Ice Coring and Drilling Services for the Office of Polar Programs

Program Solicitation
NSF 08-555

National Science Foundation

Office of Polar Programs
Division of Antarctic Infrastructure and Logistics
Division of Antarctic Sciences
Division of Arctic Sciences

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

July 03, 2008

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Ice Coring and Drilling Services 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 core drilling activities. Current NSF ice coring programs include development of drill systems that can obtain ice-cores, embed instruments in the ice, carry out geophysical borehole logging, and provide access to the ice-sheet bed.

Specifically, proposals are requested for the establishment of a Scientific Drilling Support Office, which will provide scientific leadership and oversight of ice coring and drilling activities funded by NSF, and for an Ice Drilling Design and Operations Group, which will provide the engineering design support for new drilling systems as well as the operation and maintenance of existing systems. Interested parties can propose to manage the Scientific Drilling Support Office, to manage the Ice Drilling Design and Operations Group (which includes operation of the Deep Ice Sheet Coring (DISC) Drill) or both. The Scientific Drilling Support Office 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 Design and Operations Group to develop new drilling technologies as requested by the research community and funded by NSF. These entities will be expected to work closely together and to partner, as appropriate, with research groups in the submission of research proposals.

Through a close collaboration, the successful proponent(s) 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 from research proposals funded by the NSF, as well as collaborations with international partners. The ice-drilling support awardee(s) 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):

- Julie M. Palais, 755, telephone: (703) 292-8033, email: jpalais@nsf.gov

- Alexandra Isern, 755, telephone: (703) 292-7581, email: aisern@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 to 2 cooperative agreements. Either one award for both the establishment of a Scientific Drilling Support Office and a Ice Drilling Design and Operations Group or two separate awards for these activities will be made.

Anticipated Funding Amount: $3,750,000 The overall duration of awards from this solicitation will be five years with an anticipated funding level of up to $3,750,000 per year pending availability of funds and depending on the drilling needs of the ice core community. Base level funding for program support and drill system development and modification should not exceed approximately $2,900,000 per year. Should separate awards be made for the Scientific Drilling Support Office and the Ice Drilling Design and Operations Group, funds will be distributed according to predicted expenditures. Actual annual funding for both entities will depend on activities outlined in the Annual Program Plan submitted by the Scientific Drilling Support Office, which will include all activities of the Ice Drilling Design and Operations Group.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Proposals may be submitted by all U.S. organizations, including universities and colleges, non-profit, non-academic organization, or for-profit organizations. See Chapter I, Section E of the NSF Grant Proposal Guide (GPG) for specific definitions of these categories of proposers.

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/bfa/dias/policy/docs/grantsgovguide.pdf)

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **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):

  July 03, 2008

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.

TABLE OF CONTENTS

IX. **Other Information**

I. INTRODUCTION

Ice cores from polar ice sheets and mountain 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. These variables include atmospheric temperature, chemistry and composition; DNA; changing biota; micro-meteorites; and anthropogenically influenced compounds. Ice core records have provided essential data that has 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.

Since 1973 a contract for Polar ice drilling services has been awarded to groups who have 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. Groups that have managed ice-drilling services have primarily reacted to tasking from NSF while interactions with the research community were conducted on a more ad hoc basis. However, with recent expansion in the number and variety of drilling tools and experiments, it has become necessary to develop a new organizational model as outlined in this solicitation. At the core of this new model is a Scientific Drilling Support Office that will provide a direct link between the science community and an Ice Drilling Design and Operations Group, which will be charged with developing new drilling tools as well as with operating and maintaining current systems. This new structure will enable a more direct link between the research community, drilling designers, engineers, and the operators maintaining existing drilling equipment. Increased coordination will also help NSF better respond to community needs.

In order to increase the ability of NSF to react to changing needs of the research community, successful proposals from this solicitation will be awarded under cooperative agreement with NSF to support the drilling needs of NSF-funded researchers.

Current Projects

Early ice coring efforts used conventional oil-field technology to collect cores from Greenland and Antarctica. These methods proved to be time consuming. Cable-suspended electromechanical drilling developed in the 1960s improved coring capabilities and provided the basis for many of today's deep ice coring drills. These drills were used to collect the Camp Century core in Greenland and the Byrd ice core in Antarctica. Scientific results from these early cores were very influential, and fostered the development of modern analytical techniques now applied to ice core samples. Efforts through the 1980s focused on lightweight coring systems for shallow and intermediate depth cores.

Currently there are numerous systems available for drilling boreholes and for collection of ice cores. These include the Shot Hole Drill, also known as the Rapid Air Movement drill, which is designed for rapid drilling of holes suitable for collection of seismic data. Coring drills include: various types of hand augers; the 4-inch electromechanical drill, which is essentially a motorized version of the hand auger (an electrothermal version of this drill that melts an annulus around the core); the 3-inch Eclipse drill, a more sophisticated version of the 4-inch drill with a control system allowing improved control of depth, direction, as well as cutter and winching speed; the smaller and lighter 2-inch coring drill which has an outer barrel enabling operation in solid ice and firn; and hot water drills, which pump hot water to the drill head to increase penetration speed.

Recently much effort has gone into development of the DISC Drill, which is a tethered mechanical drill system capable of cutting and retrieving cores of ice to depths of 3,800 meters. The DISC drill was developed primarily for the West Antarctic Ice Sheet Divide (WAIS Divide) ice core project (http://www.waisdivide.unh.edu). Analysis of ice cores recovered by the drill will allow investigators to address a number of important questions about climate change, including the causes of abrupt climate change, the role of greenhouse gases in climate forcing, the stability of the West Antarctic ice sheet, and the role Antarctica plays in the global climate system. This will also be the first deep Antarctic ice core to explicitly include sampling for biological materials as part of the program's science plan.

The DISC drill system consists of several major subsystems:

- Drill Sonde - The sonde is the downhole portion of the drill system that cuts the ice. It consists of a cutting head, a core barrel in which the core is collected, a motor and transmission to drive the cutting head, a pump to circulate ice cuttings in the drill fluid through the sonde, screens to remove the chips from the fluid, an instrumentation/control section, an anti-torque section to stabilize the drill in the borehole, and barrels of rigid tubing to store ice cuttings and to house the other components. At the top it connects with the drill cable.
- Drill Cable - The cable is used to suspend the drill sonde in the borehole and to provide conduits for electrical power for the sonde and for communications between the sonde and the surface.
- Tower - The tower is a mast at the top of the borehole with a number of pulleys to allow the raising and lowing of the sonde and positioning the sonde for removal of the core.
- Winch - The winch provides the means of hoisting the drill from the hole.

- Drilling Fluid - The borehole fluid provides hydrostatic compensation, necessary to prevent closure of the borehole due to "glaciostatic" pressure of the surrounding ice.

There are also several other subsystems such as fluid handling, core handling, cutting removal, etc. that, although already operational, may over time require repair and/or modification to enhance the drill's performance.

Future Projects

While specific projects will be supported in response to peer reviewed proposals, many ice core drilling concepts have been developed at workshops and through other community-based planning activities. The following paragraphs describe some of these concepts.

Interest in sampling polar ice sheets and their sub-strata, without continuous coring, has been a topic of discussion for many years among glaciologists, geologists, 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 (http://scarsale.tamu.edu/archives/workshops/FASTDRILL.pdf/view). Such a drill would be able to rapidly drill boreholes approximately 8 cm in diameter through 3-4 km of ice in perhaps 6-8 days. One concept is the Coiled Tubing Drill for Ice (CTDI) that is similar to the latest coiled tubing (CT) drills used for commercial oil and gas development (http://salegos-scar.montana.edu/docs/Literaturedocs/access_drill_2col.pdf). CT drills use a metal or advanced-composite tube to deliver fluid downhole to a hydraulic motor that drives a cutting bit. This technique should permit drilling rates as great as 40 m/hr in polar ice. The drill would be mobile to some extent, but in a 3800-m configuration it would weigh tens of metric tons. Fast-access drilling system would facilitate: sampling of subglacial geology, investigating basal conditions and their control on ice sliding, measuring geothermal flux, accessing subglacial lakes, detecting life in deep ice and sediment, selecting sites for deep ice cores, geophysical logging, and ice rheology studies.

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 recovering 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-igbp.org/ipics/data/IPICS_drilling.pdf) and, although many of these requirements can be met with currently available technology, some will require the extension of current technologies or the development and testing of new ones. Some additional requirements and challenges that have been articulated include:

- The need to identify an acceptable, appropriate, inert drill fluid with no undesirable physical or chemical characteristics;
- The ability to successfully core and recover basal ice close to or at its pressure melting point in a deep, fluid-filled hole;
- The 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;
- The ability to acquire replicate ice samples at specific depths or intervals of interest;
- 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 research community and IPICS to develop these and other ideas and concepts further and to facilitate the advancement of ice core science.

II. PROGRAM DESCRIPTION

Statement of Work

Project Activities and Management

The Office of Polar Programs (OPP) at the National Science Foundation (NSF) requests proposals for the establishment of a Scientific Drilling Support Office, which will provide scientific leadership and oversight of ice coring and drilling activities funded by NSF, and for an Ice Drilling Design and Operations Group, which will provide the engineering design support for new drilling systems as well as the operation and maintenance of existing systems (including operation of the Deep Ice Sheet Coring (DISC) Drill). This solicitation allows for a single group to propose for both activities. The successful awardee(s) will be expected to demonstrate an in-depth understanding of current, state-of-the-art drilling technologies for recovery of ice-cores and must demonstrate the ability to successfully carry out drilling activities in varying mixtures of ice, rock, and sediment.

The Scientific Drilling Support Office 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 Design and Operations 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 and to partner, as appropriate, with research groups in the submission of research proposals.

Requirements for drilling activities and development of new drilling tools will, to a large degree, be derived from research activities funded by NSF (including activities with international partners). However, the successful awardee(s) will be expected to work closely with the research community to develop cutting edge ice core drilling technologies and shall partner, when appropriate, with researchers on the submission of proposals seeking funding for these developments. Furthermore, the successful group(s) 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(s) to establish project requirements and costs to be included in proposals submitted for review to NSF.

The awardee(s) will be expected to work within the cycle of OPP's grant award process. If NSF deems a project supportable, then the Scientific Drilling Support Office will be formally requested to devote its own resources and/or those of the Ice Drilling Design and Operations Group as appropriate to implement the activities outlined in the successful proposal. A primary activity will be to work with principal investigators to prepare a detailed project plan 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. Appropriate pre-deployment testing will be an expected part of each project plan for new drilling systems. Project plans will be incorporated into the annual ice-core drilling Program Plan to be produced by the Scientific Drilling Support Office .

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 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 liaise with the research community, NSF Program Managers, developers of ice-core instrumentation and downhole geophysical logging tools, as well as with relevant industry partners. Should two awards be made, one for the Scientific Drilling Support Office and one for the Ice Drilling Design and Operations Group, it is expected that these two awardees will collaborate closely to provide high quality drilling services to the research community as well as to identify and develop new drilling technologies.

Primary Activities

The sections below outline primary activities to be carried out by the Scientific Drilling Support Office and the Ice Drilling Design and Operations Group. These lists are not comprehensive but are provided to enable proposers to further formulate their management concepts of the entities(s) for which they are proposing. Should the Scientific Drilling Support Office and the Ice Drilling Design and Operations Group be awarded to different entities NSF expects close collaborations to occur between these two groups. This collaboration 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.

Scientific Drilling Support Office

The Scientific Drilling Support 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 roles 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 scientific oversight of projects directed to the Ice Drilling Design and Operations Group
- Interact with investigators during development of research proposals that require ice core drilling services

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 Scientific Drilling Support Office. Proposals will be assessed according to the credentials of the proposing group, which must demonstrate expertise in ice-core drilling, committee organization and management, interactive web site development, and the ability to interact with the academic research community. See Section VI 1 Additional Review Criteria.

Ice Drilling Design and Operations Group

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 (current drilling inventory can be found at http://usap.gov/proposalInformation/)
- 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 environmental impacts and prevent adverse environmental impacts to the fragile ecological environments where most drilling will occur
- Maintenance and operation of the DISC drill described above.

In addition to the items above, 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 Ice Drilling Design and Operations Group. Proposals will be assessed according to the credentials of the proposing group, which must demonstrate expertise and past accomplishments in ice-core drilling, for the ability to develop new cutting-edge drilling technologies, and the ability to interact with the academic research community and industry. See Section VI, Additional Review Criteria.

Proponents for the Ice Drilling Design and Operations Group will also be assessed on the quality of their 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.

III. AWARD INFORMATION

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1 to 2 cooperative agreements. Either one award for both the establishment of a Scientific Drilling Support Office and a Ice Drilling Design and Operations Group or two separate awards for these activities will be made.

Anticipated Funding Amount: $3,750,000 The overall duration of awards from this solicitation will be five years with an anticipated funding level of up to $3,750,000 per year pending availability of funds and depending on the drilling needs of the ice core community. Base level funding for program support and drill system development and modification should not exceed approximately $2,900,000 per year. Should separate awards be made for the Scientific Drilling Support Office and the Ice Drilling Design and Operations Group, funds will be distributed according to predicted expenditures. Actual annual funding for both entities will depend on activities outlined in the Annual Program Plan submitted by the Scientific Drilling Support Office, which will include all activities of the Ice Drilling Design and Operations Group.

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

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Proposals may be submitted by all U.S. organizations, including universities and colleges, non-profit, non-academic organization, or for-profit organizations. See Chapter I, Section E of the NSF Grant Proposal Guide (GPG) for specific definitions of these categories of proposers.

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 pubs@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/bfa/dias/policy/docs/grantsgovguide.pdf). 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 pubs@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.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

The following information supplements the standard GPG or NSF Grants.gov Application Guide proposal preparation guidelines:

The project description should not exceed 20 pages in length. Refer to Section II, Program Description, for specific proposal preparation information and instructions.

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

C. Due Dates

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

  July 03, 2008

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. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. 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 where they will be reviewed if they meet NSF proposal preparation requirements. 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 who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the 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.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional

criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals 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 diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- 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.

Additional Review Criteria:

Proposals will be assessed according to the credentials of the proposing group and their ability to successfully accomplish the activities listed within this solicitation. In addition, a lead principal investigator must be designated that will have direct day-to-day involvement with these activities. Office and meeting facilities must be available for the project, including Internet communications capabilities and institutional meeting space necessary to conduct required activities.

In addition, proponents for the Ice Drilling Design and Operations Group will also be assessed on the quality of their 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.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by 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 Federal Demonstration Partnership (FDP) 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/general_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@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.

Failure to provide the required annual or final project reports 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 awardee(s) will be expected to submit quarterly interim progress reports. In lieu of a fourth quarter report, an Annual Report will be submitted by the awardee to the cognizant NSF Program Officer. This report will document past progress over the previous annual reporting period and will also include the annual Program Plan to be submitted in July for the following fiscal year of support. NSF will provide the format for these reports within one month of the award date. Should two awards be made, one for the Scientific Drilling Support Office and one for the Ice Drilling Design and Operations Group, these two awardees shall submit individual reports, but these reports must be developed in collaboration so that, when viewed together, they provide a comprehensive summary of U.S. ice core drilling activities. NSF reserves the right to initiate annual site reviews of the awardee(s).

The successful awardee(s) must demonstrate the capability to provide NSF with sound long-range planning for ice-drill development and use. Specifically, the Scientific Drilling Support Office in collaboration with the Ice Drilling Design and Operations Group must prepare, and annually update, a comprehensive five-year plan for ice-drill development 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 liaise with the research community, NSF Program Officers developers of ice-core instrumentation and downhole geophysical logging tools, as well as with relevant industry partners.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Julie M. Palais, 755, telephone: (703) 292-8033, email: jpalais@nsf.gov
- Alexandra Isern, 755, telephone: (703) 292-7581, email: aisern@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, MyNSF (formerly the Custom News Service) 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 Regional 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. MyNSF also is available on NSF's Website at http://www.nsf.gov/mynsf/.

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 40,000 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 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: pubs@nsf.gov

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records, " 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

Suzanne H. Plimpton
Reports Clearance Officer
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749