Mid-Scale Innovations Program in Astronomical Sciences (MSIP)

PROGRAM SOLICITATION
NSF 15-580

REPLACES DOCUMENT(S):
NSF 13-567

National Science Foundation

Directorate for Mathematical & Physical Sciences
Division of Astronomical Sciences

Preliminary Proposal Due Date(s) *(required)* (due by 5 p.m. proposer's local time):

September 16, 2015

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

February 22, 2016

IMPORTANT INFORMATION AND REVISION NOTES

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 16-1), which is effective for proposals submitted, or due, on or after January 25, 2016.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Mid-Scale Innovations Program (MSIP)

Synopsis of Program:

A vigorous Mid-Scale Innovations Program (MSIP) was recommended by the 2010 Astronomy and Astrophysics Decadal Survey, citing "many highly promising projects for achieving diverse and timely science." As described in this solicitation, the Division of Astronomical Sciences has established a mid-scale program to support a variety of astronomical activities within a cost range up to $30M. This program will be formally divided into four subcategories: 1) limited term, self-contained science projects; 2) longer term mid-scale facilities; 3) development investments for future mid-scale and large-scale projects; and 4) community open access capabilities. The MSIP will emphasize both strong scientific merit and a well-developed plan for student training and involvement of a diverse workforce in instrumentation, facility development, or data management.

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.

- Richard E. Barvainis,1045 S, telephone: (703) 292-4891, email: rbarvai@nsf.gov

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

- 47.049 --- Mathematical and Physical Sciences

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant or Cooperative Agreement

Estimated Number of Awards: 2 to 4

Anticipated Funding Amount: $4,000,000 to $30,000,000

Minimum budget for full program duration is $4,000,000, with the exception of open access capabilities proposals for which there is no lower limit (see Program Description). Given anticipated program budgets, no more than one proposal (and possibly none) in the upper half of the funding range will be awarded in this cycle.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds and receipt of quality proposals.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 3

A single organization may submit a maximum of three preliminary proposals as the lead institution. Full proposals are to be submitted only when invited by NSF, and no more than two invitations will be issued to a single organization. There is no limit to participation as a partner institution.

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

Any one individual may be the Principal Investigator (PI) or co-Principal Investigator (co-PI) for no more than one preliminary or full proposal.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - 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: http://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

- **Preliminary Proposal Due Date(s) *(required)*** (due by 5 p.m. proposer's local time):

  September 16, 2015

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

  February 22, 2016

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:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

The Division of Astronomical Sciences (AST) funds diverse activities ranging from three-year individual investigator grants to large-scale, multi-user facilities costing hundreds of millions of dollars. Competed programs exist to fund projects with budgets below $4M (the upper limit for MRI) and above $135M (the lower limit of MREFC for the Mathematical and Physical Sciences Directorate). The range in between has not had a formal competed program, and submitted proposals with budgets in the mid-scale category have been handled in the past on an ad-hoc basis. The need for a well-defined mid-scale funding program at NSF has been recognized by various boards and committees, including the most recent astronomy and astrophysics decadal survey *New Worlds, New Horizons in Astronomy and Astrophysics* (NWNH). Citing 29 submitted white papers describing astronomical projects that could be classified as mid-scale instruments and facilities, NWNH recommended, as its second highest priority ground-based initiative, the establishment of a competed line called the Mid-Scale Innovations Program. This solicitation is a direct response to that recommendation, continuing an organized program begun in 2014 to compete, select, and fund an array of project types within the mid-scale cost range.

II. PROGRAM DESCRIPTION

The Mid-Scale Innovations Program (MSIP) is designed to fill the need for a well-defined budgetary and competitive selection process to support astronomical projects of intermediate to large cost (but below the MREFC threshold). This solicitation fills part of the mid-scale gap, from $4M to $30M. (The current, limited budget does not allow individual project costs greater than $30M.) The demand in this funding range covers a wide variety of activities, from highly focused short-term science experiments to long-term multi-use facilities. Other opportunities for support include major new instruments for existing telescopes, laboratory astrophysics experiments, and design and development programs for possible future mid-scale and MREFC initiatives. The makeup of MSIP includes "Open Access Capabilities" (Category 4 below), an addition to the decadal survey definition that was recommended by the 2012 MPS/AST Portfolio Review because of realized budgets for the Division of Astronomical Sciences that are far below those envisioned by the decadal survey.

In order to organize this diverse range of project type and cost for strategic evaluation and review, the MSIP will be divided into the following four categories:

1. **Mid-Scale Science Projects:** Self-contained, limited term projects with well-defined construction and science utilization phases.
2. **Mid-Scale Facilities:** Construction or operation of stand-alone, long-term, mid-scale facilities.
3. **Development Investments:** Design and development for future large mid-scale and large-scale facilities.
4. **Open Access Capabilities:**
   a. New instruments for existing telescopes, both national and private, in return for US community access.
   b. Provision of observing time for US community access on existing telescopes (e.g. providing open access nights in return for partial support of operational costs of a facility).
   c. Data archiving and data management projects leading to public access to data resources.

The budgets for each of the four categories will be flexible, and distribution across categories will depend on proposal pressure modulated by consideration of programmatic emphasis. It is anticipated that solicitations will be issued on a biennial basis pending the availability of funds. However, funding of higher cost proposals that are near the upper end of the funding range may result in a longer interval between solicitations.

Mid-scale projects are recognized as ideal incubators for the next generation of leaders in astronomical technology and creators of cutting edge new capabilities. Solving the most pressing problems of the day -- such as those called out in recent decadal surveys -- using new technologies, techniques, and concepts is encouraged in this competition. As such, MSIP categories 1-3 will focus on *innovative*, potentially transformative, research programs that include a strong component of student training in instrumentation and facility development. For proposals in category 4, the science justification must demonstrate the uniqueness of the proposed capability relative to what is currently available to the general US astronomical community. Student training in instrumentation will not be appropriate for some proposals in Category 4 and will not be required. The lower limit of $4M on proposal budgets will be waived for category 4. Given that open access differs somewhat in character from the other categories, a separate panel for Category 4 proposals may be held during the pre-proposal phase provided a sufficient number of proposals in that area are received.

Investigators whose preliminary proposals are for open access capabilities similar to those currently available to the community will not be invited to submit full proposals.

All proposals must show the project's value and benefit to the US community. Examples of benefit include, but are not limited to, open-access observing time on the facility, access to data products and software, and cooperation and sharing of technology with other projects.

Strong project management will be emphasized in proposal evaluation, particularly for more costly or complex programs. Applicants are strongly encouraged to account for all foreseeable costs in the project budget, including adequate plans for risk mitigation.

Proposals formerly directed toward the now-discontinued URO (University Radio Observatories), TSIP (Telescope System Instrumentation Program), and ReSTAR (Renewing Small Telescopes for Astronomical Research) programs must now be submitted to the MSIP.

All proposers to MSIP will be required to suggest which of the four categories is most appropriate for their projects. There will be no segregation of projects via waveband.

Prior to final selection, some projects may be evaluated via a Cost, Schedule, and Management Review, generally involving a reverse site visit with specialist reviewers, as a prerequisite to the allocation of funds. If the project design is determined to be insufficiently advanced, a separate detailed design and costing phase, including an NSF-organized Preliminary Design Review, may also be required.

In the Facilities, Equipment and Other Resources section of the proposal, proposers should include an aggregated description of the internal and external resources that the organization and its collaborators will provide to the project, should it be funded. Supporting materials, such as environmental impact studies and decommissioning plans, should be included as supplementary documents. See Section V.A for additional information.

Proposals will be funded for no more than five years, and existing projects must recompete within the MSIP against all other submitted proposals, with no competitive advantage.

Important elements of the program include standard merit review and selection criteria with special attention to scientific merit, student training, relevance to community-established strategic goals and roadmaps, project management, and planning for both operations and data archive funding.

Anticipated timeline for this MSIP competition (*Revised*):

Solicitation issued mid-June 2015

Preliminary proposals due September 16, 2015

Invitations issued and declines informed, December 15, 2015

Invited full proposals due February 22, 2016

Reverse Site Visits and Cost, Schedule, and Management reviews, May - June 2016

Declines informed and recommended awards announced, July 2016

Development of cooperative agreements, where appropriate, August 2016

Anticipated start date of awards, September 1, 2016

III. AWARD INFORMATION

Anticipated Type of Award: Continuing Grant or Cooperative Agreement or Standard Grant

Estimated Number of Awards: 2 to 4

Anticipated Funding Amount: $4,000,000 to $30,000,000 pending availability of funds

Minimum budget for full program duration is $4,000,000, with the exception of open access capabilities proposals for which there is no lower limit (see Program Description). Given anticipated program budgets, no more than one proposal (and possibly none) in the upper half of the funding range will be awarded in this cycle.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds and receipt of quality proposals.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 3

A single organization may submit a maximum of three preliminary proposals as the lead institution. Full proposals are to be submitted only when invited by NSF, and no more than two invitations will be issued to a single organization. There is no limit to participation as a partner institution.

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

Any one individual may be the Principal Investigator (PI) or co-Principal Investigator (co-PI) for no more than one preliminary or full proposal.

Additional Eligibility Info:

All organizations as specified in Chapter 1, Section E of the GPG are eligible to propose, including (but not limited to) US National Observatories and Centers, with the following exceptions. Organizations affiliated with ALMA and Gemini observatories are ineligible to apply for instrumentation for those observatories, since they have instrument development funding through their international agreements. Unaffiliated organizations, such as university groups, may propose visitor instruments for Gemini, but not for ALMA.

In order to guarantee a review of complex mid-scale projects that is sufficiently informative to guide the decision-making process and be free of conflicts, the NSF will accept full proposals for MSIP funding by invitation only, based on the results of the preliminary proposal evaluation. While more than one institution may participate in a proposal, a single institution must accept overall management responsibility for the project. The proposal must be submitted by one institution, with funding provided to any other institutions through subawards; use of the separately submitted collaborative proposal method is not permitted.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals *(required)*: Preliminary proposals are required and must be submitted via the NSF FastLane system, even if full proposals will be submitted via Grants.gov.

Separately submitted collaborative proposals will not be accepted; partner institutions must be funded via subawards.

Preliminary Proposal Contents

The preliminary proposal should consist of the following elements:

1. Cover Sheet. For planning purposes, September 1, 2016 should be shown as the start date. Be sure to check the block indicating that a preliminary proposal is being submitted, and identify the program solicitation number in the program announcement/solicitation block.
2. Project Summary. (1 page maximum) Required elements include an overview of the proposed program, and separate entries addressing the intellectual merit and broader impacts. The summary should be written in the third person, informative to those working in the same or related field(s), and understandable to a scientifically or technically literate reader.
3. Table of Contents. A Table of Contents is automatically generated for the proposal by the FastLane system. The proposer cannot edit this form.
4. Project Description (8-pages maximum), including the following:
    - A statement of which of the four categories of MSIP is most appropriate for this proposal as the first sentence (see section II. Program Description).
    - A scientific justification. For Open Access Capabilities, explain the uniqueness and lack of general availability of the capability.
    - A description of the broader impacts, including student training.
    - A description of benefits to the community (observing time, data products, etc.)
    - An outline of the project management plan (where appropriate).
    - Note: Results from Prior NSF Support should not be included. Links to URLs may not be used.
5. References Cited (2-page limit). See NSF GPG instructions.
6. Biographical Sketches (2 pages each; long collaborator lists may continue on a 3rd page). Biographical Sketches are required for the PI and all co-PIs, and additional senior personnel at all participating institutions. See GPG for details.
7. Budget and Budget Justification, including budgets for any subawards.
8. Facilities, Equipment, and Other Resources: In order for NSF, and its reviewers, to assess the scope of a proposed project, all organizational resources necessary for, and available to a project, must be described in this section of the proposal (see GPG Chapter II.C.2.i for further information). Proposers should describe only those resources that are directly applicable. Proposers should include a description of the internal and external resources (both physical and personnel) that the organization and its collaborators will provide to the project, should it be funded. Such information must be provided in this section, in lieu of other parts of the proposal (e.g., budget justification, project description).
9. Supplementary Documents: (to be entered in the Supplementary Documents section of FastLane). 1) A list of the major

team members, their affiliations, and their role in the project; 2) A list of Partner Institutions to be funded via subawards, and the role of each in the project.

No other items or appendices are to be included. Information pertaining to "Results from Prior NSF Support", "Current and Pending Support", "Data Management Plan", and "Postdoctoral Mentoring Plan" is not required for preliminary proposals and should not be included. Preliminary proposals containing items other than those required above will be returned without review.

Optional Information to be submitted to NSF via the FastLane Single Copy Documents Section

List of suggested reviewers or reviewers not to include (with a brief explanation or justification for why the reviewer should be excluded); Proprietary or privileged information (if applicable).

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 Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG 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: (http://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.

See Chapter II.C.2 of the GPG for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions.

Full proposals will be accepted only if invited by NSF. Due to the complexity of the proposals being submitted, use of FastLane to prepare and submit invited full proposals is strongly encouraged. **Separately submitted collaborative proposals will not be accepted**; partner institutions must be funded via subawards. When preparing a full proposal for this competition, proposers are advised to review the Program Description and the Proposal Review Information found in this solicitation for general information pertinent to this program.

The full proposal should provide much more detail than the preliminary proposal and include a detailed project management plan where appropriate. Descriptions should be clear and concise. Every effort should be made to update information that was provided in the preliminary proposal and to fully address issues raised in the preliminary proposal review. Full proposals should be comparable in cost and scope to that which was presented in the preliminary proposal (i.e., the cost and scope of work may be fine-tuned relative to the preliminary proposal, but should not be substantially different).

The following instructions supplement the guidance in the GPG or NSF Grants.gov Application Guide:

1. Cover Sheet. For planning purposes, September 1, 2016 should be shown as the start date.
2. Project Description (page limit will be the standard 15 pages or longer, depending on the project category, and will be specified in the invitation letter), including the following:
    - A statement of which of the four categories of MSIP is most appropriate for this proposal as the first sentence (see section II. Program Description).
    - Achievements under prior NSF support.
    - A scientific justification. For Open Access Capabilities, explain the uniqueness and lack of general availability of the capability.
    - A full discussion of the broader impacts, including student training.
    - A description of benefits to the community (observing time, data products, etc.)
    - A full discussion of the project management plan (where appropriate).
3. Budget and Budget Justification, including budgets for any subawards. If the budget includes contingency, that contingency should cover the "known unknowns" and be used to mitigate identified cost or schedule risks. The estimated risk-adjusted project cost, which is the sum of the performance baseline and the budget contingency. See Sections 4.2.5 and 5.2 of NSF's Large Facilities Manual for guidance. For those invited to submit full proposals, more details will be specified in their letter of invitation. In the event of an award that totals $10 million or more, NSF will require the Awardee to develop budget estimates and associated risk estimates that are "bottom up" assessments that consider every element of the entire project.
4. Supplementary Documents: 1) A list of the Major Team Members, their affiliations, and their role in the project; 2) A list of Partner Institutions to be funded via subawards, and the role of each in the project; 3) Letters of Collaboration from each unfunded collaborator; 4) Supporting materials, such as environmental impact studies and decommissioning plans, if applicable.

Optional Information to be submitted to NSF via the FastLane Single Copy Documents Section

List of suggested reviewers or reviewers not to include (with a brief explanation or justification for why the reviewer should be excluded); Proprietary or privileged information (if applicable).

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Preliminary Proposal Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time):

  September 16, 2015

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

  February 22, 2016

None

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 the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://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. (GPG 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 GPG 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

1. All proposals must show the project's value and benefit to the US astronomical community. Examples of benefit include, but are not limited to, open-access observing time on the facility, access to data products and software, and cooperation and sharing of technology with other projects.
2. Proposals to Category 4, Open Access Capabilities, must clearly demonstrate the uniqueness of the capability and its need by the US community. Proposals for capabilities similar to those currently available to the broad community will not be invited for a full proposal. Category 4 proposals must also include a plan to provide adequate support to outside users for obtaining and reducing data from the facility.
3. Except for those in Category 4 with no instrumentation, proposals must include, and will be evaluated on, a substantial component of student training and involvement of a diverse workforce in instrumentation, facility development, or data

management/analysis.

4. A project management plan appropriate to the scope and complexity of the project is required and will be carefully evaluated as part of the proposal review. Some projects, such as open access to telescopes, will need only a minimal or no project management plan, whereas construction projects will require a clear description of the project management methods and resources to be applied. Additional specificity on the level of project management expected will be provided in the invitation letter for full proposals.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by

Ad hoc Review and/or Panel Review, Reverse Site Review, or Cost, Schedule, & Management Review.

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 http://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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

NSF may require in-person meetings, site visits, and periodic reviews depending on project scope. The award instruments will depend on project scope and complexity, and may consist of standard awards, continuing awards, or cooperative agreements.

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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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:

- Richard E. Barvainis, 1045 S, telephone: (703) 292-4891, email: rbarvai@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 provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 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:** 4201 Wilson Blvd. Arlington, VA 22230
- **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
National Science Foundation
Arlington, VA 22230