

# NATIONAL SCIENCE FOUNDATION

## RECORD OF DECISION

### I. INTRODUCTION

Arecibo Observatory is a National Science Foundation (NSF)-owned scientific research and education facility. In 2011, NSF awarded a Cooperative Agreement to SRI International, which together with the Universities Space Research Association (USRA) and Universidad Metropolitana formed the Arecibo Management Team to operate and maintain Arecibo Observatory for the benefit of scientific research communities. Arecibo Observatory enables research in three scientific disciplines: space and atmospheric sciences, radio astronomy, and solar system radar studies; the last of these is largely funded through a research award to USRA from the National Aeronautics and Space Administration (NASA). An education and public outreach program complements the Arecibo Observatory scientific program.

A key component of Arecibo Observatory's research facility is a 305-meter-diameter, fixed, spherical reflector. Arecibo Observatory infrastructure includes instrumentation for radio and radar astronomy and ionospheric physics, office and laboratory buildings, a visitor and education facility, and lodging facilities for visiting scientists.

NSF acknowledges that valuable science and education activities are conducted at Arecibo Observatory, as evidenced by decades of substantial NSF funding of both the facility and research grants. However, the purpose of the current proposal is to reduce NSF funding in light of a constrained budgetary environment.

### **PURPOSE & NEED**

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for the operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community.

NSF relies on the scientific community, via decadal surveys and senior-level reviews, to provide input on priorities, and this community has repeatedly recommended divestment from AO, as well as from other observatories under similar review.

In 2010, the National Research Council (NRC) conducted its sixth decadal survey in astronomy and astrophysics. In their report, *New Worlds, New Horizons in Astronomy and Astrophysics*, the NRC committee recommended the following:

“NSF-Astronomy should complete its next senior review before the mid-decade independent review that is recommended in this report, 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.”

In response to this recommendation, the NSF Directorate for Mathematical and Physical Sciences (MPS) commissioned a subcommittee of the MPS Advisory Committee to assess the portfolio of the AST within MPS. This subcommittee, composed solely of external members of the scientific community, was charged with recommending a balanced portfolio to maximize the science recommended by National Academy of Sciences surveys of the field, which are carried out every decade under constrained budget scenarios. The resulting Portfolio Review Committee Report (PRC Report), *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*, was released in August 2012.

The PRC Report recommended the divestment of a number of telescopes from the federal portfolio in order to maintain a balance of small-, medium-, and large-scale programs that would best address decadal survey science. With respect to Arecibo Observatory, the PRC Report made the following recommendation (Recommendation 10.4): “AST should reevaluate its participation in Arecibo and SOAR later in the decade in light of the science opportunities and budget forecasts at that time.”

This follows from a recommendation made by the AST Senior Review Committee in 2006 in its report entitled *From the Ground Up: Balancing the NSF Astronomy Program* (Recommendation 6): “The National Astronomy and Ionosphere Center [former name for Arecibo Observatory] ...should seek partners who will contribute personnel or financial support to the operation of Arecibo...by 2011 or else these facilities should be closed.” The Senior Review Report also noted that “If Arecibo is kept operating beyond 2011, it is expected that this will only be a limited-term extension, pending the deliberations of the next decadal survey”.

While AST was the primary funder of Arecibo for over a decade (funding \$10.6M annually in 2006, reducing over the years to \$4.1M in 2016), the Geospace Section (GS) of the NSF Division of Atmospheric and Geospace Sciences (AGS) in the Directorate for Geosciences (GEO) was an early co-funder of Arecibo Observatory operations and now provides approximately half of the current NSF funding (\$4.1 million annually from GS) for Arecibo Observatory. As a result, AGS has also taken a lead role in making recommendations about the future of Arecibo Observatory. In 2016, the GEO Advisory Committee concluded its own community-based portfolio review, which recommended a significant and specific funding reduction. The report written by AGS and delivered in April 2016, entitled *Investments in Critical Capabilities for Geospace Science: 2016 to 2025*, gave the following recommendation (Recommendation 9.11): “The GS should reduce its M&O [Management and Operations] support for Arecibo Observatory to \$1.1M by 2020, i.e., to a proportional *pro rata* level approximately commensurate with its fractional NSF GS proposal pressure and usage for frontier research.” The NSF/GEO Directorate commissioned a review from a second panel assembled by the National Academy of Sciences that was given the charge of assessing the process by which PRC findings and recommendations were reached; this panel agrees with Recommendation 9.11.

The continued importance of the NSF response to the PRC Report was highlighted by the annual report of the Congressionally chartered Astronomy and Astrophysics Advisory Committee

(AAAC) in March 2016, which recommended that “[s]trong efforts by NSF for facility divestment should continue as fast as is possible.” More recently, in August 2016, the National Academies of Sciences, Engineering, and Medicine (NAS) mid-decadal report, *New Worlds, New Horizons: A Midterm Assessment*, provided their Recommendation 3-1: “The National Science Foundation (NSF) should proceed with divestment from ground-based facilities which have a lower scientific impact, implementing the recommendations of the NSF Portfolio Review that is essential to sustaining the scientific vitality of the U.S. ground-based astronomy program as new facilities come into operation.”

At present, Arecibo Observatory serves a variety of scientific user communities in astronomy, aeronomy, and planetary science, and it is funded for all three activities as well as an active education and public outreach program. However, the scientific community evaluations cited previously indicate that the scientific capability of Arecibo Observatory is lower in priority than other scientific capabilities NSF funds. In a funding-constrained environment, NSF must maintain a balanced research portfolio with the largest science return for the taxpayer dollar. Therefore, the purpose of this Proposed Action is to substantially reduce NSF’s contribution to the funding of Arecibo Observatory.

## **IDENTIFICATION OF POTENTIAL ALTERNATIVES**

NSF has defined options for the future state of Arecibo Observatory, given the need to significantly decrease or eliminate NSF funding of the Observatory. NSF has sought viable concepts of operations from the scientific community via an October 26, 2015 Dear Colleague Letter [NSF 16-005](#). Preliminary proposed Alternatives were developed based on this input and were included in the Notice of Intent (NOI) published in the *Federal Register* on May 23, 2016.

A public scoping process was initiated upon publication of the NOI and was completed in June 2016. Details of this process can be found in Section 5 of the Final Environmental Impact Statement (FEIS) for the Arecibo Observatory, dated July 27, 2017, and noticed in the Federal Register on August 4, 2017. Input received during scoping was used to vet the alternatives presented in the NOI and to provide focus on the issues to be evaluated.

### **Alternatives Considered**

As detailed in the FEIS, five Action Alternatives, in addition to the No-Action Alternative, were considered for the proposed change in operations of Arecibo Observatory:

- Alternative 1: Collaboration with Interested Parties for Continued Science-focused Operations (Agency-preferred Alternative)
- Alternative 2: Collaboration with Interested Parties for Transition to Education-focused Operations
- Alternative 3: Mothballing of Facilities
- Alternative 4: Partial Demolition and Site Restoration
- Alternative 5: Complete Demolition and Site Restoration
- No-Action Alternative: Continued NSF Investment for Science-focused Operations

Under each Action Alternative described herein, there could be some level of demolition of buildings and structures; buildings/structures that could be demolished are identified for analysis purposes only, but these buildings/structures would not necessarily be demolished. Alternatives 1 and 2 are defined by the reduction of NSF funding and the continuance of science-focused (under Alternative 1) or education-focused (under Alternative 2) operations and not the disposition of any one facility or structure. Use or demolition of any particular building/structure or instrument cannot be determined unless or until a viable collaboration option is under consideration. Because reduction of NSF funding may require the safe-abandonment, mothballing, or demolition of facilities, the FEIS described these Alternatives under the most conservative (highest environmental impact) scenario in terms of NSF's analysis of potential changes to facilities, so that it may be inclusive of the full range of potential environmental impacts. The analysis approach is consistent with National Environmental Policy Act (NEPA) requirements and is sufficiently broad to allow NSF to complete the analysis during planning and without regard to the specifics of a future collaboration.

The Action Alternatives are described below.

**Alternative 1 – Collaboration with Interested Parties for Continued Science-focused Operations (Identified in the FEIS as the Agency-preferred Alternative):**

Alternative 1 would involve collaborations with new stakeholder(s) who would use and maintain Arecibo Observatory for continued science-focused operations. NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades. Under this Alternative, NSF could transfer or retain the property. Alternative 1 would involve the least change to the current facility and would retain the 305-meter telescope, the 12-meter telescope, and the supporting facilities for research.

This Alternative might include demolition activities that could remove up to 26 buildings/structures from the site. It is unknown whether specific buildings would be demolished as a collaborative agreement is not yet in place and the needs of any future collaborator(s) are not known at this time. Based on communications with the scientific community, NSF identified the 26 buildings/structures that may be likely candidates for removal, which are provided in Table 2.3-1 of the FEIS. Onsite housing, recreation facilities, and other buildings that could be determined unnecessary would be demolished. Paved roads serving areas that would no longer be used would be removed. The analysis assumes that 26 buildings/structures would be demolished and no new construction would occur, which represents the maximum amount of disturbance that could result under this Alternative.

Demolition of buildings and infrastructure would include the physical dismantling of buildings/structures and use of heavy equipment to break up and remove concrete material. Demolition debris would be recycled and reused to the extent possible, and any remaining materials would be properly disposed of in a commercial landfill. Haul trucks would transport the demolition debris from Arecibo Observatory to recycle/reuse centers in nearby municipalities and the remaining debris to a landfill in Ponce.

Equipment, tools, machinery, furniture, and ancillary items with salvage value that are no longer needed for the Observatory to operate would be disposed of in accordance with federal law. Gates and fencing would be evaluated to determine whether upgrades are needed to provide

appropriate security and access around portions of the site that would require protection. Existing utilities would be maintained and site restoration would occur. Site restoration would include reestablishing landscaping in areas where buildings/structures were demolished and may involve transporting soil to the site to support landscaping in areas where building foundations or excavated bedrock would prevent vegetation establishment.

The anticipated activities to implement demolition under Alternative 1 include the following:

- Conduct a hazardous materials assessment for asbestos-containing material (ACM), lead-based paint (LBP), and other conditions of concern for structures to be demolished. Remediate as necessary.
- Demolish buildings and structures that are no longer needed. Concrete buildings would be removed using hammerhoes, jackhammers, and other heavy equipment.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Establish soil in areas where buildings/structures were removed from bedrock. Landscape areas of bare soil.

The demolition period for Alternative 1 is expected to take 12 weeks; depending on the availability of funds, activities may be spread out over multiple fiscal years. All demolition work would be conducted within developed areas of Arecibo Observatory, so there would be no need to construct new access routes to haul debris away and no widening or other improvements to existing roads would occur.

Landscaped areas would be maintained during operations. All infrastructure related to the 12-meter and 305-meter telescopes would be maintained during operations to prevent the degradation of the instruments and to keep vegetation from overgrowing near or on the dishes.

Operations would be expected to continue during demolition activities. Demolition activities that could interfere with the experimental use of the 12-meter and 305-meter telescopes and data collection would be coordinated with Observatory staff to minimize the potential for disrupting scientific work.

Operations after demolition activities would be comparable to current operations with regard to the number of employees and their commuting activities. Specific scientific research, research programs, and educational activities may change.

Alternative 1 was identified as NSF's Preferred Alternative in the FEIS. The reason for identifying it as such is that it meets the Purpose and Need of reducing the amount of funding required from NSF, while allowing continued benefits to the scientific and educational communities. The desire to continue both scientific research and the educational programs that occur at Arecibo Observatory was repeatedly mentioned by members of the public during the NEPA public comment periods. Implementation of Alternative 1, however, is contingent upon the existence of collaborators who come forward with viable proposed plans to provide non-NSF funding in support of their science-focused operations.

## **Alternative 2 – Collaboration with Interested Parties for Transition to Education-focused Operations:**

Alternative 2 would involve collaborating with outside entities to operate and maintain Arecibo Observatory as an education-focused operation. An official collaboration would be created to keep the science center open for students and visitors. New collaborators could include Commonwealth agencies, educational institutions, industrial or commercial ventures, or private individuals. Under this Alternative, NSF could transfer or retain the property.

The visitor center, learning center, and 12-meter telescope would remain operational. The 305-meter telescope would be made inoperable but retained for visual/historical interest. Retaining the 305-meter telescope dish would require that it be secured and regularly maintained so that structural elements would not degrade and the area would not be overgrown by vegetation.

Buildings/structures not needed to meet the anticipated operations-related goals would be safe-abandoned<sup>1</sup> or demolished. The majority of residential housing and recreational facilities would not be retained. See Table 2.3-1 in the FEIS for a list of building/structure disposition as analyzed in the FEIS.

Equipment, tools, machinery, furniture, and ancillary items with salvage value that are no longer needed for the education-based facility to operate would be disposed of in accordance with federal law. Existing utilities would be maintained. There would be site restoration to establish landscaping where buildings/structures were previously located.

The anticipated activities to implement demolition activities associated with Alternative 2 include the following:

- Conduct hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be demolished. Remediate as necessary.
- Demolish or safe-abandon buildings, structures, and infrastructure that are no longer needed. Concrete buildings would be removed using hammerhoes, jackhammers, and other heavy equipment.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Establish soil in areas where buildings/structures were removed from bedrock. Landscape areas of bare soil.

The demolition period for Alternative 2 would be expected to take 12 weeks; depending on the availability of funds, activities may be spread out over multiple fiscal years. All demolition work would be conducted within developed areas of Arecibo Observatory, so there would be no need to construct new access routes to haul debris away and no widening or other improvements to existing roads would occur.

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<sup>1</sup> Safe Abandonment: To remove a building or facility from service without demolishing it. This includes removing furnishings, disconnecting utilities, and isolating the building/structure from public access by fencing or other means to reduce fall and tripping hazards and preclude vandalism. The building/structure is also made secure from environmental damage due to wind, rain, humidity, and temperature extremes. Pest and insect damage must also be taken into account and biodegradable items must be removed to the maximum extent practicable. Under safe abandonment, there is no intention that buildings/structures would be brought back to operational status.

Landscaped areas would be maintained during operations. All infrastructure related to the 12-meter and the 305-meter telescopes would be maintained during operations to prevent the degradation of the instruments and to keep vegetation from overgrowing near or on the dishes.

Operations associated with education would be expected to continue during removal of unnecessary buildings/structures. Demolition activities that could interfere with experimental use of the 12-meter telescope and data collection would be coordinated with Observatory staff to minimize the potential for disrupting scientific work.

Operations after demolition would be comparable to current operations with regard to the number of employees and their commuting activities. The specific job make-up would change, as scientific research would no longer continue. It is anticipated that a staff comparable in size to current operations would work onsite under this Alternative.

### **Alternative 3 – Mothballing of Facilities:**

Alternative 3 would involve mothballing<sup>2</sup> (preservation of) essential buildings, telescopes, and other equipment, with periodic maintenance to keep them in working order. This method would allow the facility to suspend operations in a manner that permits operations to resume efficiently at some time in the future. It is not known what type of operations would be implemented when the mothball phase ends. Operations at the time of resumption could be similar to current operations, other science-based operations, education-based operations, or some other type of operations. Because of this uncertainty, the resumption of operations is not considered as part of this Alternative.

Supporting structures would be evaluated to determine whether they are critical to the operation of the 12-meter and 305-meter telescopes. Buildings/structures that are obsolete and not needed would be removed.

A maintenance program would be required to protect the facilities from deterioration, vandalism, and other damage. Regular security patrols would be performed to monitor the site. Common mothballing measures, such as providing proper ventilation, keeping roofs and gutters cleaned of debris, and performing ground maintenance and pest control, would be implemented. Lubrication and other deterioration-preventing measures would be required on the 305-meter telescope dish, the Gregorian dome, and the support cables for the 305-meter telescope dish and the platform.

Visitor housing and recreational areas would be closed indefinitely, with water lines drained and electricity turned off. All supplies, books, photographs, furnishings, and other items not needed for periodic maintenance would be removed from the site. Equipment, tools, machinery, furniture, and ancillary items that would not be needed for resumption of operations and that have salvage value would be disposed of in accordance with federal law.

Site restoration to establish landscaping where buildings/structures were previously located would occur. Gates and fencing would be evaluated to determine whether upgrades would be needed to provide appropriate security and access around portions of the site that would require protection.

The anticipated activities to implement the demolition components of Alternative 3 include the following:

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<sup>2</sup> Mothball: Remove a building or structure from daily use while maintaining the general condition for a defined period. Equipment and structures are kept in working order but are not used.

- Prepare buildings and structures to be mothballed and turn off nonessential utilities.
- Conduct hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be demolished. Remediate as necessary.
- Demolish structures and buildings that are no longer needed. Concrete buildings would be removed using hammerhoes, jackhammers, and other heavy equipment.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Establish soil in disturbed areas where buildings/structures were removed from bedrock. Landscape areas of bare soil.
- Complete other limited site restoration activities.
- Establish site security and facilities maintenance.

The demolition period for Alternative 3 would be expected to take 15 weeks; depending on the availability of funds, activities may be spread out over multiple fiscal years. All demolition work would be conducted within developed areas of Arecibo Observatory, so there would be no need to construct new access routes to haul debris away and no widening or other improvements to existing roads would occur.

Landscaped areas would be maintained during the mothball period. All infrastructure related to the 12-meter and 305-meter telescopes would be conditioned for safe storage to prevent the degradation of the equipment and allow operations to be restarted. Regular vegetation maintenance would be implemented to keep vegetation from overgrowing the dishes.

For purposes of the analysis in the FEIS, it was assumed that operations would be suspended for an indefinite time and then resumed at some point in the future. It is anticipated that technical staff responsible for operating the 12-meter and 305-meter telescopes, scientific support staff, and cafeteria workers would not be retained. However, it is expected that current staffing levels for facilities maintenance would remain the same under this Alternative due to the level of maintenance required to keep the infrastructure operable.

#### **Alternative 4 – Partial Demolition and Site Restoration:**

Alternative 4 involves the demolition of all above-grade structures, except the large concrete structures (that is, towers, tower and catwalk anchors, and rim wall infrastructure). All below-grade foundations would be stabilized and filled in.

Equipment, tools, machinery, furniture, and ancillary items with salvage value would be disposed of in accordance with federal law. Demolition of the telescopes and other structures would be conducted during the same timeframe. If another use is identified for the 12-meter telescope, it would be repurposed and relocated rather than demolished.

The anticipated activities to implement the demolition activities of Alternative 4 include the following:

- Conduct hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be demolished. Remediate as necessary.
- Turn off and cap utilities.



- Remove the 305-meter telescope ground screen and reflector dish.
- Remove the platform, all instrumentation, and support structures suspended above the 305-meter reflector dish.
- Sequentially demolish concrete structures using hammerhoes, jackhammers, and other heavy equipment.
- Demolish structures other than those retained on the site.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Conduct site restoration work: re-grade affected areas to desired elevations and contours; use available concrete rubble as necessary; bring in fill as needed to establish grade.
- Install soil and vegetation: place soil where needed to support growth of desired vegetation; seed and transplant native species; install temporary erosion control (biodegradable fiber mats) where needed; maintain (appropriate watering as needed and weed control) until desired vegetation is established.
- Install security fencing around the three towers and the anchors for the southeastern and southwestern towers and conduct measures appropriate to secure the site.

The demolition period for Alternative 4 would be expected to take 28 weeks; depending on the availability of funds, activities may be spread out over multiple fiscal years. All demolition work would be conducted within developed areas of Arecibo Observatory, so there would be no need to construct new access routes to haul debris away and no widening or other improvements to existing roads would occur.

Areas revegetated following demolition activities would be maintained for a period of 18 months, less if target revegetation (80 percent cover by desired species) is achieved sooner. A vegetation maintenance staff would be retained through this period.

Operations at Arecibo Observatory would cease under Alternative 4; therefore, it is anticipated that staffing levels would not be maintained.

### **Alternative 5 – Complete Demolition and Site Restoration:**

Alternative 5 involves the demolition of all above-grade structures, including the large concrete structures (that is, towers, anchors, and rim wall infrastructure). Below-grade foundations would be removed and the areas backfilled. Explosives may be used to demolish the three towers, six tower anchors, catwalk anchor, and rim wall infrastructure supporting the 305-meter telescope dish. Explosives, if used, would be limited to low-force charges designed to transfer the explosive force only to the structure designated for removal.

Equipment, tools, machinery, furniture, and ancillary items with salvage value would be disposed of in accordance with federal law. Facilities and structures would be demolished. Demolition of the radio telescopes and other structures would be conducted during the same timeframe. If another use is identified for the 12-meter telescope, it would be repurposed and relocated rather than demolished.

The anticipated activities to implement Alternative 5 include the following:

- Turn off and cap utilities.
- Conduct hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be demolished. Remediate as necessary.
- Remove the 305-meter telescope ground screen and reflector dish.
- Remove the platform, all instrumentation, and support structures suspended above the 305-meter reflector dish.
- Sequentially demolish the smaller concrete structures by using hammerhoes, jackhammers, and other heavy equipment.
- Remove below-grade structures by using hammerhoes, jackhammers, and other heavy equipment.
- Remove 305-meter telescope dish foundation and rim wall infrastructure, which may entail the use of explosives in addition to hammerhoes, jackhammers, and other heavy equipment.
- Demolish towers, which may entail the use of large cranes and explosives in addition to hammerhoes, jackhammers, and other heavy equipment.
- Demolish tower and catwalk anchors, which may entail the use of large cranes and explosives in addition to hammerhoes, jackhammers, and other heavy equipment.
- Fill and safe-abandon concrete foundations that cannot be removed.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Conduct site restoration work: re-grade affected areas to desired elevations and contours; use available concrete rubble as necessary; bring in fill as needed to establish grade.
- Install soil and vegetation: place soil where needed to support the growth of desired vegetation; seed and transplant native species; install temporary erosion control (biodegradable fiber mats) where needed; maintain (appropriate watering as needed and weed control) until desired vegetation is established.
- Conduct measures appropriate to secure the site.

The demolition period for Alternative 5 would be expected to take 38 weeks; depending on the availability of funds, activities may be spread out over multiple fiscal years. All demolition work would be conducted within developed areas of Arecibo Observatory, so there would be no need to construct new access routes to haul debris away and no widening or other improvements to existing roads would occur.

Areas revegetated following demolition activities would be maintained for a period of 18 months, less if target revegetation (80 percent cover by desired species) is achieved sooner. A vegetation maintenance staff would be retained through this period.

Operations at Arecibo Observatory would cease under Alternative 5; therefore, it is anticipated that staffing levels would not be maintained.

## **No-Action Alternative: Continued NSF Investment for Science-focused Operations**

Under the No-Action Alternative, NSF would continue funding Arecibo Observatory at current levels. None of the Action Alternatives would be implemented.

## **II. ENVIRONMENTAL COMPLIANCE**

### **COMPLIANCE WITH NEPA**

The FEIS was prepared pursuant to the NEPA, 42 U.S.C. § 4321, *et seq*, to analyze the potential environmental impacts associated with NSF's proposed changes to operations at Arecibo Observatory in a reduced funding environment. NSF conducted a public processes that informed preparation of a Draft Environmental Impact Statement (DEIS) and FEIS. Due to its funding role in near-Earth objects observations, NASA served as a Cooperating Agency throughout NSF's NEPA process. A more detailed description of NSF's NEPA process is set forth below.

NSF notified, contacted, and/or consulted with agencies, individuals, and organizations during development of its DEIS and FEIS. Public disclosure and involvement regarding the Proposed Action included pre-assessment notification letters to agencies and stakeholders, social media announcements, website updates, scientific digests and blogs, newspaper public notices, public scoping meetings (conducted on June 7, 2016, in San Juan and Arecibo) and a 30-day public comment period to provide input on viable alternatives and resource areas of concern. After NSF's review and consideration of all comments received during the public scoping period, the DEIS was prepared. Public meetings on the DEIS were conducted on November 16, 2016, in Arecibo and on November 17, 2016, in San Juan. Both English and Spanish versions of media notifications and the materials distributed during the meetings were made available to the public. An English/Spanish interpreter was present during all public meetings and interpretation was provided to the public. The public was encouraged to comment during the requisite comment period of the scoping process and after publication of the DEIS. The DEIS was published and distributed to federal, state, local, and private agencies, organizations, and a stakeholder list of over 400 individuals for review and comment during a 45-day public comment period, and it was filed with the United States Environmental Protection Agency (EPA). A Notice of Availability of the DEIS was announced in the *Federal Register* on October 28, 2016. A detailed summary of comments received during the public comment periods is presented in Section 5 of the FEIS. Following the close of the public comment period on the DEIS, NSF reviewed and considered all comments received. The final result of NSF's review and consideration of the public comments is reflected in the FEIS. The FEIS is available on NSF's website, [www.nsf.gov/ast](http://www.nsf.gov/ast), as well as on EPA's Environmental Impact Statement Database.

### **ENVIRONMENTAL IMPACTS**

The FEIS contains a detailed analysis of the environmental impacts associated with each Action Alternative and the No-Action Alternative. A summary of the impacts for each of the considered Alternatives is presented below. Because none of the Action Alternatives would have the potential for measurable impacts on air quality, climate change, land use, surface waters, an analysis of impacts on those resource areas was not carried out further.

The FEIS includes the methodology used for determining impact thresholds and the factors considered in assessing the impact threshold for those resource areas analyzed under each Action Alternative and the No-Action Alternative. The designated impact level under Alternatives 1 through 5 assumes that Best Management Practices (BMPs) and mitigation measures identified in the FEIS would be implemented. See Section 4 of the FEIS for BMPs and mitigation measures associated with each Action Alternative. The BMPs and mitigation measures applicable to the selected Alternative are provided in Section V. DECISION, below. The FEIS also includes a full analysis of impacts, which is incorporated herein.

### **Alternative 1: Collaboration with Interested Parties for Continued Science-focused Operations (Identified in the FEIS as the Agency-preferred Alternative)**

**Biological Resources:** During demolition under Alternative 1, impacts on biological resources would include direct minor, adverse, and short-term impacts on common vegetation and wildlife, and direct, negligible, adverse, and short-term impacts on migratory birds and the endangered Puerto Rican boa. There would be indirect negligible, adverse, and short-term impacts on offsite wetlands and protected plant species. There would be no impacts on biological resources during operations.

**Cultural Resources:** Demolition would result in a major, adverse, and long-term impacts on known historic properties that would be considered an adverse effect on historic properties under Section 106 of the National Historic Preservation Act (NHPA). There would be no impacts on known historic properties during operations and no impacts to archaeological resources would be expected during either demolition or operation activities. Major, adverse, and long-term impacts on known historic properties would result if, under this Alternative, Arecibo Observatory were transferred to a non-federal entity. This would occur because Section 106 of the NHPA would not apply to activities carried out by a non-federal entity.

**Geology and Soils:** Demolition impacts on geological features and soils would include negligible adverse, and short-term impacts on topography and soils and minor, adverse, and long-term impacts on karst features. There would be no impacts on geological features or soils during operations.

**Groundwater:** Demolition would result in minor, adverse, and short-term impacts from runoff and negligible, adverse, and long-term impacts to underlying groundwater. There would be no impacts on groundwater during operations.

**Hazardous Materials:** A minor to moderate, long-term benefit resulting from remediation of site contamination could occur during demolition, depending on the level of contamination that must be addressed. A minor, adverse, and short-term impact would result from increased use of hazardous materials during demolition. A minor, long-term benefit would likely occur post-demolition due to the reduced use of hazardous materials during operations.

**Solid Waste:** Minor, adverse, and short-term impacts on the level of solid waste would occur during demolition due to disposal of the debris from demolished buildings/structures that could not be reused or recycled. There would be no solid waste impacts during operations.

**Health and Safety:** Negligible, adverse, and short-term impacts on public safety and protection of children during demolition would be expected. Minor, adverse, and short-term impacts on occupational health during demolition may occur. Negligible, adverse, and long-term impacts on

public safety could occur during operations, primarily resulting from the possible reduced capability to observe potentially hazardous near-Earth objects (PHOs).

**Noise:** Negligible, adverse, and short-term noise impacts from construction equipment and increased traffic would be expected during demolition. There would be no noise impacts during operations.

**Socioeconomics:** Demolition activities would result in negligible, adverse, and short-term impacts on housing and minor, adverse, and short-term impacts on education and tourism in the Municipality of Arecibo. There would be negligible, short-term benefits on employment, income, and the economy. There would be no socioeconomic impacts during operations.

**Traffic and Transportation:** Minor, adverse, and short-term impacts on traffic and transportation would be expected during demolition. There would be a minor, adverse, and long-term impact from road damage during demolition activities. No traffic impacts would be expected during operations.

**Visual Resources:** Impacts to visual resources during demolition would be minor, adverse, and short-term. No impacts on visual resources would occur during operations.

No adverse cumulative impacts on resources would occur under Alternative 1.

## **Alternative 2: Collaboration with Interested Parties for Transition to Education-focused Operations**

**Biological Resources:** During demolition, impacts on biological resources would include direct, minor, adverse, and short-term impacts on common vegetation and wildlife and direct, negligible, adverse short-term impacts on migratory birds and the endangered Puerto Rican boa. There would be indirect, negligible, adverse, and short-term impacts on offsite wetlands and protected plant species. There would be no impacts on biological resources during operations.

**Cultural Resources:** Demolition and operations activities would result in major, adverse, and long-term impacts on known historic properties that would be considered an adverse effect on historic properties under Section 106 of the NHPA. Major, adverse, and long-term impacts on known historic properties would result if, under this Alternative, Arecibo Observatory were transferred to a non-federal entity. This would occur because Section 106 of the NHPA would not apply to activities carried out by a non-federal entity. There would be no impacts on archaeological resources expected during either demolition or operations activities.

**Geology and Soils:** Demolition impacts on geological features and soils would include negligible adverse, and short-term impacts on topography and soils and minor, adverse, and long-term impacts on karst features. There would be no impacts on geological features or soils during operations.

**Groundwater:** Demolition would result in minor, adverse, and short-term groundwater impacts from runoff and negligible, adverse, and long-term impacts on underlying groundwater. There would be no impacts on groundwater during operations.

**Hazardous Materials:** A minor to moderate, long-term beneficial impact on the level of site contamination would be expected during demolition, depending on the level of contamination that must be addressed. A minor, adverse, and short-term impact would result from increased use

of hazardous materials during demolition. A minor, long-term benefit would occur from the reduced use of hazardous materials during operations.

**Solid Waste:** Minor, adverse, and short-term solid waste impacts would occur during demolition due to disposal of the debris from demolished structures that could not be reused or recycled. There would be no solid waste impacts during operations.

**Health and Safety:** Negligible, adverse, and short-term impacts on public safety and protection of children during demolition would be expected. Minor, adverse, and short-term impacts on occupational health during demolition may occur. Negligible, adverse, and long-term impacts on public safety could occur during operations, primarily resulting from the possible reduced capability to observe PHOs.

**Noise:** Negligible, adverse, and short-term noise impacts from construction equipment and increased traffic would be expected during demolition. There would be no noise impacts during operations.

**Socioeconomics:** Demolition activities would result in negligible, adverse, and short-term impacts on housing, and minor, adverse, and short-term impacts on education and tourism in the Municipality of Arecibo. There would be negligible, short-term benefits on employment, income, and the economy. Impacts during operations would include negligible, adverse impacts on population, housing, the economy, employment and income. Moderate, adverse, and long-term socioeconomic impacts would result from fewer regional education activities and science, technology, education, and math (STEM) opportunities. In addition, minor, beneficial, long-term impacts on education would be expected from new STEM programs.

**Traffic and Transportation:** Minor, adverse, and short-term impacts on traffic and transportation would be expected during demolition. There would be a minor, adverse, and long-term impact from road damage during demolition activities. No traffic impacts would be expected during operations.

**Visual Resources:** Impacts on visual resources during demolition would be moderate, adverse, and long-term. Minor, adverse, long-term impacts would be expected from operations.

No adverse cumulative impacts to resources would occur under Alternative 2.

### **Alternative 3: Mothballing of Facilities**

**Biological Resources:** During demolition, impacts on biological resources would include direct, minor, adverse, and short-term impacts on common vegetation and wildlife and direct, negligible, adverse, and short-term impacts on migratory birds and the endangered Puerto Rican boa. There would be indirect, negligible, adverse, and short-term impacts on offsite wetlands and protected plant species. There would be a minor, long-term benefit on migratory birds during the mothball period.

**Cultural Resources:** Under this Alternative, the mothballing of historic district-contributing contributing resources would result in major, adverse, and short-term impacts on cultural resources due to the loss of association and feeling, and an adverse effect under Section 106. This is because those resources would not be in use, and their use is the primary component of their significance. There would be no impacts to archaeological resources expected during either the demolition or mothball period.

**Geology and Soils:** Demolition impacts to geological features and soils would include negligible, adverse, and short-term impacts on topography and soils, and minor, adverse, and long-term impacts on karst features. There would be no impacts on geological features or soils during the mothball period.

**Groundwater:** Demolition would result in minor, adverse, and short-term impacts from runoff and negligible, adverse, and long-term impacts to underlying groundwater. A minor, long-term benefit on groundwater would be expected during the mothball period.

**Hazardous Materials:** A minor to moderate, long-term benefit on the level of site contamination would be expected during demolition, depending on the level of contamination that must be addressed. A minor, adverse, and short-term impact would result from increased use of hazardous materials during demolition. A minor, long-term benefit would occur from the reduced use of hazardous materials during the mothball period.

**Solid Waste:** Minor, adverse, and short-term impacts on the level of solid waste would occur during demolition due to disposal of the debris from demolished structures that could not be reused or recycled. A minor, long-term benefit due to reduced solid waste would be expected during the mothball period.

**Health and Safety:** Negligible, adverse, and short-term impacts on public safety and protection of children during demolition would be expected. Minor, adverse, and short-term impacts on occupational health during demolition may occur. Negligible, adverse, and long-term impacts on public safety could occur during the mothball period, primarily resulting from the possible reduced capability to observe PHOs.

**Noise:** Negligible, adverse, and short-term noise impacts from construction equipment and increased traffic would be expected during demolition. There would be no noise impacts during the mothball period.

**Socioeconomics:** Demolition activities would result in negligible, adverse, and short-term impacts on housing in the Municipality of Arecibo. There would be minor, short-term benefits on employment, income, and the economy during demolition. Impacts during the mothball period would include negligible, adverse, and long-term impacts on population and housing, and minor, adverse, long-term impacts on the economy, employment, and income. A moderate, adverse, and long-term impact would result from less regional educational activities. A major, adverse, and long-term impact would be expected from reduced STEM opportunities and tourism in Arecibo and the Commonwealth of Puerto Rico.

**Traffic and Transportation:** Minor, adverse, and short-term impacts on traffic and transportation would be expected during demolition. There would be a minor, adverse, and long-term impact from road damage during demolition activities. A minor, long-term benefit would be expected during the mothball period.

**Visual Resources:** Impacts on visual resources during demolition would be moderate, adverse, and short-term. Visual impacts during the mothball period would be minor, adverse, and long-term.

No adverse cumulative impacts on resources would occur under Alternative 3.

## **Alternative 4: Partial Demolition and Site Restoration**

**Biological Resources:** Under this Alternative, there would be moderate, adverse, and long-term impacts on vegetation as a result of demolition activities. Impacts on wildlife from demolition activities would be moderate, adverse, and short-term. There would be negligible, adverse, and short-term impacts on wetlands, the broad-winged hawk, Puerto Rican boa, listed plant species, and migratory birds during demolition. A minor, long-term benefit would occur on wildlife, listed species, and migratory birds from increased habitat after demolition.

**Cultural Resources:** Demolition would result in a major, adverse, and long-term impact on known historic properties that would be considered an adverse effect on historic properties under Section 106 of the NHPA. There would be no impacts on known historic properties after demolition and no impacts on archaeological resources would be expected during or after demolition.

**Geology and Soils:** Demolition impacts on geological features and soils would include minor, adverse, and short-term impacts on topography, minor, adverse, and long-term impacts on karst features and moderate, adverse, and long-term impacts on soils. There would be no impacts after demolition.

**Groundwater:** Demolition would result in minor, adverse, and short-term impacts from runoff and negligible, adverse, and short-term impacts on underlying groundwater. There would be a minor, long-term benefit due to a reduced lack of groundwater consumption after demolition.

**Hazardous Materials:** A minor to moderate, long-term benefit to the level of site contamination would be expected during demolition, depending on the level of contamination that must be addressed. A minor, adverse, and short-term impact would result from increased use of hazardous materials during demolition. A moderate, long-term benefit would occur from the reduced use of hazardous materials after demolition.

**Solid Waste:** Minor, adverse, and short-term impacts on the level of solid waste would occur during demolition due to disposal of the debris from demolished structures that could not be reused or recycled. There would be a minor, long-term benefit after demolition due to reduced solid waste generation.

**Health and Safety:** Negligible, adverse, and short-term impacts on the protection of children during demolition would be expected. Minor, adverse, and short-term impacts on occupational health and public safety during demolition may occur. Negligible, adverse, and long-term impacts on public safety could occur after demolition, primarily resulting from the possible reduced capability to observe PHOs.

**Noise:** Negligible, adverse, and short-term noise impacts from construction equipment and increased traffic would be expected during demolition. There would be no noise impacts after demolition.

**Socioeconomics:** Demolition activities would result in negligible, adverse, and short-term impacts on housing in the Municipality of Arecibo. There would be minor, short-term benefits on employment, income, and the economy during demolition. Impacts after demolition would include negligible, adverse, and long-term impacts on population, and housing, and minor, adverse, and long-term impacts on the economy, employment, and income. Major, adverse, and



long-term impacts would be expected from reduced regional education activities, STEM opportunities, and tourism in Arecibo and the Commonwealth of Puerto Rico.

**Traffic and Transportation:** Minor, adverse, and short-term impacts to traffic and transportation would be expected during demolition. There would be a moderate, adverse, and long-term impact on traffic and transportation from road damage during demolition activities. A moderate, long-term benefit would be expected from reduced traffic after demolition.

**Visual Resources:** Impacts on visual resources during demolition would be major, adverse, and short-term. No impacts would occur after demolition.

No adverse cumulative impacts on resources would occur under Alternative 4.

### **Alternative 5: Complete Demolition and Site Restoration**

**Biological Resources:** There would be major, adverse, and long-term impacts on the Puerto Rican boa and Puerto Rican broad-winged hawk from demolition. There would be moderate, adverse, and short-term impacts on wildlife and wetlands, as well as moderate, adverse, and long-term impacts on vegetation, from demolition. Minor, adverse, short-term impacts on listed plant species and other listed wildlife species would be expected from weeds. A minor, long-term benefit would occur to wildlife, listed species and migratory birds after demolition.

**Cultural Resources:** Demolition would result in a major, adverse, and long-term impact on known historic properties that would be considered an adverse effect to historic properties under Section 106 of the NHPA. There would be no impacts on known historic properties after demolition and no impacts on archaeological resources would be expected during or after demolition.

**Geology and Soils:** Demolition impacts on geological features and soils would include moderate, adverse, and short-term impacts on topography, karst features, and soils. There would be no impacts after demolition.

**Groundwater:** Demolition would result in minor, adverse, and short-term impacts from runoff and moderate, adverse, and long-term impacts on underlying groundwater. There would be a minor, long term benefit on groundwater after demolition.

**Hazardous Materials:** A minor to moderate, long-term benefit to the level of site contamination would be expected during demolition, depending on the level of contamination that must be addressed. A moderate, adverse, and short-term impact would result from increased use of hazardous materials during demolition. A moderate, long-term benefit on the level of site contamination would occur from the reduced use of hazardous materials after demolition.

**Solid Waste:** Minor, adverse, and short-term impacts on the level of solid waste would occur during demolition due to disposal of the debris from demolished structures that could not be reused or recycled. There would be a minor, long-term benefit after demolition due to reduced solid waste generation.

**Health and Safety:** Negligible, adverse, and short-term impacts on the protection of children during demolition would be expected. Minor, adverse, and short-term impacts on occupational health and public safety during demolition may occur. Negligible, adverse, and long-term impacts on public safety could occur after demolition, primarily resulting from the possible reduced capability to observe PHOs.

**Noise:** Moderate, adverse, and short-term noise impacts from construction equipment would be expected during demolition. Negligible, adverse, short-term noise impacts from demolition traffic would occur. There would be no noise impacts after demolition.

**Socioeconomics:** Demolition activities would result in negligible, adverse, and short-term impacts on housing in the Municipality of Arecibo. There would be minor, short-term benefits to employment, income, and the economy during demolition. Impacts after demolition would include negligible, adverse short- and long-term impacts on population, and housing; and minor, long-term, and adverse impacts on the economy, employment, and income. Major, adverse long-term impacts would be expected from reduced regional education activities, STEM opportunities, and tourism in Arecibo after demolition.

**Traffic and Transportation:** Minor, adverse, and short-term impacts on traffic and transportation would be expected during demolition. There would be a moderate, adverse, and long-term impact from road damage during demolition activities. A moderate, long-term benefit on local traffic would be expected from reduced traffic after demolition.

**Visual Resources:** Impacts on visual resources during demolition would be moderate, adverse, and short-term. No impacts on visual resources would occur after demolition.

Potential cumulative impacts could occur on biological resources under Alternative 5. These impacts involve potential cumulative effects on threatened and endangered species.

### **No-Action Alternative: Continued NSF Investment for Science-focused Operations**

Under the No-Action Alternative, current operations of Arecibo Observatory would continue. No demolition would occur and no change from current conditions would result. There would be no impacts on resources under the No-Action Alternative.

Under the No-Action Alternative, a Puerto Rican boa standard operating procedure for normal operations would be developed and implemented.

### ***ENVIRONMENTALLY PREFERABLE ALTERNATIVE***

The determination of the Environmentally Preferable Alternative is based on the analysis of environmental impacts presented in Section 4 of the FEIS and summarized under Environmental Impacts in this Record of Decision. Also considered were the net differences in impacts among the Alternatives after applying all mitigation and monitoring measures. Based on this analysis and a comparison between the net differences in impacts among all of the Alternatives, the No-Action Alternative would have the least potential for adverse impacts and is, therefore, the Environmentally Preferable Alternative. Because, however, the No-Action Alternative does not meet the purpose and need of the Proposed Action, NSF has completed a comparison of the net impacts anticipated from the five Action Alternatives. The net impacts associated with Action Alternative 1 would include no moderate adverse impacts and no major adverse impacts, other than major adverse and long-term impacts on cultural resources resulting from the potential demolition of any historic resources deemed necessary by a future collaborator(s) and from the potential transfer of the facility to a non-federal entity (in which the protections of the NHPA would be lost). However, the character of the use of the property would not change, resulting in less net adverse impacts on cultural resources than would occur under the other Action

Alternatives. Accordingly, NSF has determined that Alternative 1 is the Environmentally Preferable Action Alternative.

## **SECTION 106 COMPLIANCE**

NSF engaged parties interested in potentially affected historic properties in accordance with Section 106 of the NHPA (addressed in Sections 3.2 and 4.2 of the FEIS). NSF conducted an initial teleconference with the Puerto Rico State Historic Preservation Officer (SHPO) on May 19, 2016, to introduce the preliminary proposed Alternatives. A NOI, which included language announcing the commencement of the Section 106 consultation process, was published in the *Federal Register* on May 23, 2016, and a copy of the NOI was provided to the Puerto Rico SHPO via email during the week of May 23, 2016. On June 6, 2016, representatives of NSF met with the Puerto Rico SHPO to discuss the Proposed Action and the preliminary proposed Alternatives.

A formal Section 106 initiation letter and associated materials were submitted to the Puerto Rico SHPO on July 5, 2016, and included an invitation for representatives of the SHPO to attend a site visit at Arecibo Observatory, scheduled for July 19 and 20, 2016. On July 19, 2016, NSF forwarded its Section 106 initiation letter to the ACHP and inquired as to whether the ACHP wished to participate in NSF's Section 106 consultation process. On September 15, 2016, NSF conducted a follow-up teleconference with the Puerto Rico SHPO regarding the status of its Section 106 consultation process.

On October 6, 2016, NSF contacted the ACHP to request confirmation of the ACHP's decision not to participate in NSF's Section 106 process. This request was made because NSF had not heard from the ACHP regarding NSF's invitation to the ACHP to participate in its Section 106 process. On October 7, 2016, the ACHP responded to NSF stating that it would review the material provided by NSF.

In October 2016, NSF provided a copy of the *Proposed Changes to Arecibo Observatory Operations: Historic Properties Assessment of Effects* technical report to the Puerto Rico SHPO and Consulting Parties for review and comment. The document was discussed during an in-person meeting with the SHPO and in a Consulting Party meeting in Puerto Rico in November 2016.

On November 4, 2016, NSF sent an email to the ACHP following-up on NSF's invitation to the ACHP to participate in NSF's Section 106 process. In that email, NSF also notified the ACHP of the publication of the DEIS and provided a link to the document. Later that day, the ACHP informed NSF that it would review the DEIS and then send out a response to NSF's invitation to participate in its Section 106 process. The ACHP further indicated that, if NSF had not heard back from the ACHP within 15 days, NSF should move forward with its Section 106 process and assume that the ACHP will not likely want to participate. On December 15, 2016, NSF again emailed the ACHP to provide clarification about the Proposed Action and inquire as to whether the ACHP would like to participate in NSF's Section 106 process. The ACHP responded the same day with questions about whether NSF saw a need for the ACHP to participate. NSF responded saying that the process had been working well to date, although there are people who work at or live near Arecibo Observatory who are concerned about potential reduced operations or demolition of the facility. NSF also informed the ACHP that, after conversations with the Puerto Rico SHPO, it was determined that a Programmatic Agreement (PA) should be developed

to address potential adverse effects on historic properties. NSF further informed the ACHP that it would circulate any draft PA to the ACHP for input.

A teleconference occurred between NSF and the Puerto Rico SHPO on April 27, 2017, to discuss the preliminary draft PA. During that teleconference, the Puerto Rico SHPO requested that NSF reach out again to the ACHP and urge its participation in the consultation process. On April 28, 2017, NSF provided the ACHP with a formal invitation to participate in NSF's Section 106 consultation process and a preliminary draft PA for informal review and comment. The ACHP responded by email the same day, confirming receipt of the preliminary draft PA and notifying NSF of the staff person from the ACHP who would be handling further coordination for the proposed undertaking. During a teleconference held on May 5, 2017, the ACHP agreed to participate in the Section 106 consultation process. A follow up call was conducted with the ACHP and the Puerto Rico SHPO on June 1, 2017. A draft of the PA was provided to the Puerto Rico SHPO, the ACHP, and the Consulting Parties on June 23, 2017, for review and comment (during a 31-day public review and comment period), and NSF held a meeting in Arecibo, Puerto Rico on July 6, 2017 to discuss the draft PA. A second consultation meeting was held telephonically on July 13, 2017, to discuss the draft PA. After the review and comment period ended (on July 24, 2017), NSF reviewed and considered all written and oral comments received during the comment period, including all comments made during the July 6<sup>th</sup> and July 13<sup>th</sup>, 2017 consultation meetings. Following additional input by the ACHP in mid-August, 2017, NSF prepared a revised draft PA. The revised draft PA was submitted to the Puerto Rico SHPO, the ACHP, and the Consulting Parties, and made available to the public, on August 17, 2017. No comments on the revised draft PA were received as of September 6, 2017.<sup>3</sup> A follow-up teleconference call had been scheduled for September 5, 2017 but was cancelled due to emergency weather related issues associated with Hurricane Irma, which struck Puerto Rico on September 6, 2017. Shortly after Hurricane Irma, Hurricane Maria, on September 20, 2017, made landfall on Puerto Rico resulting in catastrophic damage, including the loss of electrical power and telecommunications. Because, as of October 11, 2017, 80% of the island did not have access to consistent and reliable communications, NSF was unable to communicate with the Consulting Parties located in Puerto Rico and, therefore, NSF consulted with the ACHP to determine next steps for finalizing the PA. In accordance with an October 6, 2017 notification from the ACHP to Federal Preservation Officers regarding post-hurricane Section 106 consultations and related matters, the ACHP concluded and communicated to NSF that it would facilitate finalization of the PA. NSF and the ACHP, with input from the Puerto Rico SHPO, finalized the PA and provided it to the Puerto Rico SHPO and the ACHP for signature. NSF also reached out to the Consulting Parties to invite them to sign the PA as Concurring Parties, if available. To demonstrate the awareness and acceptance of the terms of the PA, NSF also asked the Director of Arecibo Observatory, Francisco Córdova, who oversees the operations and the administration of Arecibo Observatory and who actively participated in NSF's Section 106 consultation process, to sign the PA as an Invited Signatory. The PA was fully executed by the Signatories on November 15, 2017, and filed with the ACHP; the final execution of the Signatories constitutes NSF's completion of its compliance obligations with the NHPA.

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<sup>3</sup> Drafts of the PA were provided in both English and Spanish, and translation services were used at the November 2016 Section 106 meeting, and available upon request at the July 6, 2017 and July 13, 2017 meetings.

## **ENDANGERED SPECIES ACT COMPLIANCE**

In May 2016, NSF began its informal consultation with the U. S. Fish and Wildlife Service (USFWS) via a telephone call identifying the general project and discussing preliminary options for alternatives. On June 17, 2016, NSF submitted a data request to USFWS regarding the project area. On June 24, 2016, USFWS responded to the data request and also requested a site visit, which was conducted on July 20, 2016. The site visit included a walk-through of the undeveloped areas on the Observatory property and a discussion of potential impacts to listed species from the potential demolition of the large concrete infrastructure (towers and towers anchors). The endangered Puerto Rican boa and the endangered fern *Tectaria estremarana* were known to occur at Arecibo Observatory and, during the site visit, USFWS confirmed the use of Arecibo Observatory grounds by the endangered Puerto Rican broad-winged hawk.

During the discussions at the site visit, USFWS recommended that NSF adopt procedures for working in areas of Arecibo Observatory where the Puerto Rican boa may occur that would be consistent with those developed and implemented by the U.S. Army at Fort Buchanan. USFWS provided the Fort Buchanan boa procedures and NSF's environmental services contractor worked with NSF to develop protocols to ensure that neither routine operations nor demolition activities would result in an inadvertent take of a Puerto Rico boa.

Additional teleconferences were held on September 27, 2016, and October 18, 2016, to discuss surveys for listed plant species, Endangered Species Act Section 7 compliance, potential mitigation activities that could be implemented to reduce the potential for a take of a listed species, and to set the date of the meeting at the USFWS office in Boquerón for November 16, 2016. On October 20, 2016, USFWS requested information on property ownership, the size of the property, the ultimate disposition of the property if the Observatory were closed, and the responsible party for ensuring that any mitigation would be implemented. USFWS also requested that the Puerto Rico Department of Natural and Environmental Resources (DNER) be invited to the November 16, 2016 meeting. NSF responded with the requested information and agreed to invite the DNER to the November 16 meeting.

On November 18, 2016, a meeting was held with USFWS, DNER, and NSF at the USFWS office in Boquerón. Attendees discussed vegetation surveys planned for December 2016, potential direct, indirect, and cumulative impacts of the Alternatives on listed species, and potential avoidance and other mitigation measures. It also was decided that informal consultation could adequately address Alternatives 1, 2, and 3, regardless of which of those Alternatives were selected. Formal consultation was likely to be needed if Alternative 4 were selected, and formal consultation would be required if Alternative 5 were selected.

On November 22, 2016, NSF informed USFWS and DNER that the vegetation surveys would be delayed until January 2017, because of a conflict with operation of the 305-meter-diameter radio telescope. On December 14, 2016, NSF confirmed the dates of January 9 through 11, 2017, for the vegetation survey with USFWS and DNER. On December 16, 2016, USFWS confirmed it would attend the surveys on January 10, 2017. On December 21, 2016, NSF informed USFWS of potential issues with using a global positioning system receiver to record locations beneath the 305-meter-diameter dish and offered an alternate mapping method should signal interference be encountered. USFW agreed with the proposed approach.

On January 13, 2017, USFWS emailed NSF with an update on the vegetation survey and requested information on the areas around the buildings/structures that were analyzed for

demolition. NSF confirmed receipt of this email on January 18, 2017. On February 17, 2017, NSF provided USFWS with the preliminary results of the vegetation surveys, confirming there were no listed plants in areas with suitable habitat where demolition could occur. NSF noted the vegetation survey report would be sent to USFWS. On February 23, 2017, NSF requested a teleconference with USFWS to discuss moving forward based on the findings of the vegetation survey and March 3, 2017, was set as the date for the teleconference.

On March 3, 2017, NSF, USFWS, and DNER discussed NSF's ESA consultation and the NEPA analysis for the proposed NSF action. No impacts on listed plant species were anticipated based on the expected areas of disturbance, the lack of plant species in areas with potentially suitable habitat, and the lack of suitability for listed plant species in developed and maintained areas. The expected areas of disturbance would be provided to any collaborator(s) under Alternatives 1 or 2. If a collaborator(s) were selected and additional areas, including additional or widened roads, would be needed for continued science-focused (Alternative 1) or educational-focused (Alternative 2) operations, NSF agreed that it would engage in additional consultation with USFWS and complete any additional surveys deemed necessary. During consultations with USFWS and DNER, NSF also clarified that some vegetation would be removed under all Alternatives. NSF also indicated that implementation of either Alternative 1 or Alternative 2 might include a transfer of the land. Under these two Alternatives, if a land transfer were included, the land transfer would be assessed during a separate consultation that would address the appropriate conservation measures.

There was a discussion of potential impacts on the Puerto Rican broad-winged hawk, including the potential for overlapping territories on the Observatory site. NSF provided a copy of the BO issued for construction of Puerto Rico Highway 10, which included conservation measures for the hawk. It was agreed that the approach should be to minimize the impacts on individuals, determine the number of nests, and then mitigate any impacts. This would include protection of the species during breeding season and, as a last resort, perform compensatory mitigation for the habitat lost. NSF committed to performing potentially impactful work outside of the breeding period for the Puerto Rican broad-winged hawk. DNER requested that the Puerto Rican Boa Protocol be updated to include DNER points of contact and NSF agreed. DNER reiterated that, prior to using explosives (i.e., under Alternative 5), the area within 100 feet (30 meters) of the detonation site should be inspected for the presence of boas and birds and the detonation would need to be delayed until no animals were present. NSF agreed with this approach.

During the same meeting, NSF conveyed to USFWS that a BA would be submitted to USFWS to request informal consultation for all Alternatives. In addition, NSF agreed that, if Alternative 5 were ultimately selected, NSF would conduct hawk surveys and additional formal consultation with USFWS, with implementation of appropriate mitigation, prior to any demolition activities.

On May 4, 2017, NSF submitted its BA and a request for consultation to USFWS. NSF also conveyed this information via email. USFWS responded, acknowledging receipt of the email and stating that the BA would be assigned for review upon receipt of the hard copy request.

On May 22, 2017, NSF informed USFWS that NSF may entertain land transfer as an option under Alternatives 1 and 2, but that any potential transfer would remain speculative. As such, NSF would commit to additional consultation with the USFWS prior to a transfer, consistent with language in the BA and did not expect that the BA would need to be modified. USFWS

responded, identifying the assigned reviewers of the BA and indicating they would review the document to determine whether any modifications would be required.

USFWS concurred with the findings of the NSF BA in a letter dated June 23, 2017 (FEIS Appendix 4.1-A). USFWS agreed that the measures proposed by NSF to avoid and minimize impacts to species were appropriate and noted that additional consultation would be required if Alternative 5 were selected. In the letter, USFWS indicated that additional consultation would be required if land transfer would occur under the selected alternative.

### **III. IMPACT OF HURRICANES IRMA AND MARIA**

On September 6, 2017, Hurricane Irma struck Puerto Rico causing a loss of electrical power and other damage. On September 20, 2017, while still recovering from Hurricane Irma, Puerto Rico and Arecibo Observatory, suffered a direct hit by Hurricane Maria, a Category 4 hurricane. The Commonwealth suffered devastating damage to almost all of its infrastructure. Communications were impossible in the first several days after the Hurricane. When communications were reestablished, NSF learned that the Observatory, though receiving some damage, escaped significant damage. In particular, the damage to structures in the historic district is repairable, and, as a result, NSF determined that no additional NEPA analysis would be needed. If feasible, either through supplemental appropriations for hurricane relief or through normal appropriated funds, NSF intends to fund the repairs of Arecibo Observatory to its pre-hurricane condition.

### **IV. NSF'S SOLICITATION REQUESTING PROPOSALS TO MANAGE AND OPERATE ARECIBO OBSERVATORY WITH REDUCED NSF FUNDING**

On January 25, 2017, NSF released a solicitation requesting proposals to manage and operate Arecibo Observatory. The solicitation specified a reduced level of NSF funding and the inclusion of voluntary committed cost sharing. If a proposer intended to maintain the current operations (at a level of approximately \$12 million per year, including the current NASA funding of \$3.6 million/year), the proposer was required to present a plan to supplement NSF funding with external support. The solicitation was also designed to allow potential collaborators the freedom to propose highly creative approaches to the management and operations of Arecibo Observatory. The broad latitude given in the solicitation enabled potential collaborators to respond with proposals that could support either Alternative 1 (Collaboration with interested parties for science-focused operations) or Alternative 2 (Collaboration with interested parties for education-focused operations). The response to the solicitation was critical to determining the viability of implementing Alternative 1, NSF's Preferred Alternative. NSF ultimately received responses that primarily took the approach of emphasizing the science-focused operations, while retaining significant education components as well. Accordingly, at this juncture, it appears as though implementation of Alternative 1 is viable.

### **V. DECISION**

NSF has determined that it must change operations at Arecibo Observatory in light of funding constraints. The scientific community's recommendations to reduce NSF's contributions to operations at Arecibo Observatory, and to ensure a balanced portfolio for both the AST and AGS

Divisions, led to NSF's determination that changes to operations at Arecibo Observatory at a reduced funding level were necessary.

In its March 2016 report, the AAAC noted: "the NSF/AST division continues to make progress in responding to the PRC recommendations...[by] partnering of some facilities while limiting the negative impact on the scientific community." Moreover, in their March 2017 report, the AAAC noted: "it is recognized by the Portfolio Review Committee, NSF/AST, and the AAAC that complete removal of funding from a facility/telescope might remove productive and sometimes unique assets from being available for astronomical research. For this reason, the preferred divestment alternative being pursued by the NSF has involved forming partnerships that enable valuable observing capabilities (the combination of telescope and instrumentation) to be used for astronomical research. This approach could and should reduce costs to NSF/AST without as severe an impact (on research) as closure."

Confronted with funding constraints, NSF pursued a path forward to address ways in which a change in operations could be accomplished, coupled with a full understanding of the environmental consequences that would result from implementation of the Action Alternatives and No-Action Alternative. This path forward also included consideration of associated demolition activities that could, potentially, be needed. The completion of this path, culminating in this decision, has taken place over several years. Engagement with the scientific community to seek alternative ways to continue operations at Arecibo Observatory has occurred for the past two years. NSF conducted a feasibility study to help inform the scope of necessary environmental reviews for any operational changes. The feasibility study was followed by an extensive 16-month environmental review process with significant public involvement. Substantial public outreach efforts were made through a wide variety of modalities, and several public meetings and comment periods were held throughout NSF's process. All public comments NSF received during this process were considered and factored into this decision. During this environmental review process, and consistent with the recommendations from the scientific community, NSF identified Alternative 1 as the Preferred Alternative, rather than closure of the Observatory. Of the six Alternatives analyzed in the FEIS (Science-focused, Education-focused, Mothballing, Closure with Partial Demolition, Closure with Full Demolition, and the No-Action Alternative), NSF now issues its decision selecting Alternative 1. This Alternative, which is also the environmentally-preferable Action Alternative (see Section II), was selected after considering the viability of the proposals received in response to NSF's solicitation to operate and manage Arecibo Observatory (see Section IV). In addition, this decision is further supported by the following factors:

- Arecibo Observatory generates significant contributions to science.
- The astronomical and aeronomy communities have indicated their desire to continue operations at Arecibo Observatory, despite lower funding levels, rather than close it completely.
- Continuation of operations at Arecibo Observatory will allow the important science-based educational programs to continue; these programs were identified during the public comment periods as being of very high value to the people of Puerto Rico.
- Arecibo Observatory is an important cultural icon to the Puerto Rican people, and is listed on the National Register of Historic Places for its scientific and engineering merit.



NSF also acknowledges that continuing operations of Arecibo Observatory will support NASA's congressional mandate to discover, characterize, and catalog potentially hazardous near-Earth objects.

Although identified as the environmentally-preferable Action Alternative, Alternative 1, as explained above and more thoroughly set forth in the FEIS, could result in several adverse impacts on various resources. To reduce those impacts, which largely stem from any demolition activities deemed necessary by a collaborator(s), NSF has committed to implement mitigation measures. The following is a list of those mitigation measures:

#### **Air Quality**

- Contracts for any demolition work will require idle reduction and proper equipment maintenance to reduce emissions during demolition.

#### **Biological Resources**

- The expected areas of disturbance that were analyzed to determine potential impacts to protected species will be provided to prospective bidders that propose to provide demolition services. If a bidder indicates that additional areas, including additional or widened roads, will be needed to complete work, NSF will delay the award until additional consultations with USFWS, including additional surveys, have been completed.
- Worksites will be clearly marked and workers will be instructed to stay within the marked areas.
- Staging areas will be placed in disturbed areas whenever possible.
- If offsite soil is needed to backfill an excavated area, the minimum amount of soil needed will be brought onto the site.
- Landscaped areas will be maintained to avoid the propagation of weed species.
- As appropriate, soil used for planting will be augmented with nutrients, organic matter, or bulking agents to provide an appropriate medium for root establishment and subsequent growth of the species selected for planting.
- Re-landscaping will use non-invasive species and will incorporate native vegetation, if feasible.
- If offsite soil is needed to backfill an excavated area, the minimum amount of soil needed will be brought onto the site.
- A site-specific stormwater pollution prevention plan (SWPPP) will be developed to support the National Pollutant Discharge Elimination System stormwater permit.
- Erosion control measures such as riprap, check-dams, and compost filter berms will be used to protect exposed soil and minimize erosion, scouring, and sedimentation. Good housekeeping measures will be practiced during demolition and the disturbed areas will be revegetated. Steep slopes that are disturbed will be protected with biodegradable erosion control measures. Pre-demolition runoff patterns will be restored upon completion of demolition activities.

- Standard operating procedures for the capture and relocation of Puerto Rican boas (FEIS Appendix 4.1-A) will be used during demolition and/or site restoration activities will be implemented as follows:
  - Key onsite personnel will be trained in the identification of boas and the value of boas and boa conservation by qualified personnel.
  - Daily pre-work surveys of equipment and work areas, including buildings/structures and karst features, will be completed by qualified personnel trained in boa identification and location.
  - Any Puerto Rico boas found on equipment or within the day’s work area will be relocated to the designated relocation area south of the staging yard on the eastern side of Arecibo Observatory; this should be done by an individual authorized by the USFWS and trained in handling Puerto Rican boas.
  - If a Puerto Rico boa is observed in the day’s work area, work will be stopped until a qualified wildlife biologist trained in handling Puerto Rican boas can relocate the snake to the designated relocation area or the Puerto Rico boa voluntarily vacates the work area.
- While it is unknown at this time whether Arecibo Observatory will be transferred out of federal control, should Arecibo Observatory property be transferred out of federal control in the future, NSF will consult with USFWS, as appropriate, to meet Section 7 consultation requirements and to determine whether any mitigation measures are necessary.
- A pre-demolition survey for active bird nests will be conducted. Any identified active nests will be protected from disturbance by a 100-foot nesting buffer, which will remain in place until the young have fledged from the nest.

### **Cultural Resources**

- Stipulations specified in the Section 106 PA (see Attachment A) will be implemented, subject to available appropriations and funding priorities. These stipulations, which were reached through consultation with the Puerto Rico SHPO, the ACHP, and the Consulting Parties, as well as input from the public, were developed to address adverse effects to historic properties. These stipulations also provide the necessary mitigation to address major impacts to cultural resources under NEPA.
- An unanticipated discovery plan will be developed prior to any demolition activities under Alternative 1 being carried out.

### **Geology and Soils**

- Construction stormwater controls will be implemented and maintained to prevent scour and soil loss from runoff.
- Before any demolition begins, a geophysical survey will be conducted to inspect designated work areas and note any suspected karst features, including sinkholes, solution cavities, and areas of soil subsidence that could be affected by demolition work. The survey will also evaluate soil stability and the vertical and horizontal projection of sinkholes. These features will be avoided when possible and protected with sandbags, nets, and filter fabric. They will be monitored during the work for changes such as soil subsidence, collapse, water infiltration, and clogging.

- A site-specific SWPPP will be prepared and implemented prior to starting any demolition activities.
- Disturbed areas, if any, will be stabilized and revegetated with native plant species to minimize the potential for erosion after any demolition is completed. Native species will, to the extent possible, be used for any necessary revegetation; if the use of non-native species is necessary, only non-invasive species will be planted.
- Earth-disturbing activities, if any, will be conducted in a manner that minimizes alteration of the existing grade and the hydrology of existing surficial karst features.
- Previously unknown karst features that are identified during any invasive work activities, including blasting and removal of foundations, anchors, towers, and below-grade structures, will be addressed as follows:
  - Work will stop within a 100-foot radius of the feature and the feature will be assessed to identify its potential to impact other karst features such as groundwater conduits, surface water conduits, and caves. The assessment method could include visual assessment, geophysical survey, or other techniques for subsurface characterization of karst features.
  - The karst feature will be either isolated or temporarily sealed to minimize impacts during demolition work (e.g., blocked with sandbags, protected with baskets, nets, or filter fabric).

## **Groundwater**

- A site-specific SWPPP will be prepared and implemented prior to starting any demolition activities.
- Construction stormwater controls will be implemented and maintained to prevent scour and soil loss from runoff anticipated to result from any demolition activities.
- Disturbed areas, if any, will be stabilized and revegetated to minimize the potential for erosion after any demolition is completed. Any necessary revegetation will use native species to the extent possible; if non-native species are needed, only non-invasive species will be planted.
- Before any demolition begins, a geophysical survey will be conducted to inspect designated work areas and note any suspected karst features, including sinkholes, solution cavities, and areas of soil subsidence that could be affected by demolition work. The survey will also evaluate soil stability and the vertical and horizontal projection of sinkholes. These features will be avoided when possible and protected with sandbags, nets, and filter fabric. They will be monitored during the work for changes, such as soil subsidence, collapse, water infiltration, and clogging.
- A spill prevention, control, and countermeasures (SPCC) plan will be developed to address risks to groundwater from potential spills. The SPCC plan will include equipment inspections, equipment refueling, equipment servicing and maintenance, equipment washing, and the use and storage of any hazardous materials, chemicals, fuels, lubricating oils, and other petroleum products.
- Any earth-disturbing activities will be conducted in a manner that minimizes alteration of the existing grade and the hydrology of existing surficial karst features.

- Previously unknown karst features that are identified during any invasive work activities, including blasting and removal of foundations, anchors, towers, and below-grade structures, will be addressed as follows:
  - Work will stop within a 100-foot radius of the feature and the feature will be assessed to identify its potential to impact other karst features such as groundwater conduits, surface water conduits, and caves. The assessment method could include visual assessment, geophysical survey, or other techniques for subsurface characterization of karst features.
  - The karst feature will be either isolated or temporarily sealed to minimize impacts during demolition work (e.g., blocked with sandbags, protected with baskets, nets, or filter fabric).

### **Hazardous Materials**

- Complete site characterization and removal or remediation of contamination will be completed prior to any demolition activities.
- Hazardous materials and wastes will be used, stored, disposed of, and transported during any demolition activities in compliance with all applicable laws and regulations.
- Demolition contractors will create and implement a spill response plan.
- NSF will require all demolition contractors to create and implement a demolition management plan, including hazardous materials discovery protocols. The demolition management plan will include, at a minimum, a list of persons to contact in case of a possible encounter with undocumented contamination; provisions for immediate notification of the observation to demolition management; and notification of the regulatory agency with jurisdiction. If previously unknown contamination is found, demolition will halt in the vicinity of the find and the next steps will be decided in consultation with the regulatory agency.

### **Solid Waste**

- Whenever possible, any demolition debris (such as soil) will be used onsite.
- Demolition debris, if any, will be diverted from landfills through reuse and recycling to the extent practicable.

### **Health and Safety**

- Any demolition contractor will develop and implement a demolition Health and Safety Plan.
- Arecibo Observatory personnel will comply with OSHA safety protocols.
- Fencing and signage will be installed around any demolition sites.

### **Noise**

- Demolition areas, if any, will be fenced to keep personnel as far away as possible from heavy equipment.

### **Traffic and Transportation**

- Transport of materials and demolition vehicles will occur during off-peak hours when practicable.

- Delivery truck personnel and demolition workers will be notified of all potential height restrictions and overhead obstructions.
- Vehicles used for material transport will be required to comply with local standards for height, width, and length of vehicles, when practicable. If at any time vehicles of excessive size and weight are required on local roads and bridges, NSF will coordinate with the appropriate transportation authority to obtain the necessary permits.
- NSF will coordinate with the appropriate transportation authority to determine the appropriate mitigation measures to implement in response to road damage.
- Further detailed waste haul routes and concerns will be addressed during the detailed design phase of the Proposed Action, including verification that all bridge crossings on the delivery routes have adequate strength and capacity.
- To minimize the impacts of any demolition on local residents, the demolition contractor will coordinate with local public schools to ensure demolition and haul routes do not adversely affect school bus traffic.

Perhaps the most significant major, adverse impact that the change in operations, under Action Alternative 1, at Arecibo Observatory could have is the impact on historic properties associated with the historic use of the Observatory. Although mitigation measures will be implemented to avoid impacts, the potential for major adverse impacts – if demolition is requested by a future collaborator(s) for continued operations – remains. Therefore, and in compliance with Section 106 of the NHPA, the PA was developed and implementation of it is designed to address those impacts. (See Attachment A)

NSF prepared a BA to assess the potential impacts to listed species with the potential to occur on or adjacent to Arecibo Observatory. The BA was submitted to USFWS as part of the informal consultation for the Proposed Action. USFWS concurred with the findings of the BA and the proposed mitigation measures identified above, in a letter dated June 23, 2017 (FEIS Appendix 4.1-A).

A member of the public submitted a concern to the USFWS Migratory Bird Lead for Puerto Rico after the FEIS was issued, indicating that NSF's use of a web-based report on wildlife was not sufficient. NSF considered this issue, and concluded that, because it used the web-based report as a starting point then coordinated directly with USFWS on the analysis of potential impacts to migratory birds during the development of the EIS, no change to the analysis is needed.

### **Alternatives Not Selected**

The No-Action Alternative was not selected because it would not meet the purpose and need for the action, which is to substantially reduce NSF's contribution to the funding of Arecibo Observatory. Under the No-Action Alternative, the level of funding provided by NSF would remain unchanged.

Alternative 2 was not selected because no proposals for educational operations were received in response to NSF's solicitation and, therefore, this Action Alternative was determined not to be viable. Moreover, while the general environmental impacts and costs associated with implementation of Alternative 2 would be comparable to Alternative 1, the impacts to cultural resources would be greater than under Alternative 1. The reason for this is because Arecibo Observatory would no longer be used to conduct scientific research, which is one of the two

main reasons why buildings/structures within Arecibo Observatory are deemed historically significant. Also, the ultimate outcome of Alternative 2 would be less in line with the mission and goals of NSF because Alternative 2 would not continue the scientific research currently conducted at Arecibo Observatory.

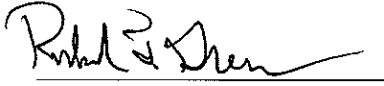
Alternative 3 was not selected because, while the general environmental impacts and costs associated with implementation of Alternative 3 would be comparable to Alternative 1, the impacts to cultural resources would be greater than under Alternative 1. This is because Arecibo Observatory would no longer be used for the purpose that forms the basis for its historical significance. In addition, Alternative 3 would remove the scientific and educational opportunities supportable under Alternative 1, and these opportunities are, according to the public comments received, very important to both the scientists and the Puerto Rican people.

Alternative 4 was not selected because the environmental impacts, public concerns, and costs associated with implementation of Alternative 4 would be greater than that for Alternative 1. Also, Alternative 4 would not allow scientific research to continue at Arecibo Observatory.

Alternative 5 was not selected for multiple reasons. The environmental impacts associated with demolition of the towers and cable anchors would be greater than any of the other Alternatives. The cost to implement Alternative 5 would be much greater than any other considered Alternative. Alternative 5 also would result in demolition of the iconic 305-meter radio telescope dish, which is one of the main reasons why Arecibo Observatory is an historically significant facility on the National Register of Historic Places. Also, Alternative 5 would not allow the continuance of scientific research or educational programs, both of which are, according to public comments received, very important to the scientists and Puerto Rican people.

It is important to note that Alternative 1 could be implemented in a manner in which NSF would retain ownership of Arecibo Observatory, or in which NSF would transfer its ownership interest to a non-federal entity. If such a transfer were to take place, consultation with the USFWS would resume to address concerns associated with the property being owned and managed by a non-federal entity, including the consequences associated with the inapplicability of Section 7 consultation under the ESA to non-federal actions conducted at the site. Similarly, a non-federal entity would not be required to comply with Section 106 of the NHPA, leaving significant historic properties without the protections afforded by that statute. For this reason, the transfer scenario is specifically addressed in the PA.

At its November 9, 2017 National Science Board meeting, after reviewing the scientific merit and other considerations related to Alternative 1: Collaboration with Interested Parties for Continued Science-focused Operations, the National Science Board authorized the Director (or her designee) to approve the selection of Alternative 1, contingent upon NSF's completion of its compliance with the NHPA (which subsequently occurred on November 15, 2017). We have considered the scientific merit of Arecibo Observatory, the budgetary constraints faced by NSF, and the environmental consequences and their associated mitigation measures. After thorough consideration of the entire administrative record, we conclude that Alternative 1: Collaboration with Interested Parties for Continued Science-focused Operations represents an opportunity to continue operations at an important and historically significant astronomical facility that provides useful and innovative science and educational activities, with reduced NSF funding contributions. Accordingly, we hereby approve the selection of Alternative 1 as the path forward for the future of Arecibo Observatory.



11/15/17

Date

Dr. Richard F. Green  
Division of Astronomical Sciences  
National Science Foundation



11/15/17

Date

Dr. Paul Shepson  
Division of Atmospheric & Geospace Sciences  
National Science Foundation

ATTACHMENT A  
Programmatic Agreement Among the  
National Science Foundation, the Advisory  
Council on Historic Preservation, and the  
Puerto Rico State Historic Preservation  
Officer Regarding Potential Changes to  
Arecibo Observatory Operations in the  
Vicinity of Arecibo, Puerto Rico

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