

Antarctic Research

PROGRAM SOLICITATION

NSF 19-595

REPLACES DOCUMENT(S):

NSF 18-530



National Science Foundation

Directorate for Geosciences
Office of Polar Programs

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

Proposals Accepted Anytime

Proposals requesting Antarctic fieldwork should be submitted no less than eighteen months prior to the desired deployment.

IMPORTANT INFORMATION AND REVISION NOTES

The Antarctic Research solicitation has been revised to encourage disciplinary research as well as research that crosses, and integrates, disciplinary perspectives and approaches in the Antarctic and Southern Ocean. The goal of this change is to remove perceived barriers for submission of research that crosses traditional disciplinary boundaries while ensuring continued support for core research themes.

To ensure the highest quality merit review, all proposals will be submitted to a general "Antarctic Research" theme rather than disciplinary programs. Subsequent to examination by the Antarctic Sciences group of Program Directors, proposals will be assigned to the most appropriate Program Director or Directors to arrange for merit review.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 19-1), which is effective for proposals submitted, or due, on or after January 28, 2019.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Antarctic Research

Synopsis of Program:

The Antarctic Sciences Section (ANT) of the Office of Polar Programs (OPP) supports cutting-edge research that (1) expands fundamental knowledge of the Antarctic and the natural laboratory it represents across a range of disciplines, (2) improves understanding of interactions between the Antarctic and Southern Ocean region and Earth system, and (3) utilizes the unique characteristics of the Antarctic continent as an observing platform. The U.S. Antarctic Program (USAP) supports scientific research in Antarctica and the Southern Ocean with logistics provided by OPP's Antarctic Infrastructure and Logistics Section (AIL). Antarctic fieldwork is supported only for research that must be performed, or is best performed, in Antarctica. ANT encourages research, using existing samples, data, and models, that does not require fieldwork. ANT also encourages research that crosses and combines, disciplinary perspectives and approaches.

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.

- Jennifer Burns, Program Director, Organisms and Ecosystems, W7178, telephone: (703) 292-2120, email: jmmburns@nsf.gov
- Paul M. Cutler, Program Director, Glaciology, Ice Core Science, and Geomorphology, W7217, telephone: (703) 292-4961, fax: (703) 292-9025, email: pcutler@nsf.gov
- Karla Heidelberg, Program Director, Antarctic Organisms and Ecosystems, W7153, telephone: (703) 292-2586, email: kheidelb@nsf.gov
- Michael E. Jackson, Program Director, Earth Science, Geodesy, Geophysics, and Antarctic Instrumentation, W7239, telephone: (703) 292-7120, email:

mejacks@nsf.gov

- Doug E. Kowalewski, Program Director, Earth Science and Paleoclimates, W7157, telephone: (703) 292-7706, email: dkowalew@nsf.gov
- Peter Milne, Program Director, Physical Oceanography, Meteorology, and Atmospheric Sciences, W7116, telephone: (703) 292-4714, fax: (703) 292-9079, email: pmilne@nsf.gov
- Vladimir Papitashvili, Program Director, Astrophysics and Geospace Sciences, W7118, telephone: (703) 292-7425, fax: (703) 292-9079, email: vpapita@nsf.gov
- Elizabeth L. Rom, Program Director, Polar Education, W8164, telephone: (703) 292-7709, email: elrom@nsf.gov
- Jessie L. Crain, Antarctic Research Support Manager, W7126, telephone: (703) 292-7457, email: jlcrain@nsf.gov
- Timothy M. McGovern, Oceans Project Manager, W7124, telephone: (703) 292-4248, email: tmcgover@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

Estimated Number of Awards: 50

Anticipated Funding Amount: \$55,000,000

The Antarctic Sciences Section anticipates committing annually up to approximately \$55 million as either standard or continuing awards made in response to this solicitation contingent on the 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_summ.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_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website)

and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

Not Applicable

- **Other Budgetary Limitations:**

Not Applicable

C. Due Dates

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

Proposals Accepted Anytime

Proposals requesting Antarctic fieldwork should be submitted no less than eighteen months prior to the desired deployment.

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.

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 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 Antarctic Sciences Section (ANT) of the Office of Polar Programs (OPP) supports cutting-edge research that (1) expands fundamental knowledge of the

Antarctic and the natural laboratory it represents across a range of disciplines, (2) improves understanding of interactions between the Antarctic and Southern Ocean region and Earth system, and (3) utilizes the unique characteristics of the Antarctic continent as an observing platform.

Research investments in ANT are guided by the National Academies of Sciences August 2015 report entitled "A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research" (<https://www.nap.edu/catalog/21741/a-strategic-vision-for-nsf-investments-in-antarctic-and-southern-ocean-research>). This report affirmed the need to maintain strong core research programs and identified the following three major themes as drivers for Antarctic research:

1. *The Changing Antarctic Ice Sheets Initiative* - How fast, and by how much, will sea level rise?
2. *Decoding the genomic and transcriptomic bases of biological adaptation and response across Antarctic organisms and ecosystems* - How have Antarctic biota evolved and adapted to the polar environment, and how might changing systems impact their populations?
3. *A next-generation cosmic microwave background program* - How did the Universe begin and what are the underlying physical laws that govern its evolution and ultimate fate?

Proposals for workshops, conferences, and Research Coordination Networks to advance, coordinate, or synthesize research in these areas are encouraged.

The Antarctic Sciences Section, as part of the U.S. Antarctic Program (USAP), supports scientific research in Antarctica and the Southern Ocean with logistics provided by OPP's Antarctic Infrastructure and Logistics Section (AIL). Antarctic fieldwork is supported only for research that must be performed, or is best performed, in Antarctica. Protection of the Antarctic environment is a fundamental consideration in all Antarctic field activities as described in the Protocol on Environmental Protection to the Antarctic Treaty (<https://ats.aq/e/ep.htm>). Antarctic fieldwork must be planned to minimize adverse impacts on the environment.

Antarctic Sciences encourages: (1) proposals from researchers who are under-represented in science and from investigators new to Antarctic research; (2) research taking advantage of existing samples, data, and models; and (3) proposals leveraging international collaborations.

II. PROGRAM DESCRIPTION

The Antarctic continent remains a frontier for exploration and discovery. As such, NSF investments in Antarctic Science support a broad portfolio of research across a spectrum of interlinked disciplinary areas. This research advances understanding of biota and physical systems operating in the Antarctic region and adjacent seas through field, laboratory, modeling, and theoretical work encompassing terrestrial, marine, cryospheric, atmospheric, and space settings. Research is supported across a broad spectrum of disciplinary areas in response to proposals from the scientific research community. Proposals advancing research through synthesis, data and sample re-use, modeling, and development of predictive tools are encouraged. Support is also provided for research that capitalizes on unique features of the Antarctic continent, and its atmosphere, for scientific research.

A core focus of Antarctic Sciences is to support research that:

1. *Expands fundamental knowledge of the Antarctic and the natural laboratory it represents*

Antarctic Sciences supports a broad-based research program across all major areas of Antarctic and Southern Ocean science to understand the wide range of environments, organisms, and processes that currently shape, and have shaped in the past, this unique continent, its surrounding continental shelves, and adjacent ocean basins. A key component of Antarctic Sciences-supported research is the identification and characterization of processes, feedbacks, and responses of the Antarctic system to physical, geochemical, and biological drivers.

2. *Improves understanding of interactions between the Antarctic and Southern Ocean and global systems*

Research carried out in the Antarctic region plays a critical role in advancing fundamental understanding of Earth systems as the biological, geochemical, and physical processes in the Antarctic and Southern Ocean are both drivers and responders to changes on a global scale. ANT supports research to improve understanding of the dynamic linkages among processes operating in the Antarctic and Southern Ocean and how they are linked to global Earth systems. This research helps inform decision making regarding environmental change.

3. *Utilizes the unique characteristics of Antarctica as an observing platform*

Antarctic Sciences supports transformative, and emerging astrophysical and geospace research that uses Antarctica as an observing platform, including studies on the fundamental physics and evolution of the Universe, cosmic microwave background radiation, galactic astronomy, solar and cosmic-ray physics, and high-energy neutrino physics.

Existing Sample/Data Use and Modeling

To help promote derivation of full benefits from prior efforts, Antarctic Sciences encourages proposals that seek to address pressing Antarctic science questions through use or re-processing of existing data and samples. Proposers should investigate the utility of samples available from individual researchers and sample/data repositories such as the Polar Rock Repository (<http://research.bpcrc.osu.edu/rr/>), Marine Geology Repository (<http://osu-mgr.org/>), National Ice Core Laboratory (<https://icecores.org/>), Polar Geospatial Center (<https://www.pgc.umn.edu/>), USAP-Data Center (<http://www.usap-dc.org/>), Antarctic Meteorological Research Center (<https://amrc.ssec.wisc.edu/>), Antarctic Glaciology Data Center (<https://insidc.org/data/agdc/>), Biological and Chemical Oceanography Data Management Office (<https://www.bco-dmo.org/>), IRIS (<https://www.iris.edu/hq/>), and UNAVCO (<https://www.unavco.org/>).

Instrumentation and Research Facilities

Antarctic Sciences supports development and field testing of scientific instrumentation for use in polar regions to: (1) enable broad, multi-disciplinary community use of field instrumentation; (2) reduce the on-ice footprint of research and/or operations in Antarctica; and (3) to enhance capabilities for in situ observing on the continent and in the surrounding ice-covered waters.

There are specific proposal preparation requirements for instrument development (see Proposal Preparation and Submission Instructions) and additional merit review criteria apply (see Merit Review Criteria). It is recommended that investigators contact a relevant Antarctic Sciences Program Director prior to submission. It is also recommended that investigators review opportunities as part of NSF's Major Research Instrumentation Program (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5260) to determine whether work to be proposed is suitable for submission to that program.

Education and Outreach

The integration of research and education is essential to NSF's mission, and NSF strives to broaden participation in science and to make the results of research projects widely accessible to students and the public. ANT seeks to meet these objectives by supporting the engagement of diverse students, educators, and the public in Antarctic research projects.

In an effort to increase the diversity of the polar workforce, ANT encourages the inclusion of support for diverse students in research proposals. Polar researchers are encouraged to request support for undergraduate and graduate students who are from groups under-represented in polar sciences, have disabilities, are veterans, are first-generation students, are from low-income backgrounds or who attend community colleges. Proposals can take advantage of existing sample/data collections to offer opportunities for graduate or undergraduate thesis work and/or to provide a means to expose under-represented groups to Antarctic research. Teams may also consider submitting proposals under this general theme to NSF's Research Experiences for Undergraduates (REU) solicitation (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517).

Investigators who wish to propose projects that are primarily education and outreach efforts are encouraged to contact the Education Liaison for the Office of Polar Programs and to submit proposals via other relevant solicitations in the Directorate of Geosciences and the Directorate of Education and Human Resources. ANT encourages scientists to partner with education researchers when submitting proposals focused primarily on education, and to consider efforts that make use of innovative technologies and pedagogies to provide large groups of students, educators, and the public remote access to research in the Antarctic. Proposals that engage audiences with long-term investments in Antarctic research and logistics, with databases that have extended lifespans, or with public participation in scientific research, such as crowdsourcing or citizen science related to the Antarctic, are also encouraged.

III. AWARD INFORMATION

The Antarctic Sciences Section anticipates committing up to approximately \$55 million annually as either standard or continuing awards made in response to this solicitation contingent on the availability of funds. In addition, and separate from these awards to organizations, field and laboratory support will be available in Antarctica for those projects for which fieldwork has been proposed and approved.

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) 292-8134 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) 292-8134 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.

Additional instructions:

1. **Proposals Involving No Fieldwork:** The statement "This proposal does not require fieldwork in the Antarctic." must be included as the last line of the Project Summary.
2. **Proposals Involving Fieldwork:** The statement "This proposal requires fieldwork in the Antarctic." must be included as the last line of the Project Summary. In addition, **investigators proposing fieldwork must follow specific instructions for fieldwork proposals found at:** https://www.nsf.gov/geo/opp/ant/ant_research_solit.jsp.
 - A. **Logistics Requirement and Field Plan** must be included as a Supplementary Document and will be subject to peer review. This document is limited to one page of text and one page of figures, and must contain:
 1. A brief statement of research objectives;
 2. A description of the geographic region to be investigated with field sites;
 3. A description of field activities and logistical resources required;
 4. The desired deployment schedule and proposed field sampling;
 5. A justification for the requested number of field team members;
 6. A description of facility construction, modification, or installation requirements; and
 7. A description of instrumentation to be deployed on aircraft, autonomous platforms, scientific instruments, equipment with special support requirements, or scientific diving essential to the proposed work.

NSF reserves the right to seek institutional verification for appropriate qualifications of all field participants. NSF encourages projects that require additional field labor to add students to the field team. USAP maintains a web portal with information about research stations, ships, field camp support, and logistics (<https://www.usap.gov/>). Information about the science support process, and associated timeline is available at (<https://www.usap.gov/proposallinformation/>).

For further information, investigators may contact their cognizant Program Director or the Research Support or Ocean Projects Managers in the Antarctic Infrastructure and Logistics Section.
 - B. Projects requiring **research vessel support** must submit a [UNOLS ship request form](#) as a Supplementary Document.
 - C. Projects requesting services from **NSF-supported research support facilities** (such as [IRIS](#), [UNAVCO](#), [PGC](#), [IDP](#), [NCALM](#), etc.) must include a letter from the facility as a Supplemental Document indicating feasibility and additional costs needed to support the proposed research.
3. **Data Management Plan:** The Data Management Plan (DMP) must be compliant with the [OPP Data Management Policy](#) and must be consistent with NSF's policy on dissemination and sharing of research results (<https://www.nsf.gov/bfa/dias/policy/dmp.jsp>). Investigators are strongly encouraged to use a DMP creation program such as the: IEDA Data Management Tool (<https://www.iedadata.org/dmp/>), California Digital Library DMP Tool (<https://www.cdlib.org/services/uc3/dmpt.html>), or ezDMP (<https://ezdmp.org/index>).

The Data Management Plan must address the following:

- A. OPP policy requires that metadata files, full data sets, and derived data products, must be deposited in a long-lived and publicly accessible archive within two years of collection or by the end of the award, whichever comes first. Antarctic measurements and observations that are collected routinely and automatically as part of long-term, ongoing projects or operations are expected to be made available to the community in their raw instrumental output format, ideally within 24 hours of availability to the PI. Any limitation on access to data beyond these timeframes that are anticipated at proposal submission must be based on a compelling justification and documented in the Data Management Plan. Any limitation on access that arises following award is subject to Program Officer approval with documentation in NSF record systems.
- B. Upon award, the lead investigator is required to register the project on the USAP Data Coordination Center (USAP-DC; <http://www.usap-dc.org/>) website. Registration will include submission of the Data Management Plan agreed to at the time of award. The Data Management Plan must be made publicly available at this time. Project registration within USAP-DC will ensure registration within the Antarctic Master Directory and will fulfill data sharing obligations under the Antarctic Treaty.
- C. Proof of Project registration with the USAP-DC and public release of the DMP will be required in the first Annual Project Report and proof of data submission must be included in the Final Project Report to NSF in the form of a link to the project page of the USAP-DC.

D. Principal Investigators are required to provide updates on the status of metadata and data archival in annual project reports and update the DMP as needed. Compliance with the most up-to-date project Data Management Plan must be documented in the final project report.

4. **Revised Proposals:** Programs will not accept resubmitted proposals that have not been substantially revised in accordance with policy outlined in the current NSF Proposal & Award Policies & Procedures Guide (PAPPG). Investigators are encouraged to contact a Program Director in Antarctic Sciences for guidance on their revised proposal prior to resubmission.
5. **Project Management:** Proposals must articulate how activities will be managed toward a successful conclusion of the project. Proposers should carefully consider the project management needs of research activities and should include an appropriate management plan in the proposal with appropriate resources in the budget to support this plan. Complex projects may require dedicated project management expertise as part of the proposing team.

Instrument Development Proposals: Proposals for instrument development must demonstrate that project management best practices will be used to manage the activity. This includes defining milestones for development and testing, establishing criteria for evaluating whether milestones are met, and conducting readiness reviews prior to deployment. Proposals must also demonstrate that the design is optimized to reduce operations and maintenance costs, and maximize logistical efficiencies, during deployment, servicing, and recovery.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Investigators proposing fieldwork must follow specific instructions for fieldwork proposals found at:

https://www.nsf.gov/geo/opp/ant/ant_research_solit.jsp.

C. Due Dates

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

Proposals Accepted Anytime

Proposals requesting Antarctic fieldwork should be submitted no less than eighteen months prior to the desired deployment.

D. FastLane/Research.gov/Grants.gov Requirements

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html. For FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and Research.gov systems. 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 or Research.gov may use Research.gov 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

1. **Justification for access to Antarctica:** NSF supports fieldwork in Antarctica for research that can only be done, or is best done, in Antarctica. Proposals must include an explanation that justifies fieldwork in the Antarctic. This statement will be evaluated to determine if it represents a compelling rationale that fieldwork in the Antarctic is required to accomplish the goals of the proposed investigation.
2. **Operational feasibility:** Proposals involving Antarctic fieldwork will be evaluated for operational feasibility, safety, and environmental impacts.
3. **Instrumentation and technology development:** The quality of development and testing plans, including milestones and criteria for acceptance, will be considered as an important criterion in the evaluation of proposals involving instrument development, or modification of instruments for polar work.

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) 292-8134 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.

Special Award Conditions:

Principal investigators are required to comply with the OPP Data Management Policy (NSF 16-055) and evidence of compliance is required in final project reports. Principal investigators must also address in the final project report the status of archival, accessibility, and metadata related to physical/biological samples collected during the project.

Projects receiving U.S. Antarctic Program (USAP) support for fieldwork in the Antarctic are subject to the Antarctic Conservation Act (ACA), as amended, 16 U.S.C. § 2401, et seq. Violations of the ACA may result in civil penalties up to approximately \$28,000 per occurrence, imprisonment for up to one year, and, where appropriate, administrative sanctions up to and including debarment. Please refer to <https://www.nsf.gov/geo/plr/antarct/aca/aca.jsp> for general guidance.

Projects receiving USAP support for fieldwork in the Antarctic shall include the following acknowledgement in publications resulting from the project (in addition to acknowledging NSF grant support as described in the NSF Proposal & Award Policies & Procedures Guide Chapter XI.E.4): "Logistical support for this project in Antarctica was provided by the U.S. National Science Foundation through the U.S. Antarctic Program."

The Polar Code of Conduct alerts participants to the National Science Foundation's expectations for professional conduct and acceptable behavior while deployed in Antarctica (https://www.nsf.gov/geo/opp/documents/policy/polar_coc.pdf). Participants in research supported by NSF are required to comply with this Code of Conduct. Participants are required to acknowledge receipt, acceptance and full understanding of the terms and expectations of the Polar Code of Conduct and to agree to abide by its terms and expectations. As noted in the Code, violations "may be shared with current and future Antarctic or Arctic program support contractors, federal agency partners, or grantee institutions" and "may result in adverse consequences to the individual, including, but not limited to, removal from a USAP or Arctic station, field camp, other facility, ship, or aircraft; termination of employment (by the employer); or other administrative, civil, or criminal enforcement actions, as appropriate.

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:

- Jennifer Burns, Program Director, Organisms and Ecosystems, W7178, telephone: (703) 292-2120, email: jmmburns@nsf.gov
- Paul M. Cutler, Program Director, Glaciology, Ice Core Science, and Geomorphology, W7217, telephone: (703) 292-4961, fax: (703) 292-9025, email: pcutler@nsf.gov
- Karla Heidelberg, Program Director, Antarctic Organisms and Ecosystems, W7153, telephone: (703) 292-2586, email: kheidelb@nsf.gov

- Michael E. Jackson, Program Director, Earth Science, Geodesy, Geophysics, and Antarctic Instrumentation, W7239, telephone: (703) 292-7120, email: mejacks@nsf.gov
- Doug E. Kowalewski, Program Director, Earth Science and Paleoclimates, W7157, telephone: (703) 292-7706, email: dkowalew@nsf.gov
- Peter Milne, Program Director, Physical Oceanography, Meteorology, and Atmospheric Sciences, W7116, telephone: (703) 292-4714, fax: (703) 292-9079, email: pmilne@nsf.gov
- Vladimir Papitashvili, Program Director, Astrophysics and Geospace Sciences, W7118, telephone: (703) 292-7425, fax: (703) 292-9079, email: vpapita@nsf.gov
- Elizabeth L. Rom, Program Director, Polar Education, W8164, telephone: (703) 292-7709, email: elrom@nsf.gov
- Jessie L. Crain, Antarctic Research Support Manager, W7126, telephone: (703) 292-7457, email: jlcrain@nsf.gov
- Timothy M. McGovern, Oceans Project Manager, W7124, telephone: (703) 292-4248, email: tmcgover@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 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 (FASSED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

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

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

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

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards,

visit the NSF Website at <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information**
(NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

Send an e-mail to: nsfpubs@nsf.gov

or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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