is also important for observations related to neutron stars and the nature of dense matter and its equation of state." Moreover, as the bias of the Portfolio Review becomes more and more evident, and as the community becomes aware of the enormity of the consequences of the Portfolio Review's recommendations, community pushback is growing (e.g. McLaughlin et al. 2017, Nature Astronomy, 1, 808). To claim, with confidence, that "the community has spoken", is false.

192b The draft EIS report (at the end of section ES.2) states "the scientific community evaluations cited previously indicate that GBO's science capability is lower in priority than other science capabilities that NSF funds". This is a false/misleading statement. The NSF did not carry out a proper review in 2012 that actually looked at the full scope of scientific priorities for the community. It was based on the 2010 decadal survey which was a wish list of future science that could be done if given an unreasonable

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amount of money to build new facilities. The 2010 survey did not compare the priorities of ongoing research with current facilities with future science opportunities that could be done with new facilities. Most astronomers (and nearly all observational astronomers) would choose to keep the current user facilities in comparison to something like the LSST for which they will never have the opportunity to use. The GBO/GBT facility is an essential scientific resource for America and the entire world. In previous decades, there were many options within the US for obtaining hands-on research experience with public-access radio/mm facilities, including the CSO, FCRAO, NRAO-12m, NRAO-140ft, OVRO, BIMA, and CARMA. All of these facilities were once NSF supported, and none exist anymore. The only remaining US radio/mm facility with public access that permits hands-on observing is the GBT.

193v It is also noted that the 2006 report referenced is done so in an unclear manner. It is known that the GBO portion of that review recommended increased funding for Green Bank, not reduced funding, and every audit and review found that the Green Bank site operated extremely lean and efficient. Lastly, there is no mention of the funding to be used for the various activities recommended in the Alternatives. Where will this funding originate and what are the costs associated with each? How do these costs compare to the costs of operation?

195b The NSF Portfolio Review Committee (PRC) issued a report in 2012 reiterating the GBO divestiture first recommended in 2006 by the AST Senior Review Committee, based on the rationale of “lower priority” science. However, since then, the NSF has awarded over \$13.3M competitively in eight separate scientific awards to West Virginia University researchers that depend critically on access to a fully functioning GBO. NSF must reconcile this apparent inconsistency with an aging report. The same PRC report stated that “the capabilities provided by the short-wavelength and pulsar-timing instrumentation on the GBT, as well as the spectroscopic capabilities for characterizing complex molecules and the potential for large-format heterodyne arrays and millimeter continuum imagers, would be significant losses to the scientific community. Concerns about the Review Process: The DEIS includes a recommendation to maintain operations with new partners but leaves unaddressed who those new partners, the process to identify those new partners, and the relationship and obligations between those new partners and the NSF. Concerns about the future of the facility are valid given these uncertainties, and the DEIS notes that anything less than current operations will result in adverse, long-term impacts on the community. Before any further actions are taken that disrupt current operations, the NSF should identify future partners and share partnership details and obligations to maintain the GBO. If implemented, any adverse effects would be borne by the citizens of Pocahontas County and West Virginia University researchers, but they had no oversight role in the fiscal and organizational management of the facility. In conclusion, West Virginia is a small rural state that needs to have such resources to build awareness and capacity for doing high technology research. The GBO provides that opportunity and is also a great source of pride for the state. In the 2014-16 time frame the state received only 0.24% of the NSF research budget, ranking only 46th overall. Continued investment in the GBO is a sincere commitment by NSF to support geographic diversity in its mission “to promote the progress of science; to advance the national health, prosperity, and welfare”. Therefore, I encourage further careful and full evaluation of the overall impact and potential the GBO has for providing a national resource to continue exciting research and education.

25b I would like to speak also to site expansion. So one of our charges has always been, since this process started, is to expand our opportunities, both in the science and commercial endeavors; however, the EIS has actually constrained us greatly in being able to do any changes to the site. Essentially, we were frozen in place for the last couple of years and not able to make any substantial changes because that would upset the baseline, as I understand it, of this report. Well, as we go forward, it's been my experience that once a report exists that people keep coming back to that and back to that and back to that and if the agency preferred approach is followed, we must have relief to be

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able to do the kinds of things that new endeavors the observatory require with a minimum of obstruction and problems, because it can be a real problem as we go forward. And then lastly, I'd just like to comment that part of this needs to talk about what is considered success criteria for any of these options, and most importantly, the agency preferred option. And right now, everything is about revenue and finances. They're very important. They're what keeps the lights on. But science is what drives the site and there needs to be an metric as we go forward that also looks at the changes in the science community and our contribution to those changes as another metric into the success of the observatory in whichever of these forms that it takes. Thank you.

156g 6. Agency Preferred Alternative: Continued Operation and Collaborative Funding Approach A - While Approach A is designated as the "Agency Preferred Alternative" in the report, there is no explanation as to why this is the case and what this means. Something more than a parenthetical reference is needed. It does suggest that quality research is being conducted, good results are being obtained, and the facility has worthwhile assets to the scientific community, but it would be better if a short explanation were provided with a reference to more detailed information. 7. Plan forward for Approach A is not clear -

Responses:

156b, 193d, 193u, and 224b: The precise reduction in the level of NSF support for continued operations of GBO (under Preferred Action Alternative A) has yet to be determined but would depend upon: (1) the viability of proposals from potential partners, (2) competing needs within the portfolio of NSF/AST, (3) consistency with scientific priorities as determined by internal and external reviews, and (4) the availability of appropriated funds. No changes were made to the FEIS as a result of this comment.

193w: The No-Action Alternative does not meet the purpose and need for the action because it would not result in reduction of costs by NSF. Therefore, the No-Action Alternative is not considered a feasible alternative. Of the feasible alternatives, Preferred Action Alternative A would, as the document correctly states, involve the least change to the current facility. No changes were made to the FEIS as a result of this comment.

156f and 184b: As discussed in Section 1.3.4, "none of the Action Alternatives include the elimination of the NRQZ, as the FCC has jurisdiction over the NRQZ; the selection of an alternative for GBO would not confer authority on NSF to dissolve or alter the NRQZ." No changes were made to the FEIS as a result of this comment.

143a, 156c, 156e, 175b, and 184c: The NEPA process is separate and distinct from the solicitation of collaborators. NEPA is a procedural statute that requires federal agencies to analyze the environmental impacts of a proposed action so that the analysis can be factored into a final agency decision. The NEPA process does not constitute the decision; rather, it is a process that factors alternative evaluations and public and agency input into decisions. The Alternatives analyzed in NSF's NEPA process for proposed changes to operations at GBO are sufficiently broad to encompass activities likely to be submitted in response to solicitation and, therefore, to provide reasonable scenarios for NSF to conduct its analysis of environmental impacts. If NSF were to select Preferred Action Alternative A in its Record of Decision, NSF's NEPA analysis of the alternative is sufficiently broad that it is anticipated to cover environmental impacts associated with any likely variation of Preferred Action Alternative A that might be selected. If that ultimately is not the case, then NSF would supplement its NEPA analysis accordingly. While NSF's NEPA and proposal solicitation processes are being conducted largely in parallel, a specific collaboration cannot be selected prior to the conclusion of the NEPA analysis and process. Similarly details of implementation are not available until a proposal for collaboration is available. It is for this reason that the sequence of events (i.e., completion of NSF's NEPA process before a proposal for a collaboration – if

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any – is selected) is both lawful and appropriate. No changes to the document have been made as a result of this comment.

39b, 171a, 175a, 192b, 193v, and 195b: The continuing utility of the Green Bank Telescope for some cutting-edge investigations was the motivation for the Preferred Alternative to be a reduction in NSF's contribution to operation costs, instead of full divestment. The consequent reduction in the fraction of time available to public competition is a result of budgetary pressures brought about by the addition of newer facilities, such as ALMA, and the need to maintain balance in various aspects of the AST program. The realization of the Preferred Alternative is intended to assure long-term stability of operations, continuing benefits to the State of West Virginia, and continuing access by the astronomy community to this unique resource. No changes were made to the FEIS as a result of this comment.

25b: The metrics mentioned are difficult to quantify “a priori,” but the ability of potential collaborators to contribute to continued science operations would be considered in evaluating partnerships to realize the Preferred Alternative. No changes were made to the FEIS as a result of this comment.

156g: Action Alternative A is the Agency-preferred Alternative. This alternative would meet the purpose of reducing the funding required from NSF and allow continued benefits to the scientific and educational communities.

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Socioeconomics

Received from:

54 Ryan Lynch, 1/7/2018

175 Felix Lockman, 1/8/2018

188 Karen O'Neil (GBO Director), 1/8/2018

39, 193 Michael Holstine (Business Manager at GBO), 11/30/2017, 1/8/2018

28, 171 Mali Minter, 11/30/2017, 1/8/2018

9 Sue Ann Heatherly (Education Officer at GBO), 11/30/2017

21 Kathryn Williamson (Astronomy professor at WVU, Former education specialist at GBO), 11/30/2017

30 Bert Schou, 11/30/2017

31 Ryan Lynch (Astronomer at GBO and Coordinator of Summer Student Research Programs), 11/30/2017

105, 183 Deana White, 1/3/2018

104 Joshua White (High school sophomore in West Virginia), 1/3/2018

224 Christine Plumley, 1/19/2018

14 Sheena Murphy (Associate Vice President for Research Development at WVU), 11/30/2017

156 Paul Kamienski, 11/25/2017

Comments:

54d Forth, Section 4.11.1.3 states that under Action Alternative A the Green Bank Elementary-Middle School specifically would not be affected and there would be no impact (DEIS 4-84). It also states that GBO would maintain...STEM-related training and that impacts would be minor, adverse, and short-term (DEIS 4-85). These conclusions seem to be based only on an analysis of potential on-site demolition. They do not consider the changes to the Observatory's scientific focus that may occur if the interested parties identified for collaboration reduce the availability of the GBT for open-skies science. If open-skies science time decreases, it will have a severe, long-term impact on college and university students throughout the U.S. and the world. Changes in observatory staffing could also impact the local school system. The DEIS does make reference to these concerns under Action Alternative B (Section 4.11.2.3), so the failure to accurately account for them under Action Alternative A is confusing. Further, Action Alternative B states that the impact on state and national educational programming would be moderate. The impact would actually be severe, and it may be severe under all Proposed Action Alternatives. These issues must be addressed in order to produce a credible Final EIS. Finally, I would like to reiterate my call for the final EIS to formally include the scientific environment and broader impacts as an independent area of study. Nothing seems to prevent the EIS from expanding its scope to include these areas, and without doing so the EIS cannot fully capture the impact of the Proposed Action Alternatives. I once again urge the NSF in the strongest possible terms to select the No-Action Alternative (continued NSF investment for science-focused operations) for the future operations of the GBO. The No-Action Alternative is the only option that will not have severe, long-term negative impacts on the socioeconomic, cultural, educational, and scientific environments of the local community of Green Bank, the State of West Virginia, the surrounding region, the entirety of the United States, and the global international community. The No-Action Alternative is also the only option that will not have severe,

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long-term negative impacts on NSF's mission to broaden the impacts of its activities and facilities. Please do not hesitate to contact me if you have any questions or would like more information.

175c As a practical matter, use of a large fraction of GBT time for commercial or government purposes would render much of the GBO staff redundant and would result in a reduction in employees of probably 50%, not zero as indicated in the DEIS. It would also make it very difficult, if not impossible, for the GBT to serve the needs of the U.S. scientific community. There is no known example of an antenna whose primary mission is for commercial/government purposes but is still a first-rate instrument for radio astronomy. The implication in the DEIS that such a path forward is viable — the Agency Preferred Alternative — is false, and seems merely an indirect way to close the facility.

188c Page 4-53: There is a contradiction in between this page and an earlier statement. Specifically, this page states, “The number of personnel at GBO is expected to be less under Action Alternative A;...” Yet in all other places in the document, it states the number of personnel is expected to remain the same under Alternative A (e.g. in the Executive Summary, on ES-6, it states “Operations after implementation would be similar to current operations, and operation staffing levels would be expected to stay the same.”) This contradiction should be removed.

193q 4.11/4-80 This table contradicts Post-Implementation statement in Section 4.7.1 page 4-53, “the number of personnel at GBO is expected to be less under Action Alternative A...”. This table indicates no change in workforce levels, therefore purposefully minimizing the socioeconomic impact.

28b The other thing I just wanted to touch on, Sue Ann touched on it, it was one of the main things I was going to talk about, was if -- I mean, of course, everyone is full funding and then we're really happy on Option A; however, if it were to go on to a different option, I think there are some fatal flaws in Option B. It says that you'll go to a tourism education facility. Then later, it says in your statement that the amount of tourists that will come will go down by half, at least, and the less, the less facilities that are up kept as far as mothballing or destroying or whatever you do to the telescopes, the less people that are going to come here. And so, basically, Option B is going to sink further and further and further down where there's no tourism coming and that will really impact our community, and so I think you need to think about that.

9a I didn't read the Draft EIS from cover to cover, but I did do some searching on it and would like to bring up a few points that I think were either understated or need further investigation before final draft or before the Final EIS is produced. And one them is, of course being the education officer, is the impact of the observatory's educational programs which really do depend on having a vibrant scientific operation here. It's just not possible to have the alternative happen where we give tours of, you know, decaying facilities out there in the field and trying to operate an educational program without a scientific program happening here. On page 3-59, the Green Bank Observatory's education programs are listed there and then they're referred to several times throughout the whole document, but they are completely under reported. And when comments were sent in last time around, I sent them a seven page detailed description of numbers, all the educational programs that we do that you can find in the comments from last time. I think they need to be addressed in the final report because it's a lot bigger than was stated.

21a I arrived here in 2013, with a big, bad Ph.D. and no practical skills at all. And so thanks to Sue Ann Heatherly and all the staff here in Green Bank, I gained really all of my inspiration to, and all of my purpose, honestly, in giving back to students and giving back to West Virginia. I'm not from West Virginia. I'm from Georgia, but I feel like West Virginia is my state now. I see there's so much potential, there's so much pain, there's so much hardship, but I believe that West Virginia has so much potential. And the Green Bank Observatory is part of that potential. Every semester, over 200 of my Astronomy

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106 students use the 20-meter telescope through the Sky Night Robotic Telescope Network. So I want to underscore what Sue Ann said, that needs to be included and emphasized in the report. Through using the telescope, my students are able to determine our direction of rotation around the center of the Milky Way, that we live in a spiraling galaxy, and we find evidence of dark matter. Now, most of my students aren't going to be scientists and most of them aren't ever going to need to really talk about dark matter, but it gives them that sense of pride and it gives them the skills to think critically and that's what our nation needs. That's what West Virginia needs. So Green Bank Observatory is basically why I'm at WVU. There's no way that I would have the skills in order to give back to the students at WVU and the students in our state without Green Bank Observatory. While I was here, we also started the Science Public Outreach Team which Olivia mentioned. We trained dozens of college students around the state, all operated out of Green Bank. So we're giving back. We're inspiring over 4,000 students every year in K through 12 audiences. But the biggest impact is on the college students. Without any prompting, our ambassadors, our future -- they're education majors. They're our future educators. They have just said on their own volition, I was afraid to teach science and now because of coming to Green Bank, because of participating in SPOT, I'm not -- they're excited to teach science now. That's one of the greatest investments we can make in this state. And SPOT is just one of the amazing programs. People have mentioned the pulsar search laboratory. No one has mentioned the First-To Network which is about training first generation college students. And there's also PING, Physicists Inspiring the Next Generation, which is a completely, fully diverse camp of students from all over amazing socio-economic brackets, all different races, all different -- rich, poor, there's all types. And I've just never seen that kind of education anywhere else. And it's what inspires me. So I truly believe that my whole purpose was shaped by my experience here, so thank you.

30a I'd like to thank the National Science Foundation for the opportunity to respond today and the importance of science and education is what my theme will be. Just before I came to this meeting today I was with a meeting called Sigma Xi. Sigma Xi as you well know has 76,000 members. We have two chapters here in the State of West Virginia; one is in Williamsburg at the West Virginia School Osteopathic Medicine. And one of the persons there asked me to ask why -- he had written letters and had not gotten any response, even that the letters had been responded to, Dr. Larry Davis, our president -- we have an officer's meeting. We have been up here to the Green Bank facility with a whole busload of people and really enjoyed bringing these scientists up here to study what's going on here. In addition, the Green Bank or the West Virginia or the Greenbrier Chapter of Sigma Xi sponsors fairs, their science fairs, and there is a science fair here at this part of Pocahontas and the school here in Green Bank and they're very active. We have four active schools or more that come to the science fair that the Sigma Xi group in Green Bank or down in Williamson or Lewisburg puts on. As you can see, I didn't prepare this and I can write some thoughts afterwards. With this importance to science, I think that we need to look at how important it reacts as well as the students have indicated here. I also think it's important, we have two national presidents, one of them is still in our chapter. We've had one before and he couldn't be here today. He's out in New Mexico or he would have been here. And so there's a great importance of it, of coming here and I think the essence of all of this is science is really important and these students are picking it up here and they're getting enthused and that's of great economic importance. So I wish that you would evaluate that in your whole program. Thank you.

31a I am an astronomer here on staff. I am also the coordinator for our Summer student research programs so I'm going to focus my comments primarily on education and research. So first, I was a little disappointed to see that the Draft EIS did not seem to mention our observatory's long standing and outstanding REU Research Experience for Undergraduates program, which is an NSF funded program, as well as the Physicist Inspiring the Next Generation program. I might have missed it, but if I didn't, I put some numbers and made reference to those in my public oral comments last year, and I'd be happy to

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share those with you again with you guys, any information that you guys need to make sure that's corrected in the final statement.

54a I am writing in regards to the Draft Environmental Impact Statement (DEIS) that has been released for the Green Bank Observatory (GBO). The DEIS fails to fully account for important impacts that would result from any of the Proposed Action Alternatives under consideration, save for the No-Action Alternative. I will be focusing my comments on the Socioeconomic Impacts section of the DEIS, specifically impacts on Education. To begin, the DEIS does not seem to mention, even once, the GBO's longstanding and out-standing National Science Foundation (NSF) funded Research Experience for Undergraduates (REU) program, as well as the newer Physicists Inspiring the Next Generation (PING) program and other summer research programs for undergraduate and graduate students. This oversight is especially baffling given the NSF's commitment to ensuring that its activities have a broader impact on the educational opportunities for young scientists, especially students from underrepresented minorities (URMs). Furthermore, I personally highlighted the importance of these programs in my written and oral comments during the EIS scoping period. To recap those comments, GBO's summer student programs provide career advancement opportunities for approximately ten students per year. Since 1991, over 40% of GBO summer students have been women, a larger percentage than is found in astronomy at large. This includes a period when GBO was part of the National Radio Astronomy Observatory. The PING program provides research and mentoring experiences specially targeted at students of color, as well as women and other underrepresented groups. Two PING mentors are already enrolled in graduate physics programs at U.S. institutions. PING also includes educational opportunities for dozens of rising high school freshmen from URMs each year.

105b The Green Bank Observatory contributes to other areas identified as top education goals in *New Worlds, New Horizons*. Many educational programs at the GBO are aimed at growing diversity in the astronomy community by giving underrepresented minority and female students two-week summer camp experiences introducing them to real, high-level science. In addition to this, the FIRST TWO program encourages STEM involvement among first-generation college students, many from rural areas. The news lately has included multiple disturbing stories of sexual harassment in the workplace and this has sparked honest conversations about the roles and culture of men and women in the workplace. It is imperative that we continue to realize the importance of bringing more women to the table and to empower women to realize their important contribution in all areas – including those in the STEM fields where women are underrepresented. The Green Bank Observatory is way ahead of the curve and has been empowering women to sit at the table and contribute in most important ways for many years. Not only is the Observatory led by an accomplished female scientist, recently there were three female post-doctoral researchers working at the facility, and many of the Observatory programs, such as the Pulsar Search Collaboratory, have significantly higher than average female participation. This holds true also in terms of the number of students hired during summer months to take part in the Observatory's ongoing student research projects. Another goal of *New Worlds, New Horizons* is that of education and public outreach. The number of students and educators that the GBO has impacted in a positive way is tremendous. The Observatory offers nationally recognized learning opportunities including the hands-on Radio Astronomer for a Day program, Skynet Junior Scholars, Research Experience for Undergraduates (REU), the program to retain first generation STEM majors called First Two, the Pulsar Search Collaboratory, Research Experience for Teachers, and student mentorships to name just a few. This facility is absolutely top-of-the-line as far as EPO is concerned, and my daughter can attest to that from her own perspective as well as that of several other young students, many of whom are female, whose lives and career paths were changed by mentorship experiences they have had at the Observatory.

188f Page 4-90: This listing of educational programs is incomplete and does not match what was sent to the consulting firm. This should be corrected.

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193g Table 2.6-1/2-10 The 20-meter Telescope is utilized for educational and science programs and is a source of external income.

188g One additional concern I have is with the description of instruments needed for Alternative B, which states only that the 40-ft. telescope would be used for educational programs. Both the 20-m telescope and the GBT play a large role in our educational programs, and the loss of those two instruments to the education programs should be considered in this alternative.

193r Tables 4.11-2&3/4-81 To maintain levels of science activities, research and education, no housing can be demolished. Table 4.11-3 cannot be realistic in numbers served without housing to accommodate the programs involved.

224c Table 2.6-1/2-9 All housing on site is utilized for both scientist and employee need, as well as for the support of educational activities. Elimination of any housing would have drastic effect on the operation as well as reduce program income. Table 2.6-1/2-10 The 20-meter Telescope is utilized for educational purposes as well as a source of external income. The 43-meter Telescope is also utilized and is a strong source of external funding.

193n 3.11.1/3-45 Also, the GBO Housing Units numbers seem incorrect. The GBO holds 28 rental housing units, a Residence Hall with 16 hotel-style rooms and 4 apartments, and one Dormitory/Bunkhouse with space for 60 people and 2 supervisor rooms. 3.11.1/3-46 As noted, the GBO includes over 28 individual houses or townhouses, not 30.

193e 2.2/2-3 Statement should read "...and operation staffing levels would be expected to stay approximately the same".

193l 3.11/3-39 The northern half of GBO surrounds the unincorporated community of Arbovale and the southern half of GBO consists of the unincorporated community of Green Bank. Additionally, the Sugar Grove facility to the northeast is in partial private ownership. The upper base is still federally-owned.

28d So that said, the only other thing I had, and I know you all want to go on break, is and I'm sorry because I meant to have it typed out, I think there are some issues with -- as everyone said, you've done a really good job putting it all together, but I still think there are a few issues with the housing and the socio-economic impact on the housing because you say, well, you know, people will be moving off-site because they won't be able to live on-site. So that will be good for the housing so there won't be that bog of an impact. But then there's not that many houses on-site compared with how many people are going to be losing their jobs, so there's a lot of people who are leaving. And they can't -- the people that would be losing their jobs if you went to B, C, D, would not be able to be employed in the same manner here in Pocahontas County. So I think some of your statistics may be a little bit off in that but I didn't get it written up nicely so I'm just going to say that in passing. And that's it, thank you.

171b The EIS draft mentions housing and the impact to the community. There will be a huge impact to the community and I believe the EIS was not using their facts correctly. Pocahontas county is the most rural county East of the Mississippi. It is roughly the size of the state of Rhode Island, but there are fewer than 9000 people. Yes, there are counties with less people, but not when you divide it by person per acre. If the NSF were to shut down or choose one of the options where most of the staff were let go the housing crisis would be terrible. Roughly 100 employees, about 3/4 living off site. So 75 homes up for sale? Not likely to work out well.

39c And lastly, without going into too much detail about other things that, you know, that statistically I can comment on, I'm concerned about the, even option alternative A and the fact that any of the options would have anything to do with the demolition of our housing. If you go through the socio-economic part of this, it mentions that there is a 50 percent vacancy rate in the housing in Pocahontas

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County, and, therefore, housing is freely available off site and, therefore, housing is not necessary on site. And I kept thinking, there is no where in this county that I think of that has a 50 percent housing vacancy. Then it occurred to me as I read through, I think, part of the appendices, as to where those numbers came from. They're talking about hunting camps. And there are structures, tons of hunting camps but those are not houses. The assessor does include them as either a second home or whatever it might be. Right now, in this last two weeks, I would guess that there is probably a 10 percent vacancy because it's hunting season and in the Summer you'll probably have a 50 percent vacancy because nobody is using them. Any rate, those are the kinds of things that I think need a little bit more massaging and explanation, and I do appreciate the opportunity to speak to you and to have you let all of these people speak to this as well. Thank you.

188b Pages 3-46, 4-83, 4-86: I do not believe the numbers used here for housing are correct, if you are looking at year-round housing. These estimates appear to include, e.g., temporary hunting cabins and similar housing.

193m 3.11.1/3-45 A 58% vacancy rate seems unreasonable unless Snowshoe Resort, hotels, and seasonal camps, etc. are included in the calculation. The seasonable camps, etc. would NOT be available for use by employees, visiting scientists, or contracted personnel.

193s 4.11.1.1/4-82 The percentage of housing stock vacancy is unreasonable for year-round availability. Is this number a snapshot in time?

224e 3.11.1/3-45 A 58% vacancy rate seems extremely high unless Snowshoe Resort is included in the calculation which is seasonal. Does this include private hunting camps only occasionally used and not available for use by employees, visiting scientists, or contracted personnel?

31c And the other thing I want to address is the magnitude of the impasse under the Action A alternative. There's a line that says that maintaining STEM related training, the impasse would be minor, adverse, and short-term under action alternative A. But that really depends on the funding model that we settle on with partners and whether or not those partners take away from the open sky science time. If the open sky science time really drops, and the research funding also drops then the educational and research opportunities drop as well. And it's not going to be minor and short term. It's going to be severe and long term. And I really encourage you guys to take a look at that and fund the report. Thank you.

54b GBO's ability to offer meaningful research experiences for students enrolled in these programs would be severely and adversely impacted under any of the Proposed Action Alternatives except for the No-Action Alternative. This includes the agency-preferred option, (continued science-focused operations with reduced NSF support) as it still entails a loss of open-skies time that contributes data to the aforementioned programs. Furthermore, a reduction in open-skies science could lead to a decrease in scientist and technical staffing levels at GBO, which would in turn reduce the available pool of student mentors, necessitating a smaller summer student program. The failure of the DEIS to consider the impact on these programs is a major oversight in the assessment of Educational impacts that needs to be corrected. I would be happy to supply more information on these programs if necessary.

104b However, I understand that the current Agency preferred alternative by the NSF (regarding the Draft Environmental Impact Statement issued November 9th), which calls for reduced funding by the NSF of the Green Bank Observatory, could potentially harm these amazing opportunities I have been able to receive. The alternative explains that the rest of the funding should be acquired by seeking "collaboration with interested parties for science- and education- based operations". However, this sort of partnership would damage the Observatory's complete ownership of the site, parts of it would be owned by the partners mentioned before. If the NSF completely cuts off their funding of the GBO (which

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is not eliminated as an option by this alternative- reduced funding can be anywhere from 99% to 0%), these partnerships would own the entirety of the Observatory. These partnerships could lead to focuses other than research, leaving behind education programs and opportunities. A generation of potential radio astronomers, engineers, and educators would miss their callings and proceed on, unaware of what could have been sparked in them by this humble, yet incredible little cluster of telescopes and buildings in the middle of nowhere. Another way that the Agency preferred alternative harms the Observatory is that the Open Skies policy may no longer be applied. One of the many standout features this Observatory has for its research is this Open Skies policy, which lets anyone, and by that I mean anyone, use the colossal Green Bank telescope to answer their own questions about the stars, free of charge. This openhearted policy greatly represents the welcoming philosophy of Green Bank itself, and is only able to exist from NSF funding. If the Observatory is funded solely by partners with other focused operations, there is a very high chance that none of these partners will be interested in giving up valuable telescope time to anyone who does not share their interests. This would effectively put an end to the GBO's Open Skies policy, which would be a painful loss indeed. If it weren't for this policy, I would not have been able to meet such fascinating people as Dr. Natalia Lewandowska, a female postdoc at the Observatory who my sister has become good friends with, Nick Pingel, a physics grad who now studies at West Virginia University, Dr. Hannah Sizemore, another female astronomer who accurately predicted how deep beneath the surface ice would be on Mars, and many others. This policy is more than just a welcoming gesture to budding astronomers and educators, it's almost the heart of the GBO itself. I'd like to finish with a brief look at the current status of West Virginia. The opioid crisis is still going strong and the overdose rates here are the highest in the country. This is a bleak time for our state, and it could use any kind of help it can get. One way we can get that help is to inspire future generations to find their passions, boosting confidence and lowering the chances that they will use drugs to get that confidence instead. The Green Bank Observatory is a wonderful example of that sort of inspiration. Nearly every week a new bus-full of young people arrive to take advantage of the amazing educational experiences offered there, and I would guarantee almost every kid that left had something new to think about on their way home from this treasure hidden away in the mountains of our state. In my opinion, the Observatory should be something we take pride in as West Virginians, and that each of us spring to its defense when it is in trouble. I believe that now, it is in danger of losing some of the most powerful tools it has- not only the 17-million-pound telescope or its constituents, but the power the Observatory has of inspiring youth, and welcoming new explorers every day that it can. Please restore full funding and retain ownership of this marvel of science, education, and inspiration so that it may be experienced by generations to come. Thank you.

14a Thank you for coming to Green Bank and thank you for the opportunity for us to provide input into this important process. I have taken the time to read the draft environmental report. It covers biology, water, geology, culture, visual aspects, but no where in the report, anywhere, does the word "pride" or "proud" appear and that is an oversight. The Green Bank Telescope is one of the premier facilities of which West Virginia is proud and we have every right to be. Indeed, any state would be proud to have this facility and we're just fortunate enough to have it in our backyard. As well as being a linchpin of the community, is it of vital importance to outstanding science at WVU as well as graduate and undergraduate student training.

31b I also wanted to address the region of influence and how that is defined for the education of socio-economic impacts. So there are a lot of comments already about the impacts of the Observatory, not just within the local community and within the state but really nationally and globally. So I just wanted to share some numbers to kind of back that up. So there were 32 states and territories of the U.S. that were represented during the public scoping period and 13 countries other than the U.S. Out of 201 commenters that provided and addressed on the written comments, were from outside the State of

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West Virginia. That's 44 percent; 61 commenters, 10 percent were outside the U.S.; and 67 percent of all comments dealt with either research or education. So my understanding is that the region of influence as it is defined narrowly as being the local community and maybe extending out to the State. But I think that demonstrates that Green Bank has an impact that is national and really global. And if you really want to assess the impact and education and on employment, you need to include the entire country and the entire world. These are of researchers who depend upon the observatory to further their educational career as well as their professional careers. There was a line in the draft EIS that the RY was not officially widened to the state beyond the State of West Virginia because it would dilute the economic consequences of the proposed action alternative. Those of you that were here last year would remember a young woman, a high school student from West Virginia who got up here and rocked it in her comments. Anyone who listened to her talk cannot possibly say that expanding the region of influence would dilute anything and I think we've heard that from other people here as well.

54c Second, The region of influence (ROI) for Socioeconomic impacts has been defined as Pocahontas County, particularly the communities of Green Bank and Arbovale, where social and economic impacts will be felt most strongly. This ROI captures the majority of the concerns identified during the public scoping process (DES 3-39). This ROI is inadequate and, in fact, does not capture the majority of concerns identified during the public scoping process. The ROI should be widened to at least the entirety of the United States, and ideally to the entire globe. This reflects the large, global user community of the Green Bank Telescope (GBT), which is relevant to Educational impacts. Comments were made during the Public Scoping Period that reflected the global reach of the GBT, and this is reflected by the locations of those who submitted comments: 32 States or Territories were represented in written comments during the Public Scoping Period, as were 13 countries other than the US. 201 commenters, 44% of those that provided written comment and gave addresses in a US State or Territory, were from outside West Virginia. 61 commenters, 10% of all those who submitted written comment, gave addresses outside of the US. 67% of all comments, written and public, commented on research and/or education. The GBO impacts research and education far beyond the confines of Pocahontas County. I would be happy to share a detailed breakdown of the comments and the data that went into these numbers. The geographic extent of the GBO's educational and research communities that are captured in the above numbers make it clear that ROI used in the DEIS is too small, and thus misses important Impacts. As such, the DEIS is incomplete and flawed. Because of the unjustly narrow ROI used in the DEIS, the category of Education only considers the impacts on the State, County, and Green Bank Elementary-Middle School[s] and the educational opportunities offered at GBO for county residents (DEIS 3-41). This does not capture the impact that GBO has on primary and secondary education outside of West Virginia, and the impact within higher education throughout the U.S. and the world. The DEIS states that the ROI was not officially widened to the entire State of West Virginia because it dilutes the economic consequences of the Proposed Action Alternatives (DEIS 3-40), but this can surely be addressed by a more detailed analysis of different areas within a widened, official ROI. If this is not done then the final EIS will drastically underestimate the impact of the Proposed Action Alternatives. Third, the DEIS does acknowledge the impacts of GBO on the national and international scale (DEIS 3-59), for example through the Skynet Junior Scholars program and the NANOGrav collaboration, but without including these in the official ROI the DEIS presents an incomplete and confusing view of their impact and how it was assessed.

156d 5. Social and Economic Impact on the Community is Understated – The largely statistical analysis that was presented based upon data and trends for population, median income, unemployment, housing costs etc. was interesting but failed to capture the major intangible contributions that GBO and their employees have on the community. The statistical analysis was also limited to the local area because the small numbers would be dwarfed by extending it to the Region or WV overall, thereby

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making the impact even smaller. It made me wonder if the large number of public comments submitted to NSF and recorded at the public information sessions at GBO (and included in the appendix) were understood and used in the analysis especially since they are not discussed in the report. There were a total of 817 total comments submitted to NSF which strike me as a large number for such a rural and sparsely populated area. Most were supportive of continued operation and only 1 (one) comment supported closure with the reason that it would reduce electromagnetic waves which is a perceived sensitivity for some people. A large number of people attended and participated in the public information session at GBO. The contributions to the local and scientific communities that were described by many people was extensive and quite impressive. However, I did not find these reflected in the analysis or report. Most reasonable and objective people would consider discontinuing research at GBO a major impact.

193t While the report is thorough in its research it is not reflective of the cultural nuances of the communities or County. Housing availability, employment rankings, etc. are season-dependent. The stability of the employment numbers of the GBO serve to stabilize the economy and the programmatic products reinforce the social fabric of the community. The cultural diversity of the area will be adversely affected by lessened NSF involvement and/or lowered employment numbers. This is not reflected in the statistics.

9d And finally, I searched for West Virginia University, I'm an alum, and a lot of the educational programs that I do are in partnership with WVU and we make use of a very vibrant astronomical staff and it's just faculty that are there. And they are there because of the GBT and because of this observatory. Yet that environmental impact, that socio-economic impact which goes far down to our county wasn't really addressed, I didn't see in the Draft EIS as far as the loss of this place for West Virginia University's Astronomy department and what that would do. They have garnered over \$13 million in grants since 2012, when this whole nightmare began. So and that's for research using the GBT. So I think that needs to be brought out as a big environmental impact. Thank you, very much.

Responses:

54d: Preferred Action Alternative A does not have a change in the number of staff at GBO, and it is not anticipated that there would not be an impact to the local school enrollment. The continuing utility of the Green Bank Telescope for some cutting-edge investigations was the motivation for the Preferred Alternative to be a reduction in NSF's contribution to operation costs, instead of full divestment. The consequent reduction in the fraction of time available to public competition is a result of budgetary pressures brought about by the addition of newer facilities, such as ALMA, and the need to maintain balance in various aspects of the AST program. The realization of the Preferred Alternative is intended to assure long-term stability of operations, continuing benefits to the State of West Virginia, and continuing access by the astronomy community to this unique resource. Additionally, the impact of Alternative B on educational activities is moderate because such activities would be possible even with half of the current staffing levels. No changes were made to the FEIS as a result of this comment.

175c: If a future partnership is identified, including an entity intending to use the facility with new partners, assertions about staffing requirements will be more known; until such a partnership is identified, assertions about staffing requirements will be merely conjecture. The continuing utility of the Green Bank Telescope for some cutting-edge investigations motivates the Preferred Alternative to be a reduction in NSF's contribution to operation costs, instead of full divestment. The consequent reduction in the fraction of time available to public competition is a result of budgetary pressures brought about by the addition of newer facilities, such as ALMA, and the need to maintain balance in various aspects of

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the AST program. The realization of the Preferred Alternative is intended to assure long-term stability of operations, continuing benefits to the State of West Virginia, and continuing access by the astronomy community to this unique resource. Under the Preferred Agency Alternative, NSF would create a new operating partnership under which that need can be met. No changes were made to the FEIS as a result of this comment.

188c and 193q: The typographical error on 4-53, 3rd paragraph has been corrected to "The number of personnel at GBO is expected to remain the same under Preferred Action Alternative A;"

28b: Your comment is noted. As discussed in the DEIS, Preferred Action Alternative A would involve collaboration with a new stakeholder(s) who would use and maintain GBO for continued science- and education-focused operations. While the specifics of Preferred Action Alternative A would depend on a proposal(s) submitted by a potential collaborator(s), this Alternative is intended to continue science- and education-focused operations at similar program and staffing levels. In the case of Action Alternative B, the socioeconomic impacts were evaluated with the assumption of half the staffing and half the tourism numbers compared to Preferred Action Alternative A. These assumptions are based on best professional judgment on the staffing required for a technology and education park; therefore, no changes have been made to the document as a result of this comment.

9a, 21a, 30a, 31a, 54a, 105b, 188f, and 193g: The specific educational opportunities offered at GBO were not intended to be all inclusive, as specific educational opportunities may change. The characterization of educational opportunities and impact assessment is qualitative in nature to capture both the range of programs that exist and the changes that may result. However, additional details about the education programs provided by the GBO has been added to the FEIS as Appendix 3.11-C.

188g, 193r, and 224c: The Facility Disposition list in the DEIS is provided for analysis purposes only. As stated in Section 2.1, "However, it must be emphasized that a collaboration may not require the full extent of demolition, safe-abandonment, or mothballing activities analyzed and could involve none or only a subset of the activities list in Table 2.6-1. The Agency preferred Alternative does not include, and this DEIS does not mandate, the demolition or removal of specific buildings and infrastructure, even if specific buildings are identified in the various Alternatives. Because of this, this DEIS should not be viewed to preclude a proposed activity or use of infrastructure." No changes were made to the FEIS as a result of this comment.

193n: This comment reflects the use of different terminology to count individual housing structures, bedrooms/units, and capacity which integrates the number of beds in each bedroom/unit. The FEIS has been modified to "28 individual houses or townhouses."

193e and 193l: The staffing levels and federal ownership have been corrected in the text.

28d and 171b: As noted, a number of factors influence the housing market. The DEIS considers long-term effects on population and housing of the proposed actions, including changes in population, changes in housing availability at GBO and in the surrounding area, the type of housing available, and the duration of time houses are on the market. Table 4.11-12 indicates that the impacts on population and housing in Pocahontas County would be minor, adverse, and long-term for Action Alternative B and moderate, adverse, and long-term for Action Alternatives C and D. No changes were made to the FEIS as a result of this comment.

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39c, 188b, 193m, 193s, and 224e: As noted in Table 3.11-4, Pocahontas County's 58% vacancy rate in 2015 corresponds to 5,104 vacant units. Of these, 53 vacant units were for sale, 369 were for rent, and 451 are classified as "other vacant"; these units may include a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or, if vacant, intended for occupancy) as separate living quarters. The remaining 4,232 units were for seasonal, recreational, or occasional use. Hunting lodges would fall within the seasonal, recreational, or occasional-use category, as would hotel rooms. Thus, the commentors are correct that the vacancy rate noted is partially due to the relatively large number of seasonal, recreational, or occasional-use units in the County. However, there were adequate vacancies on average among its rental units, with 369 vacant units in 2015, which could house 71 workers. Any excess temporary housing demands can be met via the seasonal (hotel) rooms represented by the 4,232 units, which include 28 hotels/condominium complexes nearby at Snowshoe Resort.

31c, 54b, and 104b: As noted in the response to earlier comments, Preferred Action Alternative A would involve collaborations with new stakeholder(s) who would use and/or maintain GBO for continued science- and education-focused operations. The operational details of who would use and/or maintain GBO would depend in part on collaboration proposals that might be received. Therefore, the loss of scientific research opportunities at this location, including the potential reduction in the amount of time available for the use of the GBO telescope, are not specifically addressed in this NEPA analysis. The decision to reduce scientific research opportunities was made as a result of budget reductions and mission decisions by NSF. The decision to reduce the budget and change the role of NSF is not being analyzed in this NEPA document.

14a: The DEIS, Section 3.11.5, Community Cohesion, describes the importance of GBO to the community and the multi-faceted support it provides in both services and facilities. Section 5.3 also states that "GBO is important to the West Virginia Identity." No changes to the document have been made as a result of this comment.

31b, 54c, and 156d: Your comment is noted. As described in Section 3.0, the Region of Influence (ROI) is defined as the area in which environmental impacts resulting from the Proposed Action would be most greatly concentrated and was established to provide an appropriate analysis that neither obscures or dilutes the effect of an action. Socioeconomic impacts may exist outside of the defined ROI, but are expected to be far less than within the local area and State of West Virginia.

193t: Your comment is noted. Much of the socioeconomic data is reported annually rather than seasonally, so it does not completely capture the seasonal variations. Seasonal variations are characterized by employer types and are described in the DEIS in Section 3.11.2.3, Employment. The importance of GBO to the community is described in Section 3.11.5, Community Cohesion.

9d: While West Virginia University receives grants from NSF, the University, instead of NSF, is responsible for the direction of the University's Astronomy Department. As noted previously, a reduction in the fraction of time available to public competition is a result of budgetary pressures and the need to maintain balance in various aspects of the AST program, and West Virginia University astronomers would continue to be able to compete for the available time.

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Solid Waste

Received from:

193 Michael Holstine (Business Manager at GBO), 1/8/2018

Comment:

193o 4.7.1/4-53 While noble in thought, there are no recycling facilities/programs in Pocahontas County beyond paper/cardboard sorting. These activities are already performed and various recycling programs on an individual basis/effort have been performed in the past.

Response:

193o: Pocahontas County Solid Waste Authority has a recycling program that includes paper and #1 and #2 plastics. Information on this program may be found at the following website: <http://pocahontascountyswa.yolasite.com/recycling-reducing-waste.php>. No changes to the document have been made as a result of this comment.

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Visual

Received from:

39,193 Michael Holstine (Business Manager at GBO), 11/30/2018, 1/8/2018

Comment:

39a And I think most of you know me. I'm the business manager here at the observatory, and I just wanted to speak to a few details about this. I will be submitting in the written comment period. But, you know, as you and I discussed today that this is a cooperative effort between us and the NSF. And I think we've worked well together on this program and I want everyone here to know that we've been working well together on this. And I said earlier today, you have your job to do and I have mine to do. And so now it's my turn to talk a little bit. In the Draft EIS, I do want to say that it was a very thorough job. I was impressed by the amount of detail they went into. Like some of the other commenters, though, I am concerned that there was a lack of specificity to some of the vaguer options and ideas that were in place. And it concerned me a little bit when I read some of the statistics that are fairly based to the organization that were wrong. And it concerns me that if those comments or those statistics are wrong, what else might be wrong since the site is stated as having 2200 acres. Well, it's not. It's 2,654.37 acres. I gave them those figures and why that's not reflected, I'm not sure. And I think that's right. It's 45.37 or 54.3, anyway. They'll figure that out.

193j 3.3/3-13 Although it is mentioned in various places within the report and appendices, according to the U.S. Army Corps of Engineers original site map the GBO site consists of approximately 2655 acres, not 2200.

Response:

39a and 193j: All references to the area of the site have been revised from "2,200 acres" to "approximately 2,655 acres" throughout the report.

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Water

Received from:

184 Barbara Rudnick (EPA), 1/8/2018

193 Michael Holstine (Business Manager at GBO), 1/8/2018

Comments:

184e 4. The Stormwater Pollution Prevention Plan and Groundwater Protection Plans that will be prepared and implemented as part of the Construction Stormwater General Permit from the West Virginia Department of Environmental Protection (WVDEP) should be approved prior to start of construction/demolition. Any information that is available regarding protection planning could be included in the EIS, or in later NEPA analysis.

193b ES.7/ES-11 A Stormwater Protection Plan (SWPP) and Groundwater Protection Plan (GPP) already exist for the GBO site. Any additional modifications to these documents should only address additional demolition activities by the contractor.

Responses:

184e and 193b: Section 4.5.1 of the DEIS states, "Demolition activities would require a Construction Stormwater General Permit from the WVDEP, which is required for any proposed project that would disturb 1 acre or more of land in the state. A Storm Water Pollution Prevention Plan (SWPPP) and Groundwater Protection Plan (GPP) must be prepared and implemented as part of this permit." This has been revised to state, "Demolition activities would require a Construction Stormwater General Permit from the WVDEP, which is required for any proposed project that would disturb 1 acre or more of land in the state. A Storm Water Pollution Prevention Plan (SWPPP) and Groundwater Protection Plan (GPP) must be prepared (or existing plans modified) and implemented as part of this permit and would be approved prior to the start of construction or demolition activities."

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Transportation

Received from:

188 Karen O'Neil, 1/8/2018

Comment:

188e Page 4-72: The wording here is unclear. I suspect the intent is "95 or fewer demolition workers," that is, people there specifically for demolition, and not including the staff. This should be clarified.
Pages 4-72, 4-82: The number of demolition workers needed change throughout the document, and this should again be clarified/better defined.

Response:

188e: The typographical error on Page 4-72, Section 4.10.1 has been corrected to read, "An estimated 71 or fewer demolition workers would be onsite during the 21-week demolition period."