# Earth Sciences: Instrumentation and Facilities (EAR/IF)

## PROGRAM SOLICITATION
## NSF 16-609

## REPLACES DOCUMENT(S):
## NSF 15-516

**National Science Foundation**

Directorate for Geosciences
Division of Earth Sciences

**Full Proposal Deadline(s):**

Proposals Accepted Anytime

## IMPORTANT INFORMATION AND REVISION NOTES

This solicitation supercedes NSF 15-516. Changes from the previous Earth Sciences Instrumentation and Facilities solicitation include:

1. The maximum allowable request for proposals for ***Acquisition or Upgrade of Research Equipment*** and ***Development of New Instrumentation, Techniques or Software*** has been changed to $500,000.
2. An opportunity previously titled ***Support of National or Regional Multi-User Facilities*** has been renamed ***Community Facility Support***
3. The ***Support for Early Career Investigators*** opportunity has been discontinued.
4. Organization eligibility has been restricted to some institutional types.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG).

## SUMMARY OF PROGRAM REQUIREMENTS

### General Information

**Program Title:**

Earth Sciences (EAR/IF)
Instrumentation and Facilities

**Synopsis of Program:**

The Instrumentation and Facilities Program in the Division of Earth Sciences (EAR/IF) supports meritorious requests for infrastructure that promote research and education in areas supported by the Division (see https://www.nsf.gov/div/index.jsp?div=EAR). EAR/IF will consider proposals for:

1. ***Acquisition or Upgrade of Research Equipment*** that will advance laboratory and field investigations and student research training opportunities in the Earth sciences. The maximum request is $500,000. The maximum request for upgrade of research group computing facilities remains $75,000.
2. ***Development of New Instrumentation, Techniques or Software*** that will extend current research and research training capabilities in the Earth sciences. The maximum request is $500,000.
3. ***Community Facility Support*** to make complex and expensive instruments, systems of instruments or services broadly available to the Earth science research and student communities. There are no maximum request limitations but potential proposers of new Community Facilities must contact cognizant Program Officers before submission.
   *Planned research uses of requested instruments, software, and facilities must include basic research on Earth processes SUPPORTED BY CORE PROGRAMS OR SPECIAL PROGRAMS OF THE DIVISION OF EARTH SCIENCES (see https://www.nsf.gov/div/index.jsp?div=EAR for a current list of programs funded by the Division of Earth Sciences).*

   Support is available through grants or cooperative agreements awarded in response to investigator-initiated proposals.

Human resource development and education are expected to be an integral part of all proposals submitted to EAR/IF.

Efforts to support participation of underrepresented groups in laboratory and/or field instrument use and training are encouraged. Proposals from early career (tenure track but untenured) lead investigators are also encouraged. Such proposals will be given due consideration as part of the Broader Impacts merit review criterion.

All proposers to EAR/IF are encouraged to consider ***Support of Outreach and/or Broadening Participation Activities.*** Proposals submitted to the EAR/IF Program may request up to $20,000 for such activities (please refer to Sections V.A Proposal Preparation Instructions and V.B Budgetary Information). Proposals for ***Community Facility Support*** are excluded from the $20,000 maximum for outreach and broadening participation activities.

Proposals requesting equipment, infrastructure or personnel that will also serve disciplines outside the Earth sciences may be jointly reviewed with other programs within the Foundation. EAR/IF will consider co-funding of projects with other NSF programs and other agencies. Potential applications who consider joint review a possibility for their proposal are encouraged to contact the relevant program officer to discuss this possibility.

**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.*

- Russell C. Kelz, E 8459, telephone: (703) 292-4747, email: rkelz@nsf.gov
- David D. Lambert, E 8461, telephone: (703) 292-8558, fax: (703) 292-9023, email: dlambert@nsf.gov

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

- 47.050 --- Geosciences

## Award Information

**Anticipated Type of Award:**

Standard Grant or Continuing Grant or Cooperative Agreement

**Estimated Number of Awards: 30 to 50**

**Anticipated Funding Amount: $6,000,000**

for new awards annually, pending availability of funds

## Eligibility Information

**Who May Submit Proposals:**

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- 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.

**Who May Serve as PI:**

There are no restrictions or limits.

**Limit on Number of Proposals per Organization:**

There are no restrictions or limits.

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

There are no restrictions or limits.

## 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_summm.jsp?ods_key=pappg.
  - Full Proposals submitted via Research.gov: 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_summm.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_summm.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):**

  Proposals Accepted Anytime

## 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:**

Standard NSF award conditions apply.

**Reporting Requirements:**

Standard NSF reporting requirements apply.

## TABLE OF CONTENTS


Summary of Program Requirements

I. Introduction

II. Program Description

III. Award Information

IV. Eligibility Information

V. Proposal Preparation and Submission Instructions
  A. Proposal Preparation Instructions
  B. Budgetary Information
  C. Due Dates
  D. FastLane/Grants.gov Requirements

VI. **NSF Proposal Processing and Review Procedures**
A. Merit Review Principles and Criteria
B. Review and Selection Process

VII. **Award Administration Information**
A. Notification of the Award
B. Award Conditions
C. Reporting Requirements

VIII. **Agency Contacts**

IX. **Other Information**

## I. INTRODUCTION

The Division of Earth Sciences supports meritorious proposals for research focused on improving the understanding of the structure, composition, and evolution of the Earth, the life it has supported through geological time, and the processes that govern the formation and behavior of the Earth's materials. The results of this research advance understanding of the Earth's changing environments, and the natural distribution of its mineral, water, biota, and energy resources and provide methods for predicting and mitigating the effects of geologic hazards such as earthquakes, volcanic eruptions, floods and landslides.

Earth science is the study of the Earth's structure, properties, processes, and four and a half billion years of its abiotic and ultimately, biotic evolution. Understanding these phenomena is essential to maintenance of life on the planet. The expanding world population demands more resources; faces increasing losses from natural hazards; and releases more pollutants to the air, water, and land. Sustaining our existence requires scientific understanding of the natural materials and processes linking the geosphere, hydrosphere, atmosphere, and biosphere. Life prospers or fails at the surface of the Earth where these environments intersect.

NSF organizational taxonomy may differ from other common terminology describing disciplinary boundaries which are rapidly evolving as science continues to become more interdisciplinary. The NSF Division of Earth Sciences (EAR) is one of four divisions within the Directorate for Geosciences, along with the divisions of Atmospheric and Geospatial Sciences (AGS), Ocean Sciences (OCE) and Polar Programs (PLR). Thus NSF's use of the term "Earth sciences" includes studies which address 'Earth's solid surface, crust, mantle, and core, including interactions between the solid Earth, atmosphere, hydrosphere and biosphere' (NRC, 2012, *New Research Opportunities in the Earth Sciences*, National Academy Press, Washington, DC, 117 pp.).

Detailed descriptions of core and special research programs within the Division of Earth Sciences are available in the latest program information and funding opportunities at: https://www.nsf.gov/div/index.jsp?org=EAR

The Instrumentation and Facilities Program in the Division of Earth Sciences (EAR/IF) supports meritorious proposals for infrastructure that promotes research and education in the areas currently supported by the Division. Three major funding areas are considered:

1. ***Acquisition or Upgrade of Research Equipment;***
2. ***Development of New Instrumentation, Techniques or Software;***
3. ***Community Facility Support.***

In all proposals, a central goal should be to advance research and research training in the Earth sciences.

Investigators interested in a recent history of EAR/IF awards and in learning more about national or regional multi-user facilities supported by the program are encouraged to make use the NSF award search engine (https://www.nsf.gov/awardsearch/advancedSearch.jsp) by entering Element Code 1580 and/or to browse the EAR/IF homepage at: https://www.nsf.gov/geo/ear/if/facil.jsp

## II. PROGRAM DESCRIPTION

The Instrumentation and Facilities Program in the Division of Earth Sciences (EAR/IF) supports meritorious requests for infrastructure that promotes research and education in the areas currently supported by the Division of Earth Sciences. EAR/IF will consider proposals for:

1. ***Acquisition or Upgrade of Research Equipment*** that will advance laboratory and field investigations and student research training opportunities in the Earth sciences;
2. ***Development of New Instrumentation, Techniques or Software*** that will extend current research and research training capabilities in the Earth sciences;
3. ***Community Facility Support*** to make complex and expensive instruments, systems of instruments or services broadly available to the Earth science research and student communities;

   Planned research uses of requested instruments, software, and facilities must include basic research on Earth processes SUPPORTED BY THE CORE PROGRAMS OR SPECIAL PROGRAMS OF THE DIVISION OF EARTH SCIENCES (see https://www.nsf.gov/div/index.jsp?div=EAR for a current list of programs funded by the Division of Earth Sciences).

   Support is available through grants or cooperative agreements awarded in response to investigator-initiated proposals.

   Human resource development and education are expected to be an integral part of all proposals submitted to EAR/IF.

Focused efforts to support participation of underrepresented groups in laboratory and/or field instrument use and educational and community outreach activities are also encouraged. Proposers to EAR/IF are encouraged to explore innovative outreach efforts to broaden participation of underrepresented groups in experiential learning using state-of-the-art analytical tools and to raise awareness of available geoanalytical capabilities in the U.S. Examples could include requested support for: 1) short courses or summer institutes focused on engaging representatives of underrepresented groups (faculty and students); 2) partnering with faculty at minority serving institutions and community colleges to make instrumentation available to their students and faculty for courses and research, 3) outreach to engage K-12 educators and students in field or laboratory studies involving experiential learning using the proposed instrumentation, 4) unique webcasting, social media or other activities to promote awareness of the facilities, or 5) travel to annual conferences of professional societies focused on fostering enhanced diversity in science (e.g., National Association of Black Geoscientists (NABG) -- http://www.nabg-us.org/, Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) -- http://www.sacnas.org/, American Indian Science and Engineering Society (AISES) -- http://www.aises.org/).

EAR/IF submission is appropriate for proposals that include instrumentation and facilities acquisition, upgrade and development only, as described in the three proposal categories. However, for equipment needs that would be used for the conduct of a specific research project being proposed to NSF/EAR programs, requests for equipment may be incorporated within the budget of the proposal submitted to the appropriate EAR research program. Investigators planning on submitting an EAR research proposal with a significant equipment budget should discuss these plans with the relevant research program officer prior to submission.

**Proposal Categories**

***Acquisition or Upgrade of Research Equipment***

EAR/IF accepts proposals seeking support for the acquisition of new research equipment or the upgrade of existing equipment. In addition, EAR/IF will consider proposals requesting support to acquire, ship and make suitable for research use, used analytical equipment.

Analytical laboratory and field instrumentation and computational equipment often serve a range of scientific disciplines. EAR/IF will assess the level of financial support appropriate for awards and may seek to partner with other appropriate NSF programs and other Federal agencies.

Review criteria will include an assessment of a management plan for the maintenance, operation and technical support for sophisticated analytical equipment during its expected lifetime. Detailed management plans for oversight, user access policies and anticipated user fees, if any, should be included in all proposals to the EAR/IF program.

Investigators interested in seeking NSF support for the acquisition or upgrade of research equipment that is more expensive than the current $500,000 maximum request to EAR/IF might also wish to investigate the Major Research Instrumentation (MRI) Program. MRI typically maintains a January submission deadline each year and the goals and design of the MRI Program complement those of the EAR/IF Program. Investigators are encouraged to examine the latest MRI solicitation (https://www.nsf.gov/od/iia/programs/mri/).

***Development of New Instrumentation, Techniques or Software***

EAR/IF accepts proposals seeking support for the development or refinement of new instrumentation, techniques and software that extend current research capabilities in the Earth sciences**.**

Investigators seeking to develop or refine new instrumentation, techniques and software should demonstrate that a community of geoscientists is actively interested in the new capability. Software development proposals seeking funds primarily for web service, web method, service oriented architecture or database development should be directed to the Division of Earth Science Geoinformatics Program (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503447. EAR/IF welcomes proposals for collaborative development projects between academic and industrial partners. However, EAR/IF does not support the sole commercial development of instrumentation or capabilities.

Investigators interested in seeking NSF support for the development of new research instrumentation that is more expensive than the current $500,000 maximum request to EAR/IF might also wish to investigate the Major Research Instrumentation (MRI) Program. MRI maintains a January submission deadline each year and the goals and design of the MRI Program complement those of the EAR/IF Program. Investigators are encouraged to examine the latest MRI solicitation (https://www.nsf.gov/od/iia/programs/mri/).

***Community Facility Support***

EAR/IF accepts proposals seeking support for a Community Facility.

Investigators seeking to establish support of a Community Facility are required to contact an EAR/IF Program Officer prior to submission. Investigators seeking renewed support for an established Community Facility are not required to contact an EAR/IF Program Officer but are encouraged to do so. In general, support for a Community Facility is intended for groups that seek to offer expensive or specialized analytical laboratory or field equipment and services to the broader U.S. geosciences community. EAR/IF expects that proposers will have specialized leadership capabilities and the availability of adequate and appropriate supporting infrastructure and personnel for these proposals.

## III. AWARD INFORMATION

EAR/IF anticipates approximately $6,000,000 will be available annually for 30-50 new awards, subject to the availability of funds. Awards may be standard or continuing grants or cooperative agreements.

## IV. ELIGIBILITY INFORMATION

**Who May Submit Proposals:**

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- 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.

**Who May Serve as PI:**

There are no restrictions or limits.

**Limit on Number of Proposals per Organization:**

There are no restrictions or limits.

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

There are no restrictions or limits.

## 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 FastLane, Research.gov, or Grants.gov.

- 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) 292-8569 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 Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Proposal and Award Policies and 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) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.

- 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) 292-8569 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.2 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 PAPPG instructions.

Special attention should be paid to the following when submitting a proposal to EAR/IF:

1. **Title**

The title of the proposal should convey its main topic. Proposals for ***Acquisition or Upgrade of Research Equipment, Development of New Instrumentation, Techniques or Software, and Community Facility Support*** should have respective titles beginning with:

**"Acquisition of ..."**

**"Upgrade of ..."**

**"Development of ..."**

**"Community Facility Support: ..."**

2. **Project Description**

Proposals for ***Acquisition or Upgrade of Research Equipment*** must include a description of the Earth science research projects of the principal investigator(s). The description of the research projects and the equipment should be comprehensive enough to allow reviewers to evaluate the merit of the research and the extent to which the equipment is essential and appropriate to the research program.

Proposals for ***Development of New Instrumentation, Techniques or Software*** must include a description of the instrument design, technique, or code development that is sufficiently detailed for reviewers to evaluate its technical capabilities and potential benefit to research in the Earth sciences.

Proposals for ***Community Facility Support*** must include a description of the technical capabilities of the facility and the potential impact that these capabilities may have for the Earth science community. The size and nature of the science community that will make principal use of the facility should also be described, along with any evidence of that community's desire to pool resources in support of the facility. A detailed management, operations and financial plan should also be included.

3. **Maintenance and Operation**

Proposals for ***Acquisition or Upgrade of Research Equipment, and Community Facility Support,*** must include a section describing the provisions for maintenance and operation of relevant laboratory or field equipment. This section should describe how and by whom the requested instrumentation is to be operated and maintained. If the instrument(s) being requested is/are for replacement of similar existing equipment, available data on user charges and related income, machine downtime, cost of instrument service contacts or available technical support should be discussed. Details regarding user scheduling decision procedures, relevant safety provisions and plans for user training should also be included. The management plan should refer specifically to any relevant institutional support of facilities, equipment and other resources described in the appropriate section of the proposal.

All proposals must describe plans for data management and sharing of the products of research. Fastlane will not permit submission of a proposal that is missing a Data Management Plan. Investigators are encouraged to be familiar with the many community data and informatics efforts that have been or are supported by NSF or other agencies.

For proposals that require support from centrally supported facilities, investigators must obtain letters of collaboration from the managing organization agreeing to provide the needed facility resources described in the proposal and those letters should be included as a Supplementary Document. Such letters should follow the standard format of the managing organization; if no such format exists, the letters should adhere to the standard letter of collaboration required in the PAPPG (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg). Any additional facility related costs should be clearly explained in the Budget Justification. Proposals requiring facility support but lacking support letters may be returned without review.

4. **Other Resources**
   a. **Inventory of Existing Equipment and Technician Positions**

Proposals for ***Acquisition or Upgrade of Research Equipment*** must list all comparable items of equipment to which the applicants have access at the submitting organization or elsewhere.

Existing and relevant technical support personnel in the department and their source of funding should be described with relevant biosketches included in the appropriate section.

   b. **Facilities, Equipment and Other Resources**

In order for the EAR/IF Program, and its reviewers, to assess the scope of a proposed instrumentation or facilities project, all organizational resources necessary for, and available to a project, must be described in the *Facilities, Equipment and Other Resources* section of the proposal (see the NSF PAPPG for further information).

Although these resources are not considered cost sharing as defined in 2 CFR § 200.306, the Foundation does expect that the resources identified in the *Facilities, Equipment, and Other Resources* section will be provided, or made available, should the proposal be funded.[1]

Proposers should include an aggregated 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. The description should be narrative in nature and must not include any quantifiable financial information.

[1] While not required by NSF, awardee organizations may, at their own discretion, continue to contribute voluntary uncommitted cost sharing to NSF-sponsored projects. These resources are not auditable by NSF and should not be included in the proposal budget or budget justification.

5. **Support of Outreach and/or Broadening Participation Activities**

   Focused efforts to support participation of underrepresented groups in laboratory and/or field instrument use and educational and community outreach activities are also encouraged. Proposers to EAR/IF are encouraged to explore innovative outreach efforts to broaden participation of underrepresented groups in experiential learning using state-of-the-art analytical tools and to raise awareness of available geoanalytical capabilities in the U.S. Examples could include requested support for: 1) **develop regional or state consortia to run** short courses or summer institutes focused on engaging representatives of underrepresented groups (faculty and students); 2) partnering with faculty at minority serving institutions **(e.g. Historical Black Colleges and Universities, Tribal Colleges and Universities)** and community colleges to make instrumentation available to their students and faculty for courses and research, 3) outreach to engage K-12 educators and students in field or laboratory studies involving experiential learning using the proposed instrumentation, 4) unique webcasting, social media or other activities to promote awareness of the facilities, or 5) travel to annual conferences of professional societies focused on fostering enhanced diversity in science (e.g., National Association of Black Geoscientists (NABG) -- http://www.nabg-us.org/, Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) -- http://www.sacnas.org/, American Indian Science and Engineering Society (AISES) -- http://www.aises.org/).

## B. Budgetary Information

**Cost Sharing:**

Inclusion of voluntary committed cost sharing is prohibited.

**Budget Preparation Instructions:**

The maximum request for ***Acquisition or Upgrade of Research Equipment*** and ***Development of New Instrumentation, Techniques or Software*** proposals is $500,000.

**Proposals that request support in excess of the allowable maximums will be returned without review.**

The budget section of proposals for ***Acquisition or Upgrade of Research Equipment*** should indicate the current price and any available discounts for the total equipment package requested, and should be itemized by major components. Relevant manufacturers' quotes must be included in the supplementary documents section of the proposal. **Proposals submitted without manufacturer price quotes may be returned without review.**

The EAR/IF program will NOT support requests for:

- Costs of instrument service contracts or service agreements in proposals for ***Acquisition or Upgrade of Research Equipment*** or ***Development of New Instrumentation, Techniques or Software.*** Such costs are ONLY allowable in proposals for ***Community Facility Support***.
- Construction or renovation of laboratory space to be used to house requested instrumentation, or construction of experimental facilities that include significant amounts of common building materials or standard building techniques,
- Direct costs of maintaining infrastructure or building systems or general purpose systems or platforms. This includes items such as HVAC, telecommunications, electrical systems, fume hoods, elevators, storage systems,
- Instrumentation used primarily for education.

**Proposals that request support for the above items may be subject to return without review.**

Personnel costs directly attributable to ***Development of New Instrumentation, Techniques or Software***, or ***Community Facility Support*** may be requested.

Personnel costs will not be supported through grant proposals for ***Acquisition or Upgrade of Research Equipment***.

All proposals submitted to the EAR/IF Program may request up to $20,000 for ***Support of Outreach and/or Broadening Participation Activities*** to engage audiences that otherwise will not have access to the instrumentation and/or data generated and/or to support focused efforts to broaden participation of underrepresented groups in experiential learning using state-of-the-art analytical tools and/or to raise awareness of available geoanalytical capabilities in the U.S. Budgetary requests for such activities may appear over multiple categories on the NSF Budget Form but the total should not exceed $20,000 (proposals for ***Community Facility Support*** are exempt from this limit). The Budget Justification section should summarize all planned ***Support of Outreach and/or Broadening Participation Activities*** expenditures and their total separately from other line item justifications.

Any facility support related costs should be clearly explained in the Budget Justification.

## C. Due Dates

- **Full Proposal Deadline(s):**

  Proposals Accepted Anytime

## 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: https://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 *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. 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**

In addition to the general NSF merit review criteria (intellectual merit/broader impacts), criteria considered in the evaluation of ***all*** proposals submitted to EAR/IF include:

- the intrinsic merit of the Earth science research that will benefit from the equipment, technique, or community facility;
- the number of investigators who will substantially benefit from the equipment, technique, or community facility and the strength of their Earth science research programs;
- the degree to which the equipment, technique, or community facility is appropriate and essential for the intended Earth science research;
- the degree to which core research projects supported by the Division of Earth Sciences will benefit from the proposed

equipment, technique, or community facility;
- the adequacy of the management plan describing the ability to operate and maintain complex equipment during its expected lifetime and the adequacy of the facilities, equipment and other resources provided as institutional support to carry out the proposed management plan.

An additional criterion considered in the evaluation of proposals submitted to EAR/IF for ***Community Facility Support*** includes:

- the ability to provide access to a facility intended to serve an external research community.

## B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel 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 https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8569 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=pappg.

## 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.

## 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:

- Russell C. Kelz, E 8459, telephone: (703) 292-4747, email: rkelz@nsf.gov
- David D. Lambert, E 8461, telephone: (703) 292-8558, fax: (703) 292-9023, email: dlambert@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane and Research.gov Help Desk, telephone: 1-800-673-6188.

  FastLane Help Desk e-mail:fastlane@nsf.gov

  Research.gov Help Desk e-mail: rgov@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 https://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* (FASED) 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) 292-8569
- **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
Alexandria, VA 22314