Ocean Acidification

PROGRAM SOLICITATION
NSF 10-530

National Science Foundation

Office of Polar Programs
Division of Antarctic Sciences
Division of Arctic Sciences

Directorate for Geosciences
Division of Ocean Sciences

Directorate for Biological Sciences

Letter of Intent Due Date(s) ***(required)*** (due by 5 p.m. proposer's local time)*:*

March 29, 2010

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

April 26, 2010

IMPORTANT INFORMATION AND REVISION NOTES

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Ocean Acidification

Synopsis of Program:

Since the publication of The Royal Society's report *Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide* (June 2005, http://www.royalsoc.ac.uk), there has been growing concern for the potential adverse impacts of a slowly acidifying sea upon marine ecosystems. In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, this announcement has the following broad goals:

- To understand the chemistry and physical chemistry of ocean acidification and, in particular, its interplay with fundamental biochemical and physiological processes of organisms;
- To understand how ocean acidification interacts with processes at the organismal level, and how such interactions impact the structure and function of ecosystems, e.g. through life histories, food webs, biogeochemical cycling, and other interactions;
- To understand how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

New research frontiers require the development of interdisciplinary partnerships and capacity building within the scientific community. Accordingly, full research proposals, exploratory proposals, and community development efforts such as workshops and symposia all are encouraged. Proposals must clearly demonstrate links between the research outcome and the emphasis areas described within the solicitation. Preference will be given to proposals that create new partnerships across traditional disciplines (including molecular and cellular biology, physiology, marine chemistry and physics, ecological sciences, paleoecology, and earth system history) and use diverse approaches (observational systems, experimental studies, theory and modeling) to examine cutting edge research questions related to ocean acidification.

Cognizant Program Officer(s):

- Roberta L. Marinelli, Program Director, Antarctic Organisms and Ecosystems, telephone: (703) 292-7448, email:

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- Henrietta Edmonds, Program Dierctor, Arctic Natural Sciences, telephone: (703) 292-8029, email: hedmonds@nsf.gov
- David L. Garrison, Program Director, Biological Oceanography, telephone: (703) 292-7588, email: dgarriso@nsf.gov
- Candace O. Major, Program Director, Marine Geology and Geophysics, telephone: (703) 292-8580, email: cmajor@nsf.gov
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Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.050 --- Geosciences
- 47.074 --- Biological Sciences
- 47.078 --- Office of Polar Programs

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 14 to 20 The number of awards may range from 14-20, pending availability of funds, and will vary with category (see below).

Anticipated Funding Amount:

$12,000,000 to $15,000,000

Three categories of awards are anticipated.

- Category (1), full research projects, may be a maximum of four years duration and $2,000,000. These proposals will be subject to external merit review in accordance with NSF's Merit Review criteria;
- Category (2), exploratory awards, will follow the guidelines and review criteria of EAGER proposals (Early-concept grants for exploratory research, see Proposal and Award Policies and Procedures (PAPP) Guide http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp), for a maximum of two years duration and up to $300,000. Projects will be subject to internal or external merit review, in accordance with established NSF guidelines;
- Category (3), community and capacity building projects may request a maximum of $100,000. Projects will be subject to internal or external merit review, in accordance with established NSF guidelines.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

An individual may appear as Principal Investigator (P.I.), co-P.I., other senior personnel or investigator on only one proposal in FY 2010 that responds to this program solicitation. This limitation includes proposals submitted by a lead organization, any sub-award submitted as part of a proposal, or any collaborative proposal, and this includes all categories of projects described above (1-3). **Proposals that do not meet this requirement will be returned without review.** These restrictions apply only to this solicitation and are not meant to inhibit submissions of proposals by investigators to other NSF activities or programs.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

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

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

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time)***:***

  March 29, 2010

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

  April 26, 2010

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria apply.

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

Since the publication of The Royal Society's report *Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide* (June 2005, **http://www.royalsoc.ac.uk**), there has been growing concern for the potential adverse impacts of a slowly acidifying sea upon marine ecosystems. The unprecedented build-up of atmospheric carbon dioxide during the past two centuries, driven by the burning of fossil fuels, is generally accepted as the primary cause for rapid warming of the global atmosphere. An additional consequence is a significant change in the chemistry of the sea. The physicochemical relationship between the concentration of carbon dioxide in the atmosphere and the carbonate controlled acid-base system of the sea is well understood, and accordingly, the scientific community has anticipated that acidification of the ocean will occur. However, the consequences of ocean acidification are poorly understood. How rapidly will ocean acidification proceed? How will it alter the chemistry of the ocean? What is the breadth and severity of the impacts on organisms and ecosystems? Are there parallel events in the earth's history, and what can we learn from them?

A variety of scientific workshops have been held in the U.S. and abroad [e.g. the National Academy of Sciences Ocean Acidification Study (ongoing): (**http://dels.nas.edu/**); the Ocean Carbon Biogeochemistry Workshop Report: Present and Future Impacts of Ocean Acidification on Marine Ecosystems and Biogeochemical Cycles: (**http://www.us-ocb.org/publications/OCB_OA_rept.pdf**); Oceans in a High CO2 world: Research Priorities for Ocean Acidification, Report from the Second Symposium, Monaco, 2008: (**http://ioc3.unesco.org/oanet/Symposium2008/ResearchPrioritiesReport_OceanHighCO2WorldII.pdf**); Ocean Acidification - Recommended Strategy for a U.S. National Research Program (**http://www.us-ocb.org/OCB_OA_Whitepaper.pdf**)] to evaluate what is currently known about ocean acidification, to consider its potential impacts on ocean ecosystems and the earth system, and to chart a research course for the future to address the myriad of unknowns. There is broad consensus that there is an urgent need for (1) ocean surveys, monitoring and time-series studies to establish the present day picture and future course of ocean acidification, and its ecological and environmental consequences and (2) basic research to discover and understand how the chemistry and physics of the ocean interplay with changes in acidity, how marine biota and communities function in an acidifying ocean, how historical excursions of seawater acidity have played out in the geologic past, and what they might reveal for the future.

II. PROGRAM DESCRIPTION

In view of the need for basic research, the National Science Foundation announces a five year program (FY10-14) to support research on the chemistry of ocean acidification and its interplay with fundamental biochemical and physiological processes of organisms; the implications of these effects for ecosystem structure and function; and how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean. Ocean acidification effects will be variable in space and time, with some environments (e.g. high latitude seas, coral reefs) and organisms (e.g. calcifiers) arguably at greater risk. Accordingly, research projects that identify vulnerable organisms or ecosystems, as indicated by current trends or the earth's geologic record, are particularly encouraged. Synthesis and modeling projects, that might inform earth system models at regional, decadal, or larger spatial and temporal scales, also are appropriate for consideration. This solicitation is part of the National Science Foundation's cross-directorate research and education activities related to the broad theme of climate (http://www.nsf.gov/).

Target Research Areas:

Proposals are encouraged that develop and integrate interdisciplinary perspectives (including molecular and cellular biology, physiology, marine chemistry and physics, ecological sciences, paleoecology, and earth system history) and use diverse approaches (observational systems, experimental studies, theory and modeling) to investigate one or more of the following basic research areas:

- Ocean acidification involves fundamental geochemical phenomena that are highly interconnected to oceanic biology, physics, and geology. Although some of the associated research questions for ocean chemistry are evident and have received much attention - those associated with biomineralization and carbonate dissolution, in particular - many others remain. For example, how will ocean acidification affect processes such as chemical speciation, equilibria, reaction rates, mineral authigenesis and dissolution, or particle dynamics? What are the impacts on the physical chemistry of seawater? How will regional differences in marine chemistry and physics advance acidification, and what are the downstream implications for organisms and ecosystems? Can we identify new proxies for ocean acidification that can be used to interpret the geologic record? Proposals that seek to understand fundamental changes in seawater chemistry driven by ocean acidification, their impacts on organism performance, their signatures in the geologic record, and their role in climate studies, are encouraged.

- Predicting the consequences of ocean acidification on ecosystem health and function requires knowledge of how a shifting geochemical landscape will affect basic biological processes. We seek a fusion of intellectual approaches to learn how ocean acidification affects organisms at molecular, cellular and ecological levels of organization, against the backdrop of a changing chemical milieu. To what extent will ocean acidification affect cell and organismal performance? Are there significant feedbacks to the ocean's geochemical environment? Areas of interest include, but are not limited to, mechanisms of biomineralization and photosynthesis, electrochemical gradients, cell signaling, developmental events, neural and behavioral functions, and properties of extracellular surfaces and substrates. We seek an integrated understanding of the relationship between cellular processes and oceanic chemistry, and encourage studies that include synergistic interactions with other climate-related variables (e.g. temperature, oceanic circulation, etc).

- Ocean acidification may affect the function of ecosystems through direct impacts on ecosystem members (e.g. life history, behavior and physiology) and their interactions, including food web structure, biotic interactions, and biogeochemical cycling. Model predictions of carbonate undersaturation and pH suggest that high latitude, upwelling, coral reef, and some deep sea ecosystems are particularly vulnerable to alteration by ocean acidification over time scales of decades, although over longer time frames, nearly all marine environments may be at risk. To what extent do impacts on organism's performance lead to critical alterations in abundance, distribution, and reproductive output? Are there complex interactions, cascades, or bottlenecks that will emerge as the oceans acidify, and what are their downstream ecosystem implications? Investigators are invited to propose single system studies, or comparative analyses, to examine the broader ecological implications of ocean acidification. Synergistic studies that combine ocean acidification with other climate-related variables, and synthesis/modeling efforts, are encouraged.

- The geologic record reveals the history of climate change and the assemblages of organisms that have risen, persisted, or declined, as the earth system has evolved. This history includes oceanic conditions that parallel the projected impacts of ocean acidification on organisms and ecosystems. To what extent can the geologic record inform our understanding of the response of modern biotic assemblages to ocean acidification? Are there robust geochemical signatures in the geologic record that can identify historical excursions of pH and alkalinity? Conversely, can our understanding of extant organisms and ecosystems, and their responses to the changing marine environment, be used to expand our understanding of paleoenvironments and paleoecology? Proposals that address these questions are encouraged, as are parallel studies comparing the paleo-ocean and modern environments.

This solicitation strongly encourages the development of new collaborations to surmount the challenges of interdisciplinary research; exploratory proposals; and full research projects. To this end, we solicit several **categories** *(1-3 below)* of proposals aimed at facilitating research at different levels of maturity. These include:

1. **Category 1** proposals are three-to-four year projects that address one or more of the fundamental questions outlined above. Proposals that bridge two or more of these themes (physico-chemical systems, biological and ecological systems, and earth history) are particularly encouraged. Prospective investigators also are encouraged to draw upon observational systems such as Long Term Ecological Research (LTER) sites, the Arctic Observing Network (AON), Ocean Observatory Initiative sites, and other national or international observing systems. Category 1 proposals will be subject to external merit review, in accordance with NSF's merit review criteria;

2. **Category 2** proposals are one-to-two year awards aimed at exploratory, developmental, and high-risk high-reward research. Prospective investigators must contact one or more of the cognizant program directors, **prior to submission**, to determine the appropriateness of their ideas for submission as an EAGER project. EAGER projects must be submitted by the Full Proposal deadline. Review of such proposals will follow the guidelines for the EAGER (Early Grants for Exploratory Research) mechanism outlined in the Proposal and Award Policies and Procedures (PAPP) Guide (**http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp**);

3. **Category 3** proposals involve community- and capacity-building. Conferences, symposia, and workshops that develop and enhance dialogue and collaboration across disciplines, relevant to ocean acidification, are particularly encouraged. Prospective investigators must contact one or more of the cognizant program directors, **prior to submission**, to determine the appropriateness of their ideas for a Category 3 project. These proposals must be submitted by the Full Proposal deadline. Review of Category 3 proposals will follow established NSF guidelines.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 14 to 20 The number of awards may range from 14-20, pending availability of funds, and will vary with category (see below).

Anticipated Funding Amount: $12,000,000 to $15,000,000

Three categories of awards are anticipated.

- Category (1), full research projects, may be a maximum of four years duration and $2,000,000. These proposals will be subject to external merit review in accordance with NSF's Merit Review criteria;
- Category (2), exploratory awards, will follow the guidelines and review criteria of EAGER proposals (Early-concept grants for exploratory research, see Proposal and Award Policies and Procedures (PAPP) Guide http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp), for a maximum of two years duration and up to $300,000. Projects will be subject to internal or external merit review, in accordance with established NSF guidelines;
- Category (3), community and capacity building projects may request a maximum of $100,000. Projects will be subject to internal or external merit review, in accordance with established NSF guidelines.

IV. ELIGIBILITY INFORMATION

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

An individual may appear as Principal Investigator (P.I.), co-P.I., other senior personnel or investigator on only one proposal in FY 2010 that responds to this program solicitation. This limitation includes proposals submitted by a lead organization, any sub-award submitted as part of a proposal, or any collaborative proposal, and this includes all categories of projects described above (1-3). **Proposals that do not meet this requirement will be returned without review.** These restrictions apply only to this solicitation and are not meant to inhibit submissions of proposals by investigators to other NSF activities or programs.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent *(required):*

For all categories of proposals,a one-page Letter of Intent (LOI) must be submitted via FastLane before submission of a full proposal. Letters of Intent received after the LOI deadline date specified in this solicitation will not be considered compliant and any associated proposal will be returned without review. Each Letter of Intent must include the following:

TENTATIVE TITLE - The title of a proposal must be preceded by the words "Ocean Acidification-Category 1, 2 or 3" as appropriate.

TEAM - Names, departmental and university affiliation, of the Principal Investigator, and all prospective co-Principal Investigators

and Senior Personnel.

SYNOPSIS (GOALS) - Brief description of the specific goals of the proposal (maximum of 250 words).

These letters of intent help NSF anticipate review requirements. They are not used as pre-approval mechanisms for the submission of full proposals and no feedback is provided to the submitters.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Sponsored Projects Office (SPO) Submission is not required when submitting Letters of Intent
- Submission of multiple Letters of Intent is not allowed

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

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

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

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

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

Proposal Cover Sheet

When preparing the cover page in FastLane, highlight the program solicitation number on the pull down list and click on the "Select" button. Your proposal will automatically be assigned to the correct managing division on the Cover Sheet. (Grants.gov users: The program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page.) The proposal title should be consistent with the Letter of Intent, and begin with Ocean Acidification - Category 1, 2, or 3, as appropriate.

Observational Networks, Long Term Sites, and Research Centers

Where appropriate, investigators are encouraged to work in association with existing projects, observational networks, long-term ecological research sites or research centers, or testing and evaluation facilities, whether supported by NSF or other agencies, such as USEPA, USGS, USDA or NOAA. Principal Investigators are advised to obtain letters of support that affirm such collaborative activities. The project description should make clear how the proposed work differs from and augments activities already supported.

Inclusion of Data Management Plan Required

Proposals must include a data management plan that describes how metadata and data collected as part of the project will be disseminated to the broader community, as well as plans for longer term archiving of these data. **The data management plan must be included in the Project Description.** Principal Investigators that propose to collaborate with data centers or networks are advised to obtain letters of commitment that affirm the collaboration. Where possible, all PIs are strongly encouraged to use existing data centers and data portals to archive and disseminate their data. Costs associatied with use of data centers, or data archiving, should be included in the proposal budget. All data collected by projects funded through this solicitation will be freely and openly available to any interested investigator as soon as practical, but no later than 12 months following collection.

Budget Preparation Instructions: Research Platforms and Facilities Requests

Budgets should be prepared in compliance with the Proposal and Award Policies and Procedures (PAPP) **http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp**) or NSF Grants.gov Application Guide guidelines. Budgets should include all costs charged to the project for platforms and facilities supporting the proposed research except those facilities separately supported by NSF (e.g. UNOLS research vessels, research aircraft, or field equipment). For research involving UNOLS vessels, a UNOLS ship request should be appended to proposals. Likewise, research involving polar regions should follow established guidelines for requesting logistical assets, as discussed in the relevant proposal solicitations (for Antarctic Sciences, see NSF 09-536; for Arctic Sciences, see NSF 10-503). Principal investigators are responsible for filing the appropriate requests for major research platforms; a copy of the request must be attached as an appendix to the proposal.

Conflicts of Interest Table Required

Proposals must include, in the single copy documents section, a list in a single alphabetized table, with the full names and institutional affiliations of all people with conflicts of interest for all senior personnel (PI and co-PIs) and any named personnel whose salary is requested in the project budget. Conflicts to be identified are (1) Ph.D. thesis advisors or advisees, (2) collaborators or co-authors, including postdoctoral researchers, for the past 48 months, and (3) any other individuals with whom, or institutions with which, the senior personnel (PI, co-PIs, and any named personnel) have financial ties, including advisory committees (please specify type). For each entry on the list, please specify the type of conflict.

B. Budgetary Information

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

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time)***:***

  March 29, 2010

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

  April 26, 2010

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

  Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

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

- **For Proposals Submitted Via Grants.gov:**

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

  Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal.

A. NSF Merit Review Criteria

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

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

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

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

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

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

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

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

B. Review and Selection Process

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

Proposals will be reviewed in accordance with established NSF guidelines for full research proposals, EAGER proposals, and proposals to support symposia or workshops.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Roberta L. Marinelli, Program Director, Antarctic Organisms and Ecosystems, telephone: (703) 292-7448, email: rmarinel@nsf.gov
- Henrietta Edmonds, Program Dierctor, Arctic Natural Sciences, telephone: (703) 292-8029, email: hedmonds@nsf.gov
- David L. Garrison, Program Director, Biological Oceanography, telephone: (703) 292-7588, email: dgarriso@nsf.gov
- Candace O. Major, Program Director, Marine Geology and Geophysics, telephone: (703) 292-8580, email: cmajor@nsf.gov
- Gregory Warr, Program Director, Cellular Systems, telephone: (703) 292-8284, email: gwarr@nsf.gov
- Richard K. Zimmer, Program Director, Physiological and Structural Systems, telephone: (703) 292-7888, email: rzimmer@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the

national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

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

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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

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

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

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

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

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

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

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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