

Planning a Partnership Model for a Giant Segmented Mirror Telescope

PROGRAM SOLICITATION NSF 12-526



National Science Foundation

Directorate for Mathematical & Physical Sciences
Division of Astronomical Sciences

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

April 16, 2012

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the NSF *Proposal and Award Policies and Procedures Guide* (PAPPG), [NSF 11-1](#), was issued on October 1, 2010 and is effective for proposals submitted on or after January 18, 2011. Please be advised that the guidelines contained in [NSF 11-1](#) apply to proposals submitted in response to this funding opportunity.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPPG Guide Part I: Grant Proposal Guide (PAPPG) [Chapter II.C.2.g\(xi\)](#) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: <https://www.nsf.gov/bfa/dias/policy/dmp.jsp>. See [Chapter II.C.2.j](#) of the PAPPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See [Chapter II.C.2.j](#) of the PAPPG for further information about the implementation of this requirement.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 11-1](#)), which is effective for proposals submitted, or due, on or after January 30, 2011.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Planning a Partnership Model for a Giant Segmented Mirror Telescope

Synopsis of Program:

Two major survey reports carried out by the National Academy of Sciences have identified the need for a Giant Segmented Mirror Telescope (GSMT) to address frontier astrophysical research questions in a wide array of subfields. This solicitation invites proposals to establish an initial framework for a U.S. community partnership in a proposed GSMT deriving from past, current, or potential future NSF support for design work, construction, instrumentation, and/or operations. Based on a detailed competitive review of the resulting proposals, an award will be made for further development of a public/private/international partnership model under a cooperative agreement between a GSMT project and NSF. During the award period, GSMT project management and representatives from NSF and the U.S. astronomical community are expected to refine the roles of NSF and the community in project development, engage in planning science and engineering operations, prepare for potential future Federal funding

opportunities after the start of the next decade. Selection as an awardee in this process does not imply that a GSMT will be approved for further funding.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Vernon L. Pankonin, W9164, telephone: (703) 292-4902, email: vpankoni@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.049 --- Mathematical and Physical Sciences

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1

Anticipated Funding Amount: \$1,250,000

An award will be made in the form of a cooperative agreement for a period of five years beginning in FY2012, pending availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 1

Limit on Number of Proposals per PI or Co-PI: 1

An individual may be the Principal Investigator (PI) or Co-Principal Investigator (co-PI) for only one proposal.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
 - Full Proposals submitted via FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

Not Applicable

- **Other Budgetary Limitations:**

Not Applicable

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

April 16, 2012

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

Since the 1960s, the National Academy of Sciences has sponsored six detailed studies of the state of the astronomical research field and has issued priority science objectives for the subsequent decade. The last two reviews, released in 2001 and 2010, have identified the construction of a Giant Segmented Mirror Telescope (GSMT) as a priority for the astronomical community. In the latest report, titled *New Worlds, New Horizons in Astronomy and Astrophysics* (hereafter NWNH), a GSMT was described as part of "a program that will set the astronomy and astrophysics community firmly on the path to answering some of the most profound questions about the

cosmos." and was judged to be "vital to U.S. competitiveness in ground-based optical astronomy over the next two decades." The report also stressed that a GSMT would complement other facilities planned for completion in the next several years, such as the James Webb Space Telescope, the Large Synoptic Survey Telescope (LSST), and the Atacama Large Millimeter/submillimeter Array. Finally, the report ranked a GSMT as third in priority among large-scale, ground-based projects, behind LSST and the augmentation of a mid-scale innovations program, and recommended that NSF explore "a federal investment to provide access for the entire U.S. astronomy and astrophysics community" in a GSMT project. The full report is available at http://sites.nationalacademies.org/bpa/BPA_049810.

In light of this recommendation and others in the NWNH report, the Division of Astronomical Sciences has been working with existing U.S.-based GSMT projects to implement a process that could lead to significant opportunities in research, education, and instrumentation for the U.S. community under a public/private/international partnership. The purpose of the current solicitation, in response to Congressional direction, is to review proposed partnership models, conceptual designs, cost estimates, construction and financing timelines, risks and mitigation, and the value added by a Federal investment in a GSMT project. Please note that selection as an awardee in this process does not imply that a GSMT will be approved for further funding, and that NSF does not currently intend to provide design, construction, or operations funding for a GSMT project at least until the higher priority recommendations from the NWNH report are implemented.

II. PROGRAM DESCRIPTION

For the purposes of this solicitation, a GSMT is defined as a ground-based telescope with a primary mirror collecting area 300 square meters or larger, with instrumentation permitting astrophysical research at optical/infrared wavelengths, planned for a location within or outside the United States, and involving any technology for achieving a large collecting area through combining smaller mirror segments.

This solicitation advances consideration of GSMT development in two ways: (1) proposals received in response to this solicitation will be independently evaluated for scientific impact including possible transformative research, opportunities for international cooperation, and anticipated impact on diversity and public outreach/engagement; (2) activities to be funded under a cooperative agreement will define mechanisms for community input in the definition of telescope operations and access to data, prepare the GSMT project for possible Federal involvement in construction and operations, or support other activities deemed necessary for successful completion of a GSMT.

It is recognized that the groups most likely to respond to this solicitation consist of consortia of universities, research organizations, private foundations, and organizations representing the interests of other nations, and that these groups have already invested considerable effort in the design of a GSMT and in the definition of administrative, budget, and management procedures. Proposals submitted in response to this solicitation do not need to demonstrate a high level of maturity in all areas, but in the context of establishing a baseline programmatic plan should select a level of presentation sufficient for evaluating the scientific capabilities and technical feasibility of a GSMT, provide an assessment of the current state of design, and define an initial funding and operations model that would leverage any potential Federal investments into research opportunities for the U.S. astronomical community. Proposals should describe the value added to a GSMT project by possible Federal investment, for example in levels of telescope performance or operations capabilities, and should describe the scientific, programmatic, and technological advantages of a public/private/international partnership in a GSMT.

The guiding principle governing the review process for the proposals submitted in response to this solicitation is to select a specific plan with the greatest potential for development of a world-leading GSMT that includes significant cutting-edge research and technology development opportunities for the wider U.S. astronomical community. Proposals will be reviewed by a panel of experts in the relevant astronomical fields of research, in project management, in the assessment of cost estimates and risk analysis, and in other areas deemed necessary for evaluation of the proposals. Reverse site visits, non-panel expert reviews, and NSF internal reviews may also be conducted, as appropriate.

III. AWARD INFORMATION

An award will be as a cooperative agreement for a duration of five years, beginning October 1, 2012, with anticipated NSF funding of:

FY 2012 \$250,000
FY 2013 \$250,000
FY 2014 \$250,000
FY 2015 \$250,000
FY 2016 \$250,000

Estimated program budget, anticipated number of awards, and award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 1

Limit on Number of Proposals per PI or Co-PI: 1

An individual may be the Principal Investigator (PI) or Co-Principal Investigator (co-PI) for only one proposal.

Additional Eligibility Info:

In collaborative proposals involving multiple organizations, a single organization must submit the proposal as the lead organization, and accept overall management responsibility. Collaborative proposals submitted as separate submissions from multiple organizations are not allowed and will be returned without review. For collaborative proposals that involve collaborators affiliated with state governments or national laboratories, such organizations may be included as subawardees but may not serve as lead or non-lead collaborative organizations. [Chapter II, Section D.4](#) of the NSF Proposal & Award Policies & Procedures Guide provides additional information on collaborative proposals. For cooperative projects involving U.S. and foreign organizations, support will only be provided for the U.S. portion.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Proposal & Award Policies & Procedures Guide (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

Only organizations listed as eligible in Section IV "Organization Limit" above are eligible to apply as lead or non-lead organizations.

Due to the complexity of the proposals being submitted, use of FastLane to prepare and submit proposals is strongly encouraged.

This program solicitation contains deviations from the standard NSF Proposal & Award Policies & Procedures Guide (PAPPG) or NSF Grants.gov Application Guide proposal preparation guidelines. The only deviations are in the specific information requested in the project description and in the additional review criteria, as listed below.

Proposers are reminded to review procedures under "Proprietary or Privileged Information" in [Chapter 1, Section D.3](#) of the PAPPG and to mark only such information, including patentable ideas, trade secrets, privileged or confidential commercial or financial information, disclosure of which might harm the proposer, with the appropriate legend such as, "The following is (proprietary or confidential) information that (name of proposing organization) requests not be released to persons outside the Government, except for purposes of review and evaluation." Please also see the section entitled "Privacy Act and Public Burden Statements" below.

Biographical Sketches: In the project description, provide a list of senior investigators (faculty level or equivalent), key engineering and technical personnel, higher level project management staff, and consultants, providing their full names, institutional (and departmental,

where relevant) affiliations, and roles and/or titles within the project. Include a biographical sketch for each of these participants, listing up to ten publications or other professional accomplishments most pertinent to this proposal and listing significant collaborators during the past 48 months. The format of the biographical sketches must conform to the requirements presented in the [Section II.C.2.f](#) of the NSF Proposal & Award Policies & Procedures Guide (PAPPG).

Project Description: This forms the core of the proposal. It is limited to 250 pages. The Project Description should include the following sections in the order listed, and numbered as shown here:

I. A plan for supported activities during the anticipated award period. This should include a schedule for each activity, budget, personnel needs (including scientific and technical personnel, any necessary consultants or contractors, etc.), project software and other tools, and other relevant information. These activities may include, but are not limited to, any of the following items:

- Support for project staff whose duties will advance the concept of a GSMT as a Federal user facility, such as defining specifications for a data archiving and access service, ensuring compliance with regulations for Federal construction projects, etc.
- Participant support for conferences, working groups, or other means by which U.S. community members can provide input about the scientific capabilities, modes of operation, and data access for a GSMT.
- Support for activities that will establish scientific or technical partnerships between the U.S. community and international partners in a GSMT.

II. Description of the GSMT Project and Proposed Partnership

A. Science Goals for a GSMT and their Realization in the Telescope Design

1. A description of the principal site-independent science goals for the project and how these flow down to the design of functional elements of a GSMT, including the telescope, enclosure, adaptive optics, initial instrumentation suite, and any other critical elements. This section should also discuss any design tradeoffs between the science goals and other factors such as cost, risk, schedule, or previous experience with technologies currently used in existing telescopes.
2. A description of site selection efforts, including the processes and the results of testing to determine the suitability of potential sites for a GSMT, scientific, logistical, or budgetary factors that are involved in site selection, a status update of completed environmental evaluations, a summary of known or anticipated issues associated with preferred and alternate sites including permitting requirements, a history of relations with local governments and communities, and plans to comply with applicable laws and regulations concerning historical preservation, environmental and cultural impact assessment, export control, or other required elements for a facility constructed in part with Federal funding, to identify related cost and schedule drivers.
3. A description of the construction project for the telescope, enclosure, and ancillary facilities such as shops, operations and maintenance areas, including cost estimates derived internally and from any non-advocate cost reviews, a construction schedule, and staffing requirements during construction. The description should be based on information developed in a Work Breakdown Structure or any other format that allows a thorough review of the construction of a GSMT. The description should include, as far as these are determined at the time of proposal submission, the bases for cost estimates for each major item in the construction project, the role and scope of systems engineering activity such as risk planning and risk reduction during pre-construction planning, the evaluation of enabling technologies, the identification of rate-limiting items, the methodology for cost- and/or risk-based contingency estimates, coupling between elements in a risk register and contingency estimates, plans to handle contingency through the lifetime of the project, cost control mechanisms, and any other relevant project elements.
4. A description of adaptive optics system(s) and various instruments in the initial suite of instruments proposed for inclusion in the project within five years of commissioning, including their scientific capability, timeline, and as much cost information as is presently available. This section should include, as appropriate, a description of the contributions of or design limits on the various elements in the optical train to the focal-plane image characteristics, and whether components of the adaptive optics or instrumentation require new technology or are rate-limiting items in the telescope construction timeline. Plans for the instrumentation are not expected to be presented at the same level of detail as that of the GSMT infrastructure, although detailed design and cost/contingency estimates may be submitted if available.

B. Proposed NSF Partnership, Administrative, and Financing Structures

1. A conceptual baseline schedule for, and desired amounts of, contributions from NSF that will yield a public share of at least 10% of the telescope time annually, including any previous Federal funding, funds awarded from this solicitation, anticipated Federal contributions toward construction, instrumentation, data archiving capabilities, or other items prior to commissioning, and partial funding for operations during the first 20 years of operation. In the event that such a share is not available, the proposal must explain the factors limiting the level of NSF participation and outline a funding plan that will achieve a specifically designated public share. In combination with item B.2 (below), in which the coupling between financial contributions and shares of telescope time is to be developed in more detail, the schedule and associated description must demonstrate a realistic understanding of the necessary steps in achieving NSF funding from Research and Related Activities (R&RA) and Major Research Equipment and Facilities Construction (MREFC) funds, with the constraint that significant funding from either source is not likely to be available until after the start of the next decade, based on the NWNH ranking of GSMT projects. This section of the proposal must describe the risks to the project and risk mitigation strategy if during the project the construction or operations costs significantly exceed planned amounts (including contingency), or if desired funding from NSF or project partners is delayed, significantly less than anticipated, or ultimately unavailable. In particular the description must clearly identify financial, schedule, programmatic, and other risks should construction begin before the desired NSF funds are awarded, especially if a Federal partnership poses requirements for environmental and cultural impact assessment, competitive bidding of subcontracts, the payment of prevailing wages, legal or regulatory limits on international activities, or other factors. Plans to comply with these and other applicable Federal requirements, including adherence to U.S. export control laws and regulations, should be discussed throughout the proposal where appropriate; it is expected that these plans will be developed more fully during the anticipated award period. Here and in other discussions of risk mitigation, the proposal is expected to describe delay, descope, redesign, or project termination paths and what would trigger them; the proposal may also describe future entry points for NSF participation, if any, in the event that the project is not selected for a planning partnership with NSF at the current time.

2. A description of the governance structure of the project, a preliminary description of how NSF and designated community representatives will be involved in project governance, and the nature and current status of financial commitments by current and anticipated member organizations (e.g., committed or allocated, planned for future fundraising campaigns, requiring awards from domestic or foreign governments or funding agencies, etc.), along with a projected schedule for fulfillment of future commitments. The proposal must describe procedures for entry or withdrawal of partners from the project, and any contingencies, dependencies, or requirements for participation or the delivery of funding by the various partners such as the dates for commencement or completion of construction, the timeline and level of any NSF funding, foreign governmental/funding agency actions, or other factors. The proposal must describe the mechanisms for valuation of in-kind contributions to the project and the methodology for assignment of telescope time based on the total amount and date of contributions or any other factors, if these are defined at the time of proposal submission; shares designated for local researchers in the hosting telescope site nation/institution(s) should also be described. Furthermore, the project description must also outline how allocations of telescope time would be adjusted or eliminated should NSF or other partners be unable to contribute funding at levels desired, agreed upon, or pledged, or if significant delays arise in the fulfillment of financial commitments. In the discussion of financial risk mitigation, the proposal must also outline any plans to adjust partner contributions and/or to modify the project scope or schedule if there are major cost overruns during construction or if operations costs significantly exceed current estimates. Please note that all quantifiable financial information must be included only in the project description, and this information must be affirmed via letters of collaboration from current project partners (these letters are to be submitted as supplemental documents).

C. Construction and Operations Plan

1. A management and organization plan for construction, commissioning, and operations, including specification of key departments of the GSMT project, staffing levels, and the nature of the proposed management entity. The proposal should also describe which activities will be handled by the management entity itself and which will be the responsibilities of the various project partners.
2. A transition plan from construction to operations, including costs and staffing requirements for commissioning the facility and continuing development of instrumentation, adaptive optics, or data archiving/access after construction.
3. An operations plan that includes a description of planned ongoing activities such as visitor support, testing and commissioning of instrumentation, mirror resurfacing, the maintenance of data archives, projected utilities costs, and any other factors that determine the cost of operations. The proposal should include an estimated cost profile for 20 years of operations, how these costs compare to those of any facilities currently operated by partners in the project, a plan for how the GSMT will be managed during operations, and how the operations cost plan will be matured and updated during the pre-construction and construction phases of the project. The description should also outline plans to assure the health and safety of users, staff, and visitors to the telescope.
4. A description of the anticipated lifetime of the project, including known permitting, financial, or other factors that determine the project lifetime, along with known or anticipated costs for decommissioning or other disposal of the facility. Please note that should the Federal government choose to become a minority partner, there should be no expectation that the Federal government will assume any liability for decommissioning or disposal of the facility.
5. Qualifications of management, design, and engineering teams and experience relevant for the successful completion of a GSMT.

D. Education and Outreach Plan, Impact on the Community

1. A description of the anticipated scientific impact of the facility on the U.S. community, including the identification of potentially transformative areas of research, unique scientific, research, and educational capabilities of the facility, potential synergies or complementarities with existing and planned ground- or space-based telescopes operating at any wavelength (as derived from cited publicly available information), the potential for interdisciplinary research, and anticipated contributions to the development of astronomical technologies that might be used in future telescope projects.
2. Plans for rigorously measured and evaluated education, outreach, and diversity programs, together with developing partnerships, both within the U.S. and internationally, and the potential impact of the GSMT on education, outreach, workforce development, or other broader impact activities at partner institutions.

E. Any other elements or considerations, identified by the proposing teams and not specifically listed above, that are necessary to realize a successful GSMT.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

April 16, 2012

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <http://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

NSF expects to make no more than one award to support the further development of the partnership model that provides the maximum return to the U.S. community in terms of telescope access and scientific impact. In formulating whether to recommend that an award be made, reviewers will evaluate each proposal against the following criteria, in addition to the standard NSF review criteria of Intellectual Merit and Broader Impacts:

1. The potential for Federal investment in a GSMT project to increase the scientific capabilities of a GSMT and to provide important research and collaborative opportunities for the wider U.S. astronomical community.
2. Viability of a public/private/international partnership model for a GSMT as demonstrated by responses to the GSMT-specific

- items described in section V.A. (*Proposal Preparation Instructions*), above.
3. Commitment to, and breadth and quality of the plans for, leveraging an investment in a GSMT for education, diversity, and public outreach benefits.
 4. The value of the expected scientific, technical, and educational return to the broader U.S. astrophysical community from a potential Federal investment in a GSMT, both absolutely and in relation to the return to other members of the proposed partnership.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review, Internal NSF Review, or Reverse Site Review.

The proposals submitted in response to this solicitation will be competitively peer-reviewed by a panel of experts selected to provide experienced judgment in all of the areas described in the review criteria listed above. The review process may also involve ad hoc expert reviews, a reverse site visit, and/or any other review mechanism that becomes necessary to effect a well-justified basis upon which to select a project for further development of a public/private/international GSMT partnership model.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papppg.

Special Award Conditions:

The award(s) associated with this solicitation will be a Cooperative Agreement, not a standard grant or a contract. Award Specific Financial/Administrative and Programmatic Terms and Conditions will be negotiated at time of award by the NSF Program Official and the Grants and Agreements Official.

Standard cooperative agreement terms and conditions, including supplements for managers of FFRDCs and Large Facilities, are available at https://www.nsf.gov/awards/managing/co-op_conditions.jsp?org=NSF.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Reporting Requirements: Additional reporting requirements will be negotiated at time of award.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Vernon L. Pankonin, W9164, telephone: (703) 292-4902, email: vpankoni@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at <http://www.grants.gov>.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**
 - Send an e-mail to: nsfpubs@nsf.gov
 - or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, *NSF-50*, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and *NSF-51*, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel

