Ice Coring and Drilling Program for the Office of Polar Programs

PROGRAM SOLICITATION
NSF 13-503

National Science Foundation

Office of Polar Programs
Division of Antarctic Sciences

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

January 22, 2013

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the ***NSF Proposal & Award Policies & Procedures Guide*** (PAPPG)**,** NSF 13-1, was issued on October 4, 2012 and is effective for proposals submitted, or due, on or after January 14, 2013. Please be advised that the guidelines contained in NSF 13-1 apply to proposals submitted in response to this funding opportunity. Proposers who opt to submit prior to January 14, 2013, must also follow the guidelines contained in NSF 13-1.

Please be aware that significant changes have been made to the PAPPG to implement revised merit review criteria based on the National Science Board (NSB) report, National Science Foundation's Merit Review Criteria: Review and Revisions. While the two merit review criteria remain unchanged (Intellectual Merit and Broader Impacts), guidance has been provided to clarify and improve the function of the criteria. Changes will affect the project summary and project description sections of proposals. Annual and final reports also will be affected.

A by-chapter summary of this and other significant changes is provided at the beginning of both the *Grant Proposal Guide* and the *Award & Administration Guide*.

Please note that this program solicitation may contain supplemental proposal preparation guidance and/or guidance that deviates from the guidelines established in the Grant Proposal Guide.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Ice Coring and Drilling Program for the Office of Polar Programs

Synopsis of Program:

The Office of Polar Programs (OPP) at the National Science Foundation (NSF) requests proposals from interested groups to support current and future ice drilling activities. Current NSF ice drilling programs include development of drill systems that can obtain ice cores, embed instruments in the ice, carry out various types of borehole logging, and provide access to the ice sheet bed.

Specifically, proposals are requested for the continuation of the Ice Drilling Program Office (IDPO), which helps coordinate long-term and short-term planning for ice coring and drilling projects, in collaboration with the science community, and to be the principal supplier of ice drilling and coring support and expertise for NSF-funded research. The IDPO will work with an Ice Drilling Development Office (IDDO) (through a sub-contract arrangement unless a single awardee proposes to execute both IDPO and IDDO activities). IDDO will provide the engineering design support for new drilling systems as well as the operation and maintenance of existing systems. The IDPO is expected to play a proactive role in the community to encourage innovation in ice drilling technologies in response to community needs and will help guide the development of new drilling designs as requested by the research community and funded by NSF.

Interested parties must propose to this solicitation with a plan to provide for both of the current functions (the IDPO and IDDO) under a single umbrella group with sub-awards as appropriate. These entities will be expected to work closely together and to partner, as appropriate, with scientists in the submission of research proposals.

Through a close collaboration with NSF the successful proponent will be expected to successfully manage and carry out drilling activities in varying mixtures of ice, rock, and sediment. Requirements for drilling activities will be derived both from the long range science plan developed by the IDPO as well as research proposals funded by NSF. Collaborations with international partners and scientists funded by other sources are encouraged. The awardee from this solicitation will be integral to the planning and execution of all aspects of the drilling activities that OPP supports.

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.

- Julie M. Palais, Program Director, Antarctic Glaciology, telephone: (703) 292-8033, email: jpalais@nsf.gov

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

- 47.078 --- Office of Polar Programs

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1 A single award for the establishment of an Ice Drilling Program Office (IDPO) and an Ice Drilling Development Office (IDDO) (through a subcontract arrangement if they are not at the same institution).

Anticipated Funding Amount: $ 3,750,000. The overall duration of the award from this solicitation will be five years with an anticipated funding level up to $ 3,750,000 per year pending availability of funds and depending on the drilling needs of the ice drilling community. Base level funding for support and drill system development and modification should not exceed $ 2,900,000 per year. Actual annual funding for the ice drilling enterprise will depend on activities outlined in the Annual Program Plan.

Since IDPO/IDDO provides support to many programs at NSF, if a new award is made during the year based on the submission of unanticipated, unsolicited proposal after the annual program plan has been submitted and the annual funding action has been released, additional funding for IDPO/IDDO will be handled as a supplement to the Cooperative Agreement by the NSF program funding the new award.

Eligibility Information

Organization Limit:

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

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- Letters of Intent: Not Applicable
- Preliminary Proposal Submission: Not Applicable
- Full Proposals:
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- Cost Sharing Requirements: Inclusion of voluntary committed cost sharing is prohibited.
- Indirect Cost (F&A) Limitations: Not Applicable
- Other Budgetary Limitations: Not Applicable

C. Due Dates

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

  January 22, 2013

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

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I. INTRODUCTION

Studies of the Greenland and Antarctic ice sheets, and the records of Earth history they contain in the form of ice cores, remain a relatively recent field of science. Much has been learned over the last 50 years from ice cores recovered from the inland regions of both polar ice sheets by different national and international research teams. In addition to drilling polar glaciers for the historical record contained in the ice, other scientists have drilled through the ice sheets to get to the base for geologic studies or to embed detectors in the ice for astrophysical measurements.

Ice cores from polar ice sheets and ice caps provide excellent records of environmental change because of their high temporal resolution and the large number of environmental variables and indicators recorded in the ice. Ice core records have provided essential data that have led to great advances in the understanding of global change and the behavior of earth systems. This is evidenced by the pervasiveness of ice core data in the global change peer-reviewed literature.

Prior to 2008 a contract for ice drilling services was awarded to a group that managed the planning, development, procurement, and operation of ice-drilling equipment for projects supported by the Office of Polar Programs. These contracts also supported planning for logistical coordination of ice drilling activities in both polar regions and in some high-altitude locations.

In 2008 NSF changed the organizational and funding model for supporting ice drilling so that the science community could coordinate and prioritize their drilling efforts. NSF released the solicitation (NSF 08-555) and in October 2008 awarded Cooperative Agreements to support the institutions that were selected from the competition. The new model of having an Ice Drilling Program Office (IDPO) to coordinate the science planning activities of the community and an Ice Drilling Development Office (IDDO), overseen by IDPO, providing the engineering and drilling expertise to implement the projects planned by the science community has been in effect now for 4 years. IDPO, in collaboration with IDDO, works with the science community to develop new drilling tools and operate and maintain current systems. This new structure is designed to be responsive to community needs and to improve planning of new projects.

This new solicitation encourages scientists and engineers, to establish teams to work together as an integrated organization to support the ice drilling activities of NSF's Office of Polar Programs and others. The successful proposal from this solicitation will be awarded under a cooperative agreement with NSF to support the drilling needs of NSF-sponsored researchers.

In response to the recently released report from the U.S. Antarctic Program Blue Ribbon Panel ("More and Better Science in Antarctica through increased Logistical Effectiveness"), we envision taking the opportunity over the next several years to encourage the development of new technologies for ice drilling and in-situ borehole instrumentation which will allow off-ice activities in addition to those currently underway or planned for Antarctic field work. This could include things such as new tool development,

modifications to the Deep Ice Sheet Coring (DISC) drill and other existing drills, development of procedures for accessing a wet-based ice sheet or research into the search for new drill fluids, to name a few examples.

Current Drilling Systems

Currently there are numerous systems available for drilling boreholes and for collection of ice cores. A complete inventory of the currently available systems can be found on the following web site:

http://www.icedrill.org/equipment/index.shtml

and is also attached as Table 1 in the Program Description section of this solicitation. Available systems include those that produce boreholes and numerous other drills that collect various diameter ice cores. Ice core drills include various types of hand augers and electromechanical drills. There is also a matrix showing all of the currently available systems and their availability for projects now and into the future:

http://www.icedrill.org/equipment/matrix.shtml

Recently much effort has gone into development and/or acquisition of several new drilling systems (http://www.icedrill.org/equipment/development.shtml). These development projects include the replicate drilling system and the intermediate drilling system, among others.

Future Drilling Systems

In April 2011 IDPO hosted an Interdisciplinary Science Community Planning Workshop whose goal was to identify future Arctic and Antarctic drilling/coring sites, the ice drilling technology that will be needed, and the timeline over the coming decade to be able to implement these projects (http://www.icedrill.org/science-planning-workshop-2011/index.html). Interest in sampling polar ice sheets and their sub-strata, without continuous coring, has been a topic of discussion for many years among geologists, glaciologists and biologists. In order to more rapidly obtain samples beneath the ice sheet and to emplace instruments within these boreholes, the possibility of developing a rapid, or fast-mechanical access drill has been discussed at a number of meetings and workshops in the past including the April 2011 workshop hosted by IDPO. The discussions at the April 2011 workshop built on the previous Fastdrill workshop that was held at the University of California, Santa Cruz in 2002:

http://www.es.ucsc.edu/~tulaczyk/fastdrill.htm

Among other ice-drilling activities, planning is already underway to develop and acquire the necessary intermediate-depth logging winches and other equipment to enable a wide variety of borehole logging measurements:

http://www.icedrill.org/equipment/development.shtml#winch

In addition to U.S. planning for future drilling programs, the International Partnerships in Ice Core Sciences (IPICS) group has identified four major scientific projects to be addressed in the coming years, as well as drilling and implementation plans to meet these objectives. These projects are:

- The oldest ice core: A 1.5 million year record of climate and greenhouse gases from Antarctica (a time period where Earth's climate shifted from 40,000 year to 100,000 year cycles);
- The last interglacial and beyond: A northwest Greenland deep ice core drilling project (a deep ice core in Greenland with an intact record of the last interglacial period);
- The IPICS 40,000 year network: A bipolar record of climate forcing and response;
- The IPICS 2k Array: A network of ice core climate and climate forcing records for the last two millennia;

A suite of requirements for drilling and coring capabilities to support these scientific goals has also been articulated (http://www.pages.unibe.ch/ipics/data/IPICS_drilling.pdf) and, although many of these requirements can be met with currently available technologies, some will require the extension of current systems or the development and testing of new ones. Some additional challenges that have been articulated include:

- Identifying an acceptable, appropriate, inert drill fluid with no undesirable physical or chemical characteristics (currently being worked on by IDPO);
- Successfully coring and recovering basal ice close to or at its pressure melting point in a deep, fluid-filled hole (in discussion by IDDO);
- Developing an increased ability to produce good-quality core through the brittle ice zone in polar ice caps and to handle, transport and store it without inducing additional damage;
- Acquiring replicate ice samples at specific depths or intervals of interest (in development as part of the WAIS Divide project);
- Creating successful strategies for encountering pressurized water at the bed;
- Sampling bedrock at the bottom of the hole;
- Identifying and standardizing a reliable lightweight, portable dry/wet drill system capable of reaching from several hundred to a thousand meters;
- Developing procedures to handle, transport and store core in a way that it preserves as much of its initial information as possible.

The successful awardee(s) will be expected to work with the U.S. research community and IPICS to further develop existing activities and achieve the goals articulated above. The involvement of international partners is already well advanced in the ice drilling community but the Blue Ribbon Panel recommended that NSF should look for new ways to "pursue additional opportunities for international cooperation in shared logistical support as well as scientific endeavors".

II. PROGRAM DESCRIPTION

Statement of Work

Project Description and Management

The Office of Polar Programs (OPP) at the National Science Foundation (NSF) requests proposals for the continuation of the Ice Drilling Program Office, an organization that provides scientific leadership and oversight of ice coring and drilling activities funded by

the NSF. Working in partnership with the IDPO is an Ice Drilling Development Office (IDDO), a group of engineers providing the design support for new drilling systems as well as the operation and maintenance of existing systems (including the Deep Ice Sheet Coring (DISC) Drill). This solicitation requires a single institution to propose for the combined activity or a single institution with a sub-award for the IDDO. The successful awardee must demonstrate an in-depth understanding of current, state-of-the-art ice drilling technologies for recovery of ice-cores and producing boreholes and must demonstrate the ability to successfully carry out drilling activities in varying mixtures of ice, rock, and sediment. Project planning and management is a critical component of this activity.

The Ice Drilling Program Office (IDPO) will play a proactive role in the community to encourage innovation in ice core drilling technologies in response to community needs and will help guide the Ice Drilling Development Office (IDDO) group to develop new drilling designs as requested by the research community and funded by NSF. These entities will be expected to work closely together in a seamless partnership, and collaborate with others, as appropriate, on the submission of research and development proposals for new technology.

Requirements for drilling activities and development of new drilling tools will be, to a large degree, derived from research activities funded by NSF (including activities with international partners). However, the successful awardee will also be expected to work closely with the community to develop cutting edge ice core drilling technologies and shall partner, when appropriate, with scientists on the submission of research proposals seeking funding for these developments. The successful group will be required to work closely with investigators, other agencies, contractors, and other national programs to prepare operational plans to support ice-drilling activities worldwide. During proposal development, investigators will work with the awardee to establish project requirements and costs to be included in proposals submitted to NSF for review.

The awardee will be expected to work within the cycle of OPP's grant award process. If NSF determines that a project is supportable, then the Ice Drilling Program Office will be formally directed to devote IDDO resources to implement the work described in the successful proposal. A primary task will be to work with principal investigators to prepare detailed project plans that will include the project schedule, milestones, costs (including life-cycle costs), and resource requirements needed for completion. An integrated cost/schedule document will be used to develop plans and budgets for major projects. This same document will be used to track progress and actual expenditures, including Earned Value reporting. ***A sample project cost/schedule document with sample cost/progress reports must be included with the proposal as a supplementary document or the proposal will be considered non-compliant.*** Appropriate pre-deployment testing will be an expected part of each project that involves development of new drilling systems. Project plans for the coming year will be incorporated into the annual IDPO Program Plan that is submitted yearly to NSF for review and funding.

The successful awardee(s) must demonstrate the capability to provide NSF with sound long-range planning for ice-drill development and use. Specifically, the awardee must prepare, and annually update, a comprehensive five-year plan for ice-drill development, the Long Range Drilling Technology Plan, to support the U.S. research community. This plan will include drill allocation to specific projects to the degree that these commitments are known. To develop this document, the awardee will interact closely with the research community, NSF Program Managers, developers of ice-core instrumentation and downhole geophysical logging tools, as well as with relevant industry partners.

Primary Tasks

The sections below outline primary activities to be carried out by the Ice Drilling Program Office (IDPO) and the Ice Drilling Development Office (IDDO). These lists are not comprehensive but are provided to enable proposers to formulate their management concepts and organizational structure. The collaboration between the IDPO and IDDO must include development and execution of cross cutting activities such as implementation of a common website for both groups that describes current ice drilling capabilities, with examples of recent activities, as well as detailed conceptual descriptions of future drilling systems. It is also expected that the groups will work together to proactively develop plans for appropriate scientific workshops and conferences related to ice core drilling. The awardee is also expected to produce integrated reports of activities undertaken by IDPO and IDDO throughout the year so that the output of their activities is clearly documented for NSF in a fashion that is concise, useful, and easy for everyone to understand.

Ice Drilling Program Office (IDPO)

The Ice Drilling Program Office will play a proactive role in the community to encourage innovation in ice core drilling technologies in response to community needs. To that end, the following tasks will be essential to the operation of the office:

- Provide community leadership in ice core drilling research and development;
- Establish appropriate community advisory and working groups to develop long-range scientific plans for ice core drilling;
- Act as a focal point for community input related to ice core research and drilling activities;
- Provide a clearinghouse for information related to ice core drilling research and development as a service to the research community;
- Coordinate information exchange between the U.S. ice core research community and international groups;
- Provide leadership and coordination for the long-range planning efforts of the science community and project management oversight of drill development activities being undertaken by the Ice Drilling Development Office.

In addition to the items above, proponents must describe the administrative, scientific, and technical staff required; the available office environment; and any leveraged support services needed to ensure success of the Ice Drilling Program Office. Proposal assessment will include consideration of the credentials of the proposing group, which must demonstrate expertise in ice drilling, committee organization, project management and oversight, interactive web site development, and the ability to interact with the academic research community.

Ice Drilling Development Office (IDDO)

To support drilling design activities as well as operations and maintenance of existing systems proponents must describe how the following services and facilities will be provided:

- Appropriate storage areas to preserve the equipment inventory;
- Workshop space for drill development, fabrication, testing, and maintenance;
- Adequate inventory of ice-coring and drilling equipment to meet the U.S. scientific community's long term field requirements, including replacement plans for active drilling systems;
- Drilling support of NSF projects in the Arctic, Antarctic, and in lower latitude ice-sheets and glaciers;
- Safety planning for fabrication and drilling operations;
- Environmental planning to mitigate and prevent adverse environmental impacts to the fragile ecological environments where most drilling will occur;
- Maintenance and operation of the Deep Ice Sheet Coring (DISC) drill.

If the IDDO is to be housed at an institution other than the location of the IDPO, then proponents must describe in their proposal the

administrative, scientific, and technical staff required; the available office environment; and any leveraged support services needed to ensure success of the IDDO. The proposal for the IDPO/IDDO will also be assessed on the quality of the management plan that must outline how development activities will be controlled using standard project management principles, including a demonstrated ability to use earned value management to oversee large development projects. The management plan must also include a description of a quality assurance program utilizing quantitative factors to document and enable systematic improvements to services provided. (See Section VI- Additional Review Criteria).

Table 1. Drilling Systems

1. 2-inch drill
2. 4-inch drill
3. Auger, Hand
4. Auger, Kovacs
5. Badger-Eclipse Drill
6. Blue Ice Drill
7. Chipmunk Drill
8. Deep Ice Sheet Coring (DISC) Drill
9. Electromechanical Drill
10. Intermediate Depth Drill
11. Koci Drill
12. Portable Hot Water Drill
13. Prairie Dog Drill
14. RAM Drill
15. Sidewinder Drive System
16. Winch, Logging

III. AWARD INFORMATION

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1
A single award for the establishment of an Ice Drilling Program Office (IDPO) and an Ice Drilling Development Office (IDDO) (through a subcontract arrangement if they are not at the same institution).

Anticipated Funding Amount: $ 3,750,000. The overall duration of the award from this solicitation will be five years with an anticipated funding level up to $ 3,750,000 per year pending availability of funds and depending on the drilling needs of the ice drilling community. Base level funding for support and drill system development and modification should not exceed $ 2,900,000 per year. Actual annual funding for the ice drilling enterprise will depend on activities outlined in the Annual Program Plan.

Since IDPO/IDDO provides support to many programs at NSF, if a new award requiring IDDO support is made during the year based on the submission of unanticipated, unsolicited proposal after the annual program plan has been submitted and the annual funding action has been released, additional funding for IDPO/IDDO will be handled as a supplement to the Cooperative Agreement by the NSF program funding the new award.

IV. ELIGIBILITY INFORMATION

Organization Limit:

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

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

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. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

The project description must contain the administrative, scientific, and technical staff required; the available office environment; and any leveraged support services needed to ensure success of the Ice Drilling Program Office. The proposal must describe the credentials of the proposing group, which must demonstrate expertise in ice drilling, committee organization, project management and oversight, interactive web site development, and the ability to interact with the academic research community. The proposal must include a management plan that outlines how development activities will be controlled using standard project management principles, including demonstrated ability to use earned value management (EVM) tools to help oversee both large and small development projects. The management plan must also include a description of a quality assurance program utilizing quantitative factors to document and enable systematic improvements to services provided. The project description should not exceed 20 pages in length.

A sample project cost/schedule document (to be submitted as a supplemental document) with sample cost/progress reports, and any other innovative project management tools that will be used by the proposing organization to track progress, actual expenditures (including Earned Value reporting) and assure success, will be reviewed as part of the proposal submission. This document must be included with the proposal or the proposal will be considered non-compliant.

For additional information, please be sure to carefully read Section II, "Program Description", and Section VI, "Additional Solicitation Specific Review Criteria" for specific proposal preparation information and instructions.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

C. Due Dates

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

  January 22, 2013

D. FastLane / Grants.gov Requirements

- For Proposals Submitted Via FastLane:

  Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are 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.

  Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

- For Proposals Submitted Via Grants.gov:

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding 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.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years (FY) 2011-2016*. 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 core strategies 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 provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the variety of learning perspectives.

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

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

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

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

1. What is the potential for the proposed activity to
    1. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    2. 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

Proposals will be assessed according to the credentials of the proposing group, which must demonstrate expertise and past accomplishments in ice drilling and the ability to develop new cutting-edge drilling technologies, as well as the ability to interact with the academic research community and industry, among others. This should include, but not be limited to, demonstrated ability in project management and oversight, advisory committee organization, interactive web site development and the ability to work with the academic research community and NSF to plan and implement successful field programs. A lead principal investigator must be designated that will have direct day-to-day involvement with these activities and who will serve as the point of contact for the Office of Polar Programs. The capability to provide office and meeting facilities for the project, including internet communication and teleconferencing capabilities, will also be assessed.

Proposals will also be assessed on the proponents' demonstrated abilities and knowledge of project management best practices, as evidenced by the quality of their management plan. The plan (or the proposal) must outline how development activities will be controlled using standard project management principles, including demonstrated ability to use earned value management (EVM) tools to help oversee both large and small development projects. Samples of any other innovative project management tools that will be used by the proposing organization to track progress and assure success will be assessed as part of the proposal submission.

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 formulate a recommendation to either support or decline each proposal. 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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, 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.

In all cases, 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 and 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.

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 letter, 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 letter; (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 letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

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

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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 at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after 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 that PI. 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 FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational), publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Other Reporting Requirements

The awardee will provide regular reports jointly with IDDO. The awardee will submit all required reports via FastLane using the appropriate reporting category; for any type of report not specifically mentioned in FastLane, the awardee will use the "Interim Reporting" function to submit reports. These reports may include:

a. IDPO/IDDO Strategic and Implementation Plan

b. Quarterly Progress Reports

c. Annual Progress Report (APR) and Annual Program Plan (APP)

The awardee will acknowledge the support of NSF on any signs identifying the IDPO/IDDO at its various locations. An acknowledgement of NSF support and disclaimer must appear in any publication of any material based upon or developed under this Cooperative Agreement using the following language: The IDPO/IDDO is sponsored by the National Science Foundation. Any opinions, findings and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation." (The preceding sentence may be omitted from scientific articles or papers published in scientific journals.). Also, support of other agencies or international contributors shall be acknowledged as appropriate.

D. Annual Reviews

In years two, four, and five a Virtual Site Visit or Reverse Site Visit (at the awardee's expense) will be convened to enable NSF staff to review the progress of IDPO/IDDO. In year three of the Award, NSF will convene an external review panel that will conduct a Site Visit to review IDPO/IDDO progress on activities described in the 5 year Strategic and Implementation Plan and Annual Program Plans as well as to review the collaborative integration of the organizations.

The level of continued NSF support will be negotiated with the awardee annually and will depend upon a review of progress through the annual site review, the NSF Program Officer's assessment of progress, and the availability of funds for the program. Additionally, NSF may request a site visit at any time to investigate activities conducted by the awardee under the auspices of the Cooperative Agreement.

Within a 2 year period following award of the Cooperative Agreement, the awardee may also be required to participate in a Business Systems Review (BSR), which is intended to evaluate the awardee business practices against government requirements, as well as to provide guidance on best practices.

E. Award Renewal/Recompetition

On or about March 1 in year 4 of the CA, NSF will conduct a Reverse Site Visit at NSF at the awardees' expense or a Virtual Site Visit using video-teleconferencing capabilities to determine whether or not to recompete the award or to ask the incumbents for a renewal proposal. Within 30 days of the review, NSF will inform the awardee if they will be invited to submit a renewal proposal. If a renewal proposal is to be submitted, then the proposal will be due at NSF on a date agreed upon by the cognizant NSF program manager and the awardee. If the awardee chooses not to submit a renewal proposal, NSF support for the project will be phased down over the year remaining in the term of the award and a new solicitation will be released. If the award is renewed for a second five year term NSF will determine at the end of that award whether or not the activity should be recompeted or renewed again.

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:

- Julie M. Palais, Program Director, Antarctic Glaciology, telephone: (703) 292-8033, email: jpalais@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service 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 Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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

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

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

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

- Location: 4201 Wilson Blvd. Arlington, VA 22230
- For General Information (NSF Information Center): (703) 292-5111
- TDD (for the hearing-impaired): (703) 292-5090
- To Order Publications or Forms:

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

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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