Arctic Research Opportunities

PROGRAM SOLICITATION
NSF 05-618

REPLACES DOCUMENT(S):
NSF 05-514

National Science Foundation

Directorate for Geosciences
Division of Polar Programs

Full Proposal Target Date(s):

December 16, 2005

November 10, 2006 and November 10th each year thereafter.

IMPORTANT INFORMATION AND REVISION NOTES

Single Annual Competition Target Date
The Arctic Sciences Section will hold a single competition annually for each of its programs. In 2005 the Target Date for proposals is December 16th. In 2006 and each year thereafter the Target Date will be November 10th. Other announcements of opportunity may occur for particular initiatives.

Prior Approval Required to Submit a Proposal after the Target Date
Target Dates allow program officers to accept proposals after the appointed date has passed. To submit a proposal after the Target Date, the principal investigator must receive approval from the cognizant program director prior to the Target Date. Proposals submitted after the Target Date without prior approval of the program director may be returned without review.

Bering Ecosystem Study (BEST)
Under this solicitation, proposals may be submitted for research addressing goals of the Bering Ecosystem Study. See the full text of this solicitation for details.

International Polar Year
The international community of polar researchers and funding agents are planning for an International Polar Year (IPY) to take place March 2007-March 2009. Proposals may be submitted to this Arctic Opportunities solicitation for IPY activities that are consistent with program goals described in this solicitation and with National Academy of Science guidelines for IPY (http://www.us-ipy.org/). See the full text of this solicitation for details.

A planned U.S. Navy Ice Camp on the Arctic Ocean in 2007 may be an opportunity for researchers. See the Program Description, Section II, Additional Opportunities, for more details about proposing to use the Navy Ice Camp.

Compliance with Environmental Policies is addressed in Section V, Proposal Preparation instructions. Both NSF and grantees have responsibilities for compliance with federal, state and local environmental regulations.

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Arctic Research Opportunities
Arctic Natural Sciences; Arctic Social Sciences; Arctic System Science; Arctic Observing Network

Synopsis of Program:

The National Science Foundation (NSF) invites investigators at U.S. organizations to submit proposals to conduct research in the Arctic including field and modeling studies and data analysis. Arctic research is supported at NSF by the Office of Polar Programs (OPP), Arctic Sciences Section (http://www.nsf.gov/div/index.jsp?div=ARC), in the Office of the Director, as well as by a number of other programs within the Foundation.

The goal of the NSF Arctic Sciences Section is to gain a better understanding of the Earth's physical, biological, geological, chemical, social and cultural processes, and the interactions of ocean, land, atmosphere, biological, and human systems in the Arctic. The Arctic Sciences Section and other NSF programs support projects that contribute to the development of the next generation of researchers and scientific literacy for all ages through education, outreach and broadening participation in science, technology, engineering and mathematics. Program

representatives from OPP and other NSF programs that support arctic research coordinate across NSF, including joint review and funding of arctic proposals and mutual support of special projects with high logistical costs.

Planning is underway for the International Polar Year 2007-2009, with NSF designated as the lead agency for the U.S. Proposals may be submitted to the Arctic Opportunities solicitation for International Polar Year activities, as outlined in the National Academy of Science vision document (http://www.us-ipy.org), and should be consistent with the program descriptions and requirements described in the Arctic Opportunities solicitation.

The Bering Ecosystem Study (BEST) is a comprehensive research program that has been in development for many years (http://www.arcus.org/bering). Proposals to the Arctic Opportunities solicitation that address BEST research goals and that meet descriptions and requirements of programs described in the Arctic Opportunities solicitation are appropriate.

The Arctic Research Opportunities solicitation provides investigators with information about available programs and priorities to determine the program best suited to their proposed work. Proposals should be written and planned in accordance with NSF's Grant Proposal Guide (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg), OPP's Guidelines and Award Conditions for Scientific Data (OPP 9-91 available on the OPP website http://www.nsf.gov/dir/index.jsp?org=OPP) and the Principles for Conduct of Research in the Arctic (http://www.nsf.gov/od/opp/arctic/conduct.jsp).

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.

- Marie H. Bundy, Biology & Medicine Associate Program Manager, 755 S, telephone: (703) 292-7418, fax: (703) 292-9079, email: mbundy@nsf.gov
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- Jane V. Dionne, Arctic Natural Sciences Program Director, 755 S, telephone: (703) 292-7427, fax: (703) 292-9082, email: jdionne@nsf.gov
- Janet Intrieri, Arctic System Science Associate Program Manager, 755 S, telephone: (703) 292-4426, email: jintrier@nsf.gov
- Anna M. Kerttula, Arctic Social Sciences Program Director, 755 S, telephone: (703) 292-7432, fax: (703) 292-9082, email: akerttul@nsf.gov
- Simon N. Stephenson, Arctic Research Support and Logistics Program Director, 755 S, telephone: (703) 292-7435, fax: (703) 292-9082, email: sstephen@nsf.gov
- Neil R. Swanberg, Arctic System Science Program Director, 755 S, telephone: (703) 292-8029, email: nswanber@nsf.gov
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Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.050 --- Geosciences

Award Information

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

Estimated Number of Awards: 80 to 100 per year, pending availability of funds.

Anticipated Funding Amount: $16,000,000 per year approximately, pending availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- U.S. Organizations

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

Letters of Intent: Not required

- **Preliminary Proposal Submission:** Not required
- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from the standard NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

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 Target Date(s)**:

  December 16, 2005

  November 10, 2006 and November 10th each year thereafter.

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

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

TABLE OF CONTENTS

I. INTRODUCTION

The Arctic Sciences Section in the Office of Polar Programs (OPP) supports scientific research in the arctic region and related research and operational support. Science programs are suitable for disciplinary, multidisciplinary and broad, interdisciplinary investigations directed toward both the Arctic as a region of special scientific interest and a region important to the global system. Models indicate that the Arctic is among the regions most sensitive to environmental change. Climate records and human settlement spanning thousands of years, as well as vast landscapes and partially ice-covered oceans, provide a unique basis for integrated research on global systems and human adaptation.

OPP disciplinary interests appropriate to the Arctic Natural Sciences program encompass the atmospheric, biological, physical, earth, and ocean sciences. A broad spectrum of social sciences research is funded through the Arctic Social Sciences program. The Arctic System Science program provides the unique opportunity for interdisciplinary investigations of the Arctic as a system. OPP also encourages research relevant to both polar regions, especially glaciology, permafrost, sea ice, oceanography, ecology, and aeronomy. The integration of research with education is consistent with NSF's merit review criteria and is encouraged by OPP in proposals to the research programs. Projects may seek funding for pilot projects linking research with education through the Arctic Research and Education program. Arctic research projects that partner with schools, students (K-12 and higher), and communities in the North and that improve the public's understanding of science and basic research are strongly encouraged.

The Foundation is one of twelve Federal agencies that sponsor or conduct arctic science, engineering, and related activities. As mandated by the Arctic Research and Policy Act of 1984, Federal interagency research planning is coordinated through the Interagency Arctic Research Policy Committee (IARPC), which is chaired by NSF.

The United States Arctic Research and Policy Act of 1984 defines the Arctic as all areas north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas including the Arctic Ocean and the Beaufort, Bering, and Chukchi seas; and the Aleutian chain. Field projects falling outside these boundaries but directly related to arctic science and engineering conditions, or issues, such as laboratory and theoretical studies, may also be appropriate; OPP recommends contacting the program director to verify the appropriateness of the proposed study before preparing a proposal.

Because the Arctic is the homeland of numerous Native peoples, special attention must be given to all aspects of research and education that may potentially impact their lives. An interagency statement of "Principles for the Conduct of Research in the Arctic" has been developed. All arctic research grantees are expected to abide by these principles, which can be found at http://www.nsf.gov/od/opp/arctic/conduct.jsp. Researchers may find helpful information in the "Guidelines for Improved Cooperation between Arctic Researchers and Northern Communities" at http://www.arcus.org/guidelines.

The Study of Environmental ARctic CHange (SEARCH) is an interagency effort to study changes occurring in the arctic system (http://www.arcus.org/SEARCH/index.php). NSF is among the agencies contributing to this effort, which is also gaining support as a major international effort as the International Study of Arctic Change (ISAC). SEARCH themes supported by the Arctic Sciences Section will be guided by the research community through avenues such as the SEARCH Science Steering Committee, the SEARCH Open Science Meeting and the SEARCH Implementation Workshop held in May 2005. The Arctic Sciences Section has funded components of SEARCH research through special announcements of opportunity and expects to continue supporting the development of SEARCH through special announcements and through this program solicitation, depending on the availability of funds.

The community of international scientists is planning the fourth International Polar Year (IPY) to take place March 2007-March 2009. SEARCH and its international extension, the International Study of Arctic Change (ISAC; http://www.aosb.org/isac.html), are important research emphasis areas to be addressed during IPY. More information about IPY can be found at http://www.ipy.org and http://www.us-ipy.org. A special solicitation for IPY proposals is anticipated to be available from OPP in fall/winter 2005.

In fiscal year 2004 NSF spent $94.7 million on awards for Arctic science, education, and infrastructure projects. Of this, $74.9 million was from the OPP Arctic Research Program. This annual investment includes funds for field logistics support, continuing grant increments and new awards. Information for FY2005 will be available in summer 2006.

II. PROGRAM DESCRIPTION

This section provides detailed information and descriptions of the following programs, emphasis areas and special research opportunities:

A. Arctic Natural Sciences Program

B. Arctic Social Sciences Program

C. Arctic System Science Program

D. Arctic Research Support and Logistics Program

E. Arctic Cyberinfrastructure and Sensors Emphasis Area

F. Arctic Research and Education Program

G. Bering Ecosystem Study (BEST)

H. International Polar Year (IPY)

The descriptions below should help guide investigators in determining the appropriate program for their proposals. In addition, please consult the full text of this announcement for further information on proposal preparation, field work, data management, review criteria, award conditions and other pertinent information.

A. Arctic Natural Sciences Program

The Arctic Natural Sciences (ANS) Program provides core support for disciplinary and interdisciplinary research on arctic processes

and coordinates its support of arctic research with the Directorates for Geosciences, Mathematical and Physical Sciences, Social and Behavioral, and Biological Sciences. Upper atmospheric and space physics proposals often are considered jointly with the Division of Atmospheric Sciences in the Geosciences Directorate and with OPP's Antarctic Aeronomy and Astrophysics Program when conjugate studies are proposed.

Areas of special interest include marine and terrestrial ecosystems, arctic atmospheric and oceanic dynamics and climatology, arctic geological and glaciological processes, and their connectivity to lower latitudes. The Program particularly encourages proposals that treat uniquely arctic processes and that provide hypothesis testing required to produce the understanding needed to develop predictive tools based on first principles. Proposals to perform monitoring *per se* are discouraged.

ANS supports projects that emphasize understanding the adaptation of organisms to the unique aspects of the arctic environment. Terrestrial and marine geology and geophysics projects of greatest interest are those that will improve our ability to interpret the geologic record of environmental change in the Arctic, particularly during the Quaternary. Understanding the processes responsible for the evolution of permafrost and consequences of changing permafrost remains a priority, as well. Projects that focus on the history and dynamics of all naturally occurring forms of arctic snow and ice, including seasonal snow, glaciers, and the Greenland ice sheet, are encouraged. The Program supports ocean science projects that advance knowledge of the processes of the Arctic Ocean and adjacent seas and their interactions with their boundaries.

B. Arctic Social Sciences Program

The OPP Arctic Social Sciences Program (ASSP) encompasses all social sciences supported by NSF. These include, but are not limited to anthropology, archaeology, economics, geography, linguistics, political science, psychology, science and technology studies, sociology, traditional knowledge and related subjects.

Although proposals in any of the social sciences mentioned above are welcome, areas of particular interest include culture and environment, resources and economic change, development of social and political institutions, ethnic (cultural) and regional identities, and knowledge systems. These five research areas are identified and explained in the report, *Arctic Social Sciences: Opportunities in Arctic Research* (Arctic Research Consortium of the United States, June 1999, Fairbanks, Alaska; available for download at http://www.arcus.org/ASSP/1999_report.html).

The Arctic Social Sciences Program especially encourages projects that are circumpolar and/or comparative; involve collaborations between researchers and those living in the Arctic; or form partnerships among disciplines, regions, researchers, communities, and/or students (K-12, undergraduate, or graduate).

Dissertation research proposals are accepted by the Arctic Social Sciences program. Please consult the "Dissertation Panel Advice to Students" guidelines in the Division of Behavioral and Cognitive Sciences (DBCS; http://www.nsf.gov/sbe/bcs/anthro/cultdadv.jsp). These guidelines are to provide the applicant with a basic outline for their proposals. Applicants should apply to this OPP solicitation and talk to the ASSP program director about funding limits, which vary from those in DBCS.

Projects involving research with human subjects must ensure that subjects are protected from research risks in conformance with the relevant federal policy known as the Common Rule (*Federal Policy for the Protection of Human Subjects*, 45 CFR 690). Advice is available at http://www.nsf.gov/bfa/dias/policy/guidance.jsp.

The Arctic Social Sciences Program considers joint review and funding within OPP, with other NSF programs, other agencies and international efforts when appropriate. Researchers interested in linguistics are encouraged to examine the announcement of opportunity on Documenting Endangered Languages (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05590&org=NSF) released to support projects to develop and advance knowledge concerning endangered human languages. The DEL program is interested in proposals from arctic researchers for work during the International Polar Year. Special funding opportunities may also be available through the Human Dimensions of the Arctic (HARC) component of the Arctic System Science (ARCSS) Program (see below).

NSF is collaborating with the European Science Foundation's program "BOREAS: Histories from the North – environments, movements, narratives" (http://www.esf.org/boreas). Please contact Anna Kerttula at akerttul@nsf.gov or 703-292-8029 for more information.

C. Arctic System Science (ARCSS) Program

The Arctic comprises a complex, tightly coupled system including air, ice, ocean, land and people. The arctic system behaves in ways that we do not understand fully and has demonstrated the capacity for rapid and unpredictable change with global ramifications. Because the Arctic is pivotal to the dynamics of our planet, it is critical that we understand this complex and interactive system. The goal of the Arctic System Science (ARCSS) program is to answer the following question:

What do changes in the arctic system imply for the future?

To address this question ARCSS must:

- Advance from a component understanding to a system understanding of the Arctic.
- Understand the behavior of the arctic system, past, present, and future.
- Understand the role of the Arctic as a component of the global system.
- Include society as an integral part of the arctic system.

Building on a solid foundation of over a decade of observation, modeling, and process studies, the ARCSS program is entering a synthesis-driven enterprise aimed at achieving system level understanding of the Arctic. This may well include some of the kinds of component level studies carried out before, but successful proposals will focus much more on the relationships amongst the pieces of the system than on the pieces themselves and priorities will be set by the needs of the program in understanding the system. ARCSS will focus on achieving that system understanding. The ARCSS program will:

- Integrate modeling, observational, process, and paleoenvironmental studies.
- Develop a hierarchy of conceptual and quantitative models of the arctic system.
- Identify the most sensitive components and interactions driving arctic system behavior.
- Refine understanding of these key components and interactions.
- Strengthen the interactions between arctic system research and the broader Earth system science.
- Enhance two-way communication with stakeholders, decision-makers, and the public.

ARCSS Structure and Focus

In recent years ARCSS had four active, more-or-less disciplinary components: Ocean/Atmosphere/Ice Interactions (OAII); Land/Atmosphere/Ice Interactions (LAII); Human Dimensions of the Arctic System (HARC), and Paleoenvironmental Arctic Sciences (PARCS), under which research activities were developed. PARCS proposals were considered within the Earth System History

competition of the United States Global Change Research Program solicited under a different NSF announcement with separate submission dates.

Since then the ARCSS program has undergone a major transition, led by the research community, away from these somewhat multidisciplinary organizing principles toward a new program that is integrated, more synthetic and truly interdisciplinary. Efforts will continue to extract as much as possible from research already performed and to capture the knowledge and experience achieved under these components. Replacing the disciplinary components will be a more pro-active ARCSS committee that will guide the system level thinking of the program, strive to develop more extensive connections to a broader array of disciplines for new ideas, and devote considerable attention to fostering ARCSS research efforts during their full life cycle from inception of idea through archival of data, synthesis of results and communication of them to the community and public.

The ARCSS program supports most of its research through special targeted announcements developed in close cooperation among NSF, the ARCSS research community and the ARCSS committee. However ARCSS does support a small number of proposals received through this program solicitation. Proposals to this solicitation should put forth new ideas or efforts that do not fit well under more organized banners and that are smaller in scope than one might find in the specialized announcements of opportunity. Just as any ARCSS proposal, these proposals must focus on advancing our knowledge of the arctic system as a whole. Moreover, with the exception of proposals that were specifically encouraged by a panel and by NSF to resubmit as filling an essential gap in a particular ARCSS effort, this program solicitation should not be viewed as a mechanism to re-submit proposals that were declined in a targeted announcement, because those efforts are assembled as a package.

Information describing the current thinking in the ARCSS program is available on the ARCSS web site (http://www.arcus.org/ARCSS/index.html) and via links therein. Future special announcements for funding opportunities in ARCSS will draw on and aggregate ideas presented in more than one individual disciplinary science plan. ARCSS is working proactively with its constituent communities to develop new ideas.

Synthesis in ARCSS

The arctic system includes physical, chemical, geological, biological, and cultural factors that respond to global change processes. Some models that predict the climatic response to global change show greater change in the Arctic than any other region. The predicted climatology, however, may not consider the largely unknown interannual to centennial variability in the Arctic. The historical and current human occupation of and dependence on resources in the Arctic, a region subject to possibly large environmental perturbations, makes it important that scientists understand better the interactions of the global and arctic systems. Therefore, the research supported in ARCSS extends beyond purely observational studies to those studies that predict and analyze the consequences of environmental variability and global change important to wise stewardship of renewable resources and development of decision and policy options for resource managers and residents.

To achieve this, ARCSS supports efforts that synthesize knowledge of how the arctic system works, including focus on the linkages between parts of the system, and better articulation of the implications for the future. In general the program is trying to concentrate on understanding the relations among the components of the system and leaving the detailed studies at the subcomponent level to other, more disciplinary programs.

Defining an ARCSS Proposal

The interdisciplinary nature of system science can make it difficult to determine whether a proposal is or is not suitable for the ARCSS program. A good rule of thumb is if a proposal is focused on some piece of the system, then it is probably not a good fit to ARCSS, unless the understanding to be achieved about that piece is demonstrably essential to system-level understanding. A proposal suitable for competition in the ARCSS program will normally be expected to:

- Have a direct connection to and be essential to success of the ARCSS effort,
- Fill a significant gap in our understanding of the arctic system that has been identified by the ARCSS synthesis,
- Determine or investigate the important relations amongst components of the arctic system,
- Help explain the range of states for the arctic system, or
- Contribute significantly to our understanding of the structure and function of the arctic system through synthesis and further study.

To be successful, a proposal to the ARCSS program should have several or all of the above characteristics. Moreover ARCSS proposals MUST define explicitly and in detail how they contribute to broad system understanding. Failure to do so will result in the return of a proposal without review. The degree to which a proposal contributes to system understanding will be one of the key factors in judging its intellectual merit.

As defined by the ARCSS Committee, a good ARCSS project (either an individual proposal or set of proposals):

1. Demonstrates explicitly how the components and their interactions (or processes) DRIVE the arctic system.
2. Explicitly incorporates synthesis into the design of the project (as an intrinsic part of the project).
    1. Integrates each part of the project internally.
    2. Integrates into the arctic system (through analysis and synthesis).
3. Has a broad and/or significant impact on understanding the arctic and earth system.
4. Includes innovative (or tried and true) approaches for data management and transfer, including value-added products.

D. Arctic Research Support and Logistics Program

The Arctic Research Support and Logistics (RSL) program will accept proposals that:

- Support long-term observations of the Arctic,
- Support the acquisition of data sets useful to a broad segment of the arctic research community,
- Will lead to Cooperative Agreements to operate multi-use arctic research facilities, or
- Provide services that broadly support the arctic research community, such as facilitating communication, development of research ideas in an arctic-wide community setting, and cooperation with arctic communities.

Long Term Observations

The Arctic Research Support and Logistics (RSL) program will accept proposals that seek to establish or maintain long-term observation data sets. They should be justified in the context of providing critical data to regional or global modeling efforts and/or as a framework for process studies. Investigators are encouraged to show strong community support for these measurements and mechanisms to engage the stakeholders in providing guidance on the collection of the datasets. If appropriate, reference should be made to how the proposed activity fits into the SEARCH implementation plan (see the SEARCH web site for more information http://www.arcus.org/SEARCH/index.php). Development of robust instrumentation approaches is encouraged and these can be developed in conjunction with support from the Arctic Cyberinfrastructure and Sensors (CIS) effort described below. Data sets from

Long-Term Observatories are expected to be made publicly available immediately upon collection.

Data Acquisitions or Collection

The RSL program will accept proposals that:

- Support the acquisition of satellite and airborne imaging and mapping data and the production and dissemination of user-friendly data products that will be made available to the NSF research community.
- Support aspects of collecting underway data from ships. This includes documentation, quality control and archiving. Proposals need not address all possible data streams, but they should address the end-to-end management of any covered data stream to the point that data are suitable for acceptance into an appropriate archive. Researchers are required to develop a website or alternative venue that advertises the existence of the data, and how the data can be obtained. Researchers wishing to propose an underway data project are encouraged to review the posted correspondence that is available on the AICC website (http://www.unols.org/committees/aicc/). It is envisioned that proposals may be received to cover the acquisition of multibeam and other bathymetric data, acoustic Doppler current profiler data, and meteorological data.
- Develop components of geospatial information infrastructure to benefit the arctic research community. The Arctic GIS website hosted by the Arctic Research Consortium of U.S. (ARCUS; http://www.arcus.org/gis) contains information about meetings, workshops, initiatives and links to data and information about arctic geospatial information infrastructure.

Facility Operations

The RSL program will accept proposals for the operation of new or existing research facilities that support NSF-funded projects. If successful, awards are expected to be made as cooperative agreements. Proposals should show the range of projects and programs supported by the proposed facility.

The proposal should also show the facility's approach to project planning, how decisions are made on project support plans, the approach to project support in a research and polar environment (both of which tend to force adaptation of plans), how the facility solicits user feedback and how that feedback is evaluated and leads to organizational change.

Field Work

The RSL program supports field components of research funded by the Arctic Sciences Section, other directorates at NSF and occasionally other federal agencies. Support includes, but is not limited to, providing transportation, food and shelter while conducting field work, user and day-rate fees at field camps, salaries of staff hired specifically for field work, activities such as travel to coordinate projects with permitting agencies and local communities. More detailed information is available on the RSL web site (http://www.nsf.gov/od/opp/arctic/res_log_sup.jsp).

Access to logistical support from the RSL program is through the regular proposal process. For information regarding field support for proposals with field components, please see the *Proposal Preparation and Submission Instructions* below.

E. Arctic Cyberinfrastructure and Sensors Emphasis Area

The goal of the Arctic Cyberinfrastructure and Sensors (CIS) emphasis area is to enable the development of both sensors and links in an arctic-wide network of multidisciplinary, integrated sensors, connecting to potential users via the Internet.

The term *cyberinfrastructure* was explicated in the 2003 NSF report *Revolutionizing Science and Engineering Through Cyberinfrastructure* (http://www.nsf.gov/cise/sci/reports/toc.jsp): “The base technologies underlying cyberinfrastructure are the integrated electro-optical components of computation, storage, and communication that continue to advance in raw capacity at exponential rates. Above the cyberinfrastructure layer are software programs, services, instruments, data, information, knowledge and social practices applicable to specific projects, disciplines, and communities of practice. Between these two layers is the ***cyberinfrastructure*** layer of enabling hardware, algorithms, software, communications, institutions and personnel. This layer should provide an effective and efficient platform for the empowerment of specific communities of researchers to innovate and eventually revolutionize what they do, how they do it, and who participates.”

The 2004 NSF program solicitation for Sensors and Sensor Networks (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05526) discusses sensor development at length. These discussions are relevant to the development of sensors and sensor networks for the Arctic. Within these contexts and specific to the Arctic, CIS will focus on the research required to create new, more capable sensors of physical, biological or chemical variables in the ocean, ice and air, as well as the methodologies to enable such measurements to be made from fixed arrays or autonomous platforms and captured or transmitted.

A natural tie exists between the CIS emphasis area and the RSL program; as a rule of thumb, CIS should be the recipient of proposals that address forefront research issues in the development of novel sensors or instruments. Conversely, proposals for long-term observations in the Arctic using more established means should be submitted to the RSL Program. Because development efforts may be a part of proposals to the ANS, Arctic Social Sciences and ARCSS Programs, such proposals will be jointly reviewed and joint funding may result for successful proposals.

F. Arctic Research and Education Program

The integration of scientific research with science education and outreach is important to the Office of Polar Programs. Investigators are encouraged to include education activities in their research proposals in accordance with the Broader Impacts review criterion. The Arctic Research and Education program supports activities that bridge research and education in the arctic sciences. The goals of the program are to:

- Promote science literacy and widespread understanding of polar research,
- Increase diversity in the (polar) sciences,
- Contribute to improved K-12 science instruction,
- Attract and retain students in Science, Technology, Engineering and Mathematics fields, and
- Develop long-term collaborations between arctic research and science education.

Proposals to this program may include formal or informal education for students K-12 and higher or to the broader public. Awards can be supplements to existing research grants and agreements or proposals for new ventures. Award sizes vary but are typically $5,000-50,000. This program is appropriate to pilot new project ideas that, once developed, may evolve into education efforts that can compete for long-term support in other programs at NSF and elsewhere. In addition, the Arctic Research and Education program seeks to collaborate with other directorates at NSF to promote the integration of research and education. Examples of projects that have received support from this program are:

- Alaska Lake Ice and Snow Observatory Network (ALISON; http://www.gi.alaska.edu/alison/)
- Teachers and Researchers Exploring and Collaborating (TREC; http://www.arcus.org/TREC/index.php)

- Sustainability and Stewardship in Alaska (http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0331261)
- Bridging the Poles Workshop (http://www.ldeo.columbia.edu/~mkt/PolarED_Web.htm)
- Science Journalists at Toolik Field Station (http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0425045)

G. Bering Ecosystem Study (BEST)

The Arctic Sciences Section has been working with the arctic research community and residents of the Arctic to develop a comprehensive approach to research in the Bering Sea. The Bering Sea Ecosystem Study (BEST; http://www.arcus.org/bering/) is the result of several years of planning for research beginning in 2005. The eastern Bering Sea supports highly productive marine ecosystems. The resources of the area include vast numbers of marine birds and mammals - including federally protected species - and productive commercial stocks that generate more than 50% of all fish and shellfish landings in the United States. The Bering Sea is also directly or indirectly the source of over 25 million pounds of subsistence foods used by nearly 55,000 local residents, primarily Alaska Natives in small rural communities. The Alaska Native communities have strong local cultural ties to the Bering Sea and a history of adaptation to changes in the associated ecosystem. As the system responds to external forcing, its ability to support the resources on which people depend may change.

Recent changes in the marine ecosystems of the eastern Bering Sea, in many cases, have been correlated with physical variability. As this dynamic region undergoes transition, an understanding of the underlying processes responsible for these ecosystem responses is needed to provide the basis for good stewardship. The United States Arctic Research Commission has noted both the need for "...process studies to illuminate the interactions between environmental variables and the ecosystem..." and the present "...absence of emphasis on the ability to predict change in the Bering Sea system..." (http://www.arctic.gov/files/USARCReportOnGoals2005.pdf). This solicitation for proposals is an effort to address these deficiencies in our understanding of the Bering Sea ecosystem.

The Arctic Sciences Section seeks proposals focused on the ecosystem of the eastern shelf of the Bering Sea addressing one or more aspects of the following coupled themes:

- How are global and regional climate processes linked to the physical oceanography of the eastern Bering Sea?
- How does variability in the physical aspects of the marine system affect ecosystem processes and structure?
- How will changes in climate affect the productivity and sustainability of the marine ecosystems of the eastern Bering Sea?
- In what ways are social and economic systems that rely on the eastern Bering Sea vulnerable to the spatial and temporal scales of variation in climate and ecology envisioned?

For the purposes of this section of the Arctic Opportunities solicitation, the eastern Bering Sea shelf is considered to be the shelf region from the Aleutian Islands northward to St. Lawrence Island that lies within U.S. waters. The seasonal sea ice cover of the eastern Bering Sea shelf, a dominant characteristic of this region's oceanographic environment, has a significant influence on the shelf ecosystem. Recent changes in the timing and extent of this ice cover appear to be occurring on decadal or longer time scales and correlated with climate variability. This solicitation calls for proposals to understand the effects of a varying sea ice cover on the shelf ecosystem, to project the potential changes in response to anticipated climate variations on decadal time scales, and to assess the vulnerability of the local communities to such changes. Proposals may include, among others, retrospective analyses, process studies, and synthesis studies. These may include, but are not limited to, some or all of the following approaches: observational cruises, moorings, satellite studies, social science surveys, and model development. Studies may address changes in the processes across a range of latitudes or focus on a narrower region of the shelf. Funded proposals will be coordinated by the Arctic Sciences Section and the research team of principal investigators to make best use of available logistics resources and address science goals creatively and deliberately.

Particular emphasis should be placed on understanding how the shelf ecosystem (including human societies) responds to climate change. This section of the solicitation draws on the community planning embodied in the BEST science plan (http://www.arcus.org/Bering/science_plan.html), sustaining the Bering Ecosystem: a Social Sciences Plan (http://www.arcus.org/Bering/hbest/index.html), and the draft BEST implementation plan (http://www.arcus.org/Bering/oiw/best_workshop_05.html); however, this section of the Arctic Opportunities solicitation to address BEST goals should not be considered a replacement for, or the full implementation of, any of these plans. The research efforts resulting from this section of the solicitation are expected to be a partial contribution to the interagency Study of Environmental Arctic Change (SEARCH) (http://www.arcus.org/SEARCH/index.php) and the international Ecosystem Studies of Sub-Arctic Seas program (http://www.pml.ac.uk/globec/structure/regional/essas/essas.htm).

The proposals funded under this section of the Arctic Opportunities solicitation are expected to comprise an integrated program. To ensure a high degree of cross-project collaboration and coordination, the geographical extent of the eastern Bering Sea to be studied has been deliberately limited. It is not a requirement of the final program that it encompass the full extent of this limited area. The intent is to have projects co-locate and investigate ecosystem processes in this region collaboratively, but with the larger goal of understanding how interactions and linkages in other arctic shelf regions may respond to climate variability. Proposals should include specific explanation of how the proposed research contributes to such systems-level understanding.

The projects funded under this solicitation will be NSF's contribution to a broader, multi-agency interest in the Bering Sea ecosystem. It is expected that these projects will create synergies with programs funded by other agencies interested in processes over the eastern Bering Sea shelf, such as NOAA's North Pacific Climate Regimes and Ecosystem Productivity program (NPCREP) and the North Pacific Research Board's ongoing activities, and effectively utilize the large and excellent data sets that have been collected for many years, during such programs as the Processes and Resources of the Bering Sea study (PROBES), the Outer Continental Shelf Environmental Assessment Program (OCSEAP), and the Fisheries Oceanography Coordinated Investigations (FOCI). NSF's priority for BEST is development of the understanding necessary to predict the responses of the physical environment and ecosystem of the Bering Sea to projected climate change and the vulnerability of these systems, including their human dimensions.

Proposals addressing BEST goals should be submitted to the Arctic Natural Sciences program, which will coordinate management of the review process. See proposal Section V., Proposal Preparation and Submission Instructions and Section VII., B. and C., Award Conditions, for further details on submitting proposals for BEST.

H. International Polar Year (IPY)

The international community of polar researchers and funding agents has begun planning for an International Polar Year (IPY) to take place March 2007-March 2009 (see http://dels.nas.edu/us-ipy and http://www.ipy.org/).

A special solicitation for IPY is anticipated to be released from OPP in fall 2005 requesting proposals for specific science and education themes. One of these themes is anticipated to be furthering the Study of Environmental ARctic CHange (SEARCH) program (http://www.arcus.org/SEARCH/index.php) through development and implementation of a circumarctic observation system. The SEARCH Science Steering Committee convened the SEARCH Implementation Workshop in May, 2005. The implementation report from that workshop is available on the SEARCH website and highlights emphasis areas in the SEARCH program. Proposals for SEARCH activities that address the science themes of the OPP IPY special solicitation should be submitted to that solicitation.

This Arctic Opportunities solicitation is appropriate for proposals for activities that address IPY goals, but that may not fit the emphasis areas described in the special IPY solicitation.

ADDITIONAL OPPORTUNITIES

U.S. Navy Ice Camp in 2007
Researchers may be interested in conducting field studies at an ice camp planned by the U.S. Navy in spring 2007. Proposals for research based out of the U.S. Navy ice camp may be submitted to the programs described in this solicitation to study a broad array of topics. For those interested in sea ice mass balance, the NSF-sponsored workshop "Sea Ice Mass Budget of the Arctic (SIMBA) held in 2005 (http://www.iarc.uaf.edu/workshops/SIMBA_2005/index.php) identified key research questions now available in a draft report (http://www.frontier.iarc.uaf.edu/~jenny/SIMBAreport_firstDraft.doc). This workshop was sponsored in part by the SEARCH program. Many research priorities identified in the report are appropriate for proposals to this solicitation to conduct research from the ice camp.

Other NSF Funding Opportunities
See Section IX on Other Programs of Interest and consult the NSF online program guide to browse for funding opportunities http://www.nsf.gov/funding/browse_all_funding.jsp).

III. AWARD INFORMATION

Pending availability of funds, $16,000,000 may be available for proposals to this solicitation. This does not include logistics support that may be provided through the Arctic Research Support and Logistics program. NSF estimates 80 to 100 awards per year as standard or continuing grants, or cooperative agreements. The number of awards and average award size and duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- U.S. Organizations

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Additional Eligibility Info:

Only U.S. organizations are eligible to submit proposals under this solicitation. There is no limit on PI eligibility, and there is no limit on the number of proposals that may be submitted.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines specified 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-PUBS (7827) or by e-mail from nsfpubs@nsf.gov.

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

Proposals may be returned without review for failing to comply with the Grant Proposal Guide, this solicitation and the instructions that supplement the GPG.

Please note:

- Proposals that are re-submissions must be substantially changed from the original,
- Proposals must comply with GPG specifications for minimum font size and maximum lines and characters per centimeter,
- Biosketches must follow formatting rules, in particular, do not include more than 10 publications,
- For efficiency of processing, please arrange entries alphabetically by last name in lists such as collaborators, students,

advisors, other affiliations, and suggested reviewers.

Principles for the Conduct of Research in the Arctic
Researchers should conform to the *Principles for the Conduct of Research in the Arctic*, prepared by the Social Science Task Force of the U.S. Interagency Arctic Research Policy Committee (IARPC) and approved by IARPC in 1990. These principles apply to all researchers and are listed at http://www.nsf.gov/od/opp/arctic/conduct.jsp. Proposers may also find the "Guidelines for Improved Cooperation between Northern Communities and Arctic Researchers" helpful (http://www.arcus.org/guidelines).

Proposals Involving Human Subjects
The NSF Grant Proposal Guide (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg) provides procedural information for projects with human subjects in the section Projects Involving Human Subjects. Investigators must ensure that human subjects are protected from research risks in conformance with the relevant federal policy known as the Common Rule (*Federal Policy for the Protection of Human Subjects*, 45 CFR 690). Additional information is available at http://www.nsf.gov/bfa/dias/policy/guidance.jsp. Letters of permission or approval, such as those from Native organizations or communities in which the work will take place, should be included in the Supplementary Documents section of proposal.

Proposals Involving Arctic Field Work
The Arctic Sciences Section does not require the use of logistics forms for arctic fieldwork. However, for proper review of the proposal and to initiate logistics planning for successful proposals, the anticipated fieldwork should be described in the proposal. Proposals are encouraged to include a section describing the scope of the fieldwork, the overall project schedule, maps and figures in the Project Description.

If a third-party is arranging logistics (a logistics contractor) their costs should **not** be itemized or included in the FastLane budget forms. Instead, the scope and kind of support should be described clearly in the budget justification to allow the logistics provider and reviewers to assess the scope, feasibility and initiate planning (see Section II, "Arctic Research Support and Logistics").

Proposals that include fieldwork should be submitted well in advance of the field season to allow for logistics planning. For example, proposals submitted in December 2005 should not plan to go to the field in summer of 2006, but rather in 2007. Third-party logistics providers may be able to accommodate shorter planning times but should be consulted in advance of proposal submission to verify.

The RSL program was created, in part, to enhance access, safety and interactions with arctic communities. Accordingly investigators are encouraged to propose effective and efficient use of logistics resources to reach research goals and cooperate with communities near field research sites. More information is available on the RSL program website (http://www.nsf.gov/od/opp/arctic/res_log_sup.jsp).

Logistics Providers and Field Stations
The RSL program works with several organizations to meet the needs of arctic field research. NSF's prime arctic logistics contractor is VECO Polar Resources (VPR; http://vecopolar.com/). VPR can help scope out logistics for all projects, regardless of whether they ultimately provide the logistics services. They are helpful in proposal preparation and can provide letters of support for projects to establish they are achievable. Investigators are encouraged to contact VPR to develop a preliminary plan and to provide project support if appropriate.

Researchers proposing to work near Barrow, Alaska are required to contact the Barrow Arctic Science Consortium (BASC) prior to submission of a proposal to ensure the project can be accommodated, see (http://www.sfos.uaf.edu/basc/).

Researchers proposing to work at Toolik Field Station are required to contact the station prior to submission of a proposal to ensure the project can be accommodated, see (http://www.uaf.edu/toolik/). More information about research support and logistics facilities in the Arctic can be found at the Arctic Logistics Information And Support (ALIAS) website

Greenland
Principal investigators contemplating work in Greenland should obtain the Danish Polar Center application form for research in Greenland. Application forms are available at http://www.dpc.dk/Res&Log/ProjectPlanner/Start.html. A copy of the application should be included in the Supplementary Documents to the proposal.

Arctic Logistics Information And Support (ALIAS)
The ALIAS database contains useful information about research support and logistics capabilities around the Arctic http://www.arcus.org/alias/.

UNOLS Vessel Requests
Researchers intending to use a vessel from the University-National Oceanographic Laboratory System (UNOLS) or the U.S. Coast Guard (USCG) vessels *Healy*, *Polar Sea* or *Polar Star* should follow the UNOLS procedure (http://www.unols.org).

UNAVCO
UNAVCO (www.unavco.org) is a non-profit organization that supports and promotes Earth science by advancing high-precision geodetic and strain techniques such as the Global Positioning System (GPS) to support university and other research investigators in Earth sciences research. UNAVCO provides state-of-the-art GPS equipment and field engineering support for projects, by installing, operating and maintaining continuous GPS networks globally, by undertaking new technology development and evaluating commercially available products for research applications, and by archiving GPS data and data products for future applications. UNAVCO maintains Differential GPS stations and provides other services to arctic researchers. Investigators should contact Bjorn Johns at UNAVCO to arrange these products (bjorn@unavco.org or 303-381-7470).

Environmental Policy Considerations of Fieldwork
Federal agencies must comply with the National Environmental Policy Act (NEPA). The Code of Federal Regulations (CFR) pertaining to NSF can be found at Title 45 Part 640 (http://www.gpoaccess.gov/cfr/index.html). Most NSF awards support individual scientific research projects and are not considered major Federal actions significantly affecting the quality of the human environment. Projects involving construction, drilling or major disturbance to the local environment may need to have an assessment of environmental impacts performed.

In addition to NEPA, all federal agencies are regulated under acts such as the Endangered Species Act, the Marine Mammal Protection Act, and the National Historic Preservation Act. Researchers proposing projects with fieldwork involving perturbation of the environment, excavation of archaeological sites, use of underwater seismic air guns, drilling, construction, or other activity that may be considered a major Federal action should confer with program officers for guidance on project planning in compliance with NEPA and other federal environmental protection acts. For example, work proposed in the tundra area around Barrow, Alaska should consider the presence of threatened Steller's eiders (*Polysticta stelleri*) May-July and may require federal consultations. Researchers are encouraged to contact OPP for more information about environmental impact considerations of their proposed field work.

Bering Ecosystem Study (BEST) Proposals
All proposals submitted for work addressing BEST goals should be submitted to the Arctic Natural Sciences program, including

proposals that emphasize social sciences or system science. Proposals will be reviewed and managed in accord with the subject matter of the research.

To identify proposals as BEST, begin the title with acronym "BEST", in all capital letters, followed by a colon, then the title of the project (e.g., "BEST: Ecosystem dynamics of...").

Proposals should be for a maximum duration of four years. Field work should be completed after the first three years of the program.

Investigators funded under BEST will be asked to attend a science team meeting before fieldwork commences. At that time, further integration of projects will be implemented. Proposals should budget for the principal investigator to attend this meeting. Furthermore, proposers should budget travel funds for an annual investigators' meeting and will be expected to coordinate and integrate plans and results with other investigators supported in the competition.

As BEST is a subprogram of SEARCH, all BEST projects must conform to the SEARCH data requirements. These requirements are very specific and listed in Section VII. B., Award Conditions.

International Polar Year (IPY)
Proposals being submitted as contributions to IPY must include a statement articulating the relevance of the project to IPY and addressing IPY goals as expressed by the U.S. National Academy of Sciences (U.S. NAS) and the International Council for Science (ICSU). For U.S. NAS IPY information, see http://dels.nas.edu/us-ipy. For ICSU IPY information, see http:// www.ipy.org or http://www.ipy.org/concept/index.html.

Identify this Solicitation Number on the Proposal Cover Sheet

Proposers are reminded to identify the NSF publication number (located on the first page of this document) 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.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required under this solicitation.

C. Due Dates

- **Full Proposal Target Date(s)**:

  December 16, 2005

  November 10, 2006 and November 10th each year thereafter.

All programs covered under this solicitation will have a single, annual competition with the Target Date of December 16th, 2005. In 2006 and each year thereafter the Target Date will be November 10th.

Proposers must contact the cognizant program director for approval prior to the Target Date when intending to submit a proposal after the Target Date. This is essential for orderly review of all submissions. Late proposals may miss a particular panel review, but may still be reviewed ad hoc if received after the target date, provided the proposer has prior approval from the program director. Failure to obtain prior approval of the cognizant program director for late submissions may result in the proposal being returned without review.

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through use of the NSF FastLane system. Detailed instructions regarding the technical aspects of proposal preparation and submission via FastLane are available at: http://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.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the

Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

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

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

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

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

International Polar Year (IPY)
In addition to the NSF merit review criteria, proposals submitted as contributions to IPY will be evaluated on the relevance and effectiveness of the project to address goals for IPY as expressed by the U.S. National Academy of Sciences (U.S. NAS) and the International Council of Scientists (ICSU). For U.S. NAS IPY information, see http://dels.nas.edu/us-ipy. For ICSU IPY information, see http:// www.ipy.org or http://www.ipy.org/concept/index.html.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process).

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?

org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

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

Special Award Conditions:

Principles for the Conduct of Research in the Arctic
Principal Investigators are expected to follow the Principles for the Conduct of Research in the Arctic, prepared by the Social Science Task Force of the U.S. Interagency Arctic Research Policy Committee (IARPC) and approved by IARPC in 1990. These principles are listed at http://www.nsf.gov/od/opp/arctic/conduct.jsp. Investigators may find useful the Guidelines for Improved Cooperation between Arctic Researchers and Northern Communities (http://www.arcus.org/guidelines).

Guidelines for Scientific Data (OPP 9-91)
This statement provides guidelines from the Office of Polar Programs (OPP) at the National Science Foundation (NSF) and sets out special conditions applicable to OPP grants to implement the Foundation's Sharing Policy by assuring timely submission of OPP-award data to national data centers and other OPP-specified repositories for secondary use by the scientific community. The Office of Polar Programs, in conformance with NSF policy (see Grant Proposal Guide, http://www.nsf.gov/pubsys/ods/getpub.cfm?gpg), expects investigators to share with other researchers, at no more than incremental cost and within a reasonable time, the data, derived data products, samples, physical collections and other supported materials gathered or created in the course of the research project. The purpose of this policy is to facilitate full and open access to data and materials for polar research from projects supported by OPP.

General Guidelines
For all OPP supported projects:

- All data and derived data products collected under OPP-awards which are appropriate for submission to a national data center or OPP specified data repository (OPP-approved website) should be promptly submitted within a reasonable amount of time, as described below, in responsibilities of Principal Investigators of OPP-Awards.
- OPP considers the documentation of data sets, known as metadata, as vital to the exchange of information on polar research and to a data set's accessibility and longevity for reuse.
- Data archives of OPP-supported projects should include easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance for locating and obtaining the data.
- National and international standards should be used to the greatest extent possible for the collection, processing and communication of OPP-sponsored data sets.

Special Note for Arctic Social Sciences Awards: The Arctic Social Sciences Program supports the full range of social science disciplines and adheres to the Data Sharing Policy developed by NSF's Directorate for Social Behavioral and Economic Research (SBE). The nature of the data, the way they are collected, analyzed, and stored, and the pace at which this occurs, vary widely. Different storage facilities and access requirements exist for different types of social science data, e.g., archaeological data, specimens from physical anthropology, large-scale survey data, oral interviews, and field records. Where appropriate and possible, grantees from all social science fields will develop and submit specific plans to share materials collected with NSF support. These plans should cover how and where these materials will be stored, at reasonable cost, and how access will be provided to other researchers, at their cost. Many complexities arise across the range of data collection supported by the Arctic Social Sciences Program. Therefore, such unusual circumstances and any necessary modifications or exemptions to the general policy of data sharing should be described in the OPP-awardees sharing plans.

Responsibilities of Principal Investigators of OPP-Funded Awards
Principal investigators should make their data available to all reasonable requests and where applicable the principal investigators should submit the data collected to designated data centers as soon as possible, but no later than two (2) years after the data are collected. **Data sets from Long-Term Observatories are expected to be made publicly available immediately upon collection.**

Principal investigators working in coordinated programs (multi-investigator and/or multi-agency programs) may (in consultation with the OPP program managers and other funding agencies involved) establish more stringent data submission procedures to meet the needs of these larger coordinated programs. PIs with OPP-funded awards should comply with data policies established for these coordinated programs and submit their data as required to the appropriate repository stipulated by the coordinated program office.

Compliance with the data guidelines will be considered in the program managers overall evaluation of a Principal Investigator's prior support record.

Conditions for OPP Awards
Principal Investigators of OPP-funded awards are REQUIRED to submit to appropriate electronic data directories, a description of their data (i.e. metadata) resulting from OPP-funded research in the form of a Directory Interchange Format (DIF) entry. Submission of the DIF may be at any time during the tenure of the grant. At the time of submission of the Final Report to NSF, a copy of the DIF must be sent to the cognizant program officer in OPP. Failure to provide final technical reports delays NSF review and processing of pending proposal for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data. Sample DIFs can be found on the Global Change Master Directory web page at http://gcmd.gsfc.nasa.gov.

Data sets from OPP supported arctic scientific research should go to the appropriate data center for the specific type of data collected. Any questions concerning this policy should be directed to the cognizant program officer in the Office of Polar Programs.

Bering Ecosystem Study (BEST)
As BEST is a subprogram of SEARCH, all BEST projects must conform to the SEARCH data requirements. These requirements are very specific and listed below. Proposers should also see Section VII. B for OPP's data policy.

Requirements for the data management plan for SEARCH proposals:

a. Data authors (investigators who produce data under SEARCH) shall provide, within the first 3 months, a metadata inventory description (a high-level summary of the data they plan to collect) to the relevant archive. If SEARCH establishes a data coordination service, the metadata inventory must be shared with them.
b. Investigators must specify, in their proposal, where their data will be archived. At a minimum, the proposal should include a letter of support from the specified data center or data manager contact.
c. Investigators must specify, in their proposal, a person who will be the data management point of contact, responsible for submitting the data and documentation.
d. Investigators must specify, in their proposal, which data that they will collect are destined to be community data. All community data must be made available through a data management system as soon as data are collected and verified.

e. For the purposes of this solicitation, computer model codes and data analysis program codes will be considered as derived data products and must be archived in a manner similar to other data products.
f. Every project must submit complete documentation and quality-controlled data to the appropriate archive in accordance with the OPP data policy.
g. Investigators submitting proposals to this solicitation must agree to adhere to the general data policy of OPP. Adherence to the specific terms of the SEARCH data policy, once it is finalized, will be requested.

Annual reports must include information about the status of data management activities. Noncompliance with the OPP data management policy could be used as grounds for suspension or cancellation of funding commitments.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

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

Please see the OPP Guidelines for Scientific Data (OPP 9-91) described in Section VII. B. Award Conditions in this program solicitation for information about award conditions for data.

For proposals funded to address goals of the Bering Ecosystem Study (BEST), annual reports must include information about the status of data management activities.

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:

- Marie H. Bundy, Biology & Medicine Associate Program Manager, 755 S, telephone: (703) 292-7418, fax: (703) 292-9079, email: mbundy@nsf.gov
- Renee D. Crain, Arctic Research and Education Assistant Program Director, 755 S, telephone: (703) 292-4482, fax: (703) 292-9082, email: rcrain@nsf.gov
- Jane V. Dionne, Arctic Natural Sciences Program Director, 755 S, telephone: (703) 292-7427, fax: (703) 292-9082, email: jdionne@nsf.gov
- Janet Intrieri, Arctic System Science Associate Program Manager, 755 S, telephone: (703) 292-4426, email: jintrier@nsf.gov
- Anna M. Kerttula, Arctic Social Sciences Program Director, 755 S, telephone: (703) 292-7432, fax: (703) 292-9082, email: akerttul@nsf.gov
- Simon N. Stephenson, Arctic Research Support and Logistics Program Director, 755 S, telephone: (703) 292-7435, fax: (703) 292-9082, email: sstephen@nsf.gov
- Neil R. Swanberg, Arctic System Science Program Director, 755 S, telephone: (703) 292-8029, email: nswanber@nsf.gov
- William J. Wiseman, Arctic Natural Sciences Program Director, 740 S, telephone: (703) 292-4750, fax: (703) 292-9082, email: wwiseman@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.
- Linda Izzard, Program Coordination Specialist, 740 S, telephone: (703) 292-7430, fax: (703) 292-9082, email: lizzard@nsf.gov

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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

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

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

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

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

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Arlington, VA 22230