

## Graduate Student and Optical Instrumentation Support Related to the Advanced Modular Incoherent Scatter Radar (AMISR)

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### Program Solicitation

NSF 05-564



**National Science Foundation**  
Directorate for Geosciences  
Division of Atmospheric Sciences

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

June 03, 2005

### SUMMARY OF PROGRAM REQUIREMENTS

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#### General Information

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#### Program Title:

Graduate Student and Optical Instrumentation Support Related to the Advanced Modular Incoherent Scatter Radar (AMISR)

#### Synopsis of Program:

The Advanced Modular Incoherent Scatter Radar (AMISR) is a solid-state, phased array incoherent scatter radar that will measure basic properties of the upper atmosphere and ionosphere with unprecedented versatility and power. The phased-array design allows pulse-to-pulse beam steering, thus enabling three-dimensional "imaging" of ionospheric properties, such as electron density, electron and ion temperatures, and ion drift velocities. The modular design facilitates reconfiguration of the radar antenna, as well as relocation in response to changing scientific priorities. Current plans are for deployment of AMISR systems at Poker Flat, Alaska, and Resolute Bay, Canada. The radar system at Poker Flat consists of a single face approximately 35 meters square, while the system at Resolute Bay will consist of two such faces arranged to extend coverage across the polar cap.

AMISR scientific goals will be enhanced by the addition of two important activities. One is the training of graduate students to help establish a user base of highly-qualified scientists who are knowledgeable in incoherent scatter theory and understand the practical challenges of designing and executing radar experiments. Second, is the development and deployment of optical instrumentation capable of observing properties of the upper atmosphere not measurable by AMISR. This solicitation is to provide funding for graduate students and optical instrumentation in support of the AMISR systems at Poker Flat and Resolute Bay. The graduate student activity entails support for scientists at academic institutions to pay graduate student costs for three years, plus no more than one month of the graduate student advisor's salary support for each of three years. Optical instrumentation support is for acquisition, design, development, and deployment of instruments at one of the two AMISR sites, or at a nearby site as appropriate.

#### Cognizant Program Officer(s):

- Robert M. Robinson, Program Manager, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8529, fax: (703) 292-9022, email: [rmrobins@nsf.gov](mailto:rmrobins@nsf.gov)
- Robert Kerr, Program Director, Directorate for Geosciences, Division of Atmospheric Sciences, 790 N, telephone: (703) 292-8529, fax: (703) 292-9023, email: [rkerr@nsf.gov](mailto:rkerr@nsf.gov)

- Kile B. Baker, Program Director, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8519, fax: (703) 292-9022, email: [kbaker@nsf.gov](mailto:kbaker@nsf.gov)
- Richard A. Behnke, Section Head, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8518, fax: (703) 292-9022, email: [rbehnke@nsf.gov](mailto:rbehnke@nsf.gov)

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

- 47.050 --- Geosciences

#### Eligibility Information

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- **Organization Limit:** Proposals for graduate student support should be from academic institutions, or include a co-investigator from an academic institution. See the full text of this solicitation for further information.
- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** None Specified.

#### Award Information

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- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 5 to 11
- **Anticipated Funding Amount:** \$900,000 in FY06, pending availability of funds.

#### Proposal Preparation and Submission Instructions

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##### A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** Standard GPG Guidelines apply.

##### B. Budgetary Information

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

##### C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m. proposer's local time):  
June 03, 2005

#### Proposal Review Information

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- **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

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- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

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## I. INTRODUCTION

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The Advanced Modular Incoherent Scatter Radar (AMISR) is a new radar being constructed in Alaska and Canada. The solid-state, phased-array incoherent scatter radars are designed to measure basic properties of the upper atmosphere and ionosphere with unprecedented versatility and power. The phased-array design allows pulse-to-pulse beam steering, enabling three-dimensional “imaging” of ionospheric properties, such as electron density, electron and ion temperatures, and ion drift velocities. The modular design facilitates reconfiguration of the radar antenna, as well as relocation in response to changing scientific priorities. Current plans are for deployment of AMISR systems at Poker Flat, Alaska, and Resolute Bay, Canada. The radar system at Poker Flat consists of a single face approximately 35 meters square, while the system at Resolute Bay will consist of two such faces arranged to extend coverage across the polar cap.

AMISR scientific goals will be enhanced by the addition of two important activities. One is the training of graduate students to help establish a user base of highly-qualified scientists who are knowledgeable in incoherent scatter theory and understand the practical challenges of designing and executing radar experiments. Second, is the development and deployment of optical instrumentation capable of observing properties of the upper atmosphere not measurable by AMISR. This solicitation is to provide funding for graduate students and optical instrumentation in support of the AMISR systems at Poker Flat and Resolute Bay. The graduate student activity entails support for scientists at academic institutions to pay graduate student costs for three years, plus no more than one month of the graduate student advisor’s salary support for each of three years. Optical instrumentation support is for acquisition, design, development, and deployment of instruments at one of the two AMISR sites, or at a nearby site as appropriate.

Although incoherent scatter radars have been used for more than four decades to observe the upper atmosphere and ionosphere, the theory and practice of incoherent scatter is not a standard part of university undergraduate and graduate course curricula. Thus, well-trained graduate students have originated from the few universities in which senior faculty members have the necessary knowledge and experience to provide high-quality instruction to students. On the other hand, incoherent scatter radar data has become an essential element in graduate student research across many domains of space science. Because of the improving capabilities and growing complexity of incoherent scatter radars, it is critical that students possess a thorough understanding of not only how to interpret incoherent scatter radar data, but also how to design and implement new and innovative radar experiments. This solicitation provides support for graduate students, through their thesis advisors, to conduct research that depends heavily on incoherent scatter radar, particularly the Advanced Modular Incoherent Scatter Radar, which will have unprecedented versatility and flexibility for making ionospheric measurements.

In addition to knowledgeable graduate students, success of AMISR depends on the availability of ancillary measurements of ionospheric and thermospheric properties using optical techniques. Past experience with incoherent scatter radars has shown that scientific research is enhanced by the complementary view provided by optical instrumentation such as spectrometers, all-sky cameras, interferometers, and lidars. Although some of these instruments may already be operating at the AMISR sites in Alaska and Canada, opportunities exist for development and deployment of other optical instruments, either at the sites or at strategically located near-by sites. This solicitation provides support for innovative optical instrumentation that would enhance the scientific research resulting from AMISR observations.

## II. PROGRAM DESCRIPTION

The National Science Foundation currently supports the operation of four incoherent scatter radars located in Peru, Puerto Rico, Massachusetts, and Greenland. The four radars provide observations of the ionosphere and thermosphere from the magnetic equator to very high magnetic latitudes at the boundary of the polar cap. The absence of coverage within the polar cap has inhibited research on many important ionospheric and atmospheric processes near the magnetic pole. The demand for polar cap observations has also led to recognition of other important gaps in radar coverage. The concept of a relocatable incoherent scatter radar began as a result of earlier plans for the construction of a radar at Resolute Bay, Canada, near the northern polar cap. Subsequent discussions and workshops led to the recommendation that a relocatable radar would provide scientists with the ability to address new research priorities as they arise through the years. The design and development of the Advanced Modular Incoherent Scatter Radar (AMISR) emerged from this recommendation. Initially, AMISR systems will be constructed in Alaska and Canada.

AMISR is a phased-array incoherent scatter radar with unique features that allow efficient and cost-effective dismantling, shipping, and re-assembly. The radar comprises three identical antenna faces, each with approximately three times the sensitivity of the incoherent scatter radar currently operating at Sondre Stromfjord, Greenland. AMISR will provide the means for unique scientific observations via two significant features that have not been technically feasible in the past and will greatly enhance the way observations and experimental campaigns are conducted. First, the phased-array concept will allow pulse-to-pulse beam steering, thus enabling three-dimensional "imaging" of electron density features in high signal-to-noise environments. Second, an incoherent scatter radar with a solid-state transmitter and no moving parts will increase immunity to single-point radar failures, and allow extended operating periods with remote internet access and minimal on-site personnel.

The radar beam from each AMISR face can be steered instantaneously to within  $25^\circ$  of the bore sight of the antenna. Deployment plans for the three AMISR faces include the construction of one face at Poker Flat, Alaska, and two faces at Resolute Bay, Canada. The face at Poker Flat will be canted at an angle of  $16^\circ$  from the zenith in a direction  $15^\circ$  east of geographic north. This is to give maximum coverage to the north of Poker Flat for better viewing of aurora and the regions of the ionosphere typically sampled by sounding rockets launched from the collocated rocket range. The two faces at Resolute Bay will be canted in such a way as to give extended coverage in one direction. At this time, the azimuthal orientation of this extended coverage has not been decided. In addition, each AMISR face contains 4096 individual antenna elements with 8 receivers, so that each receiver is connected to 512 elements. This provides the capability of performing interferometric measurements using subsets of the AMISR face. With the expanded versatility of the AMISR system, the importance of creating and maintaining a knowledgeable user base is critical to the success of AMISR related research.

AMISR science priorities are described in detail in a workshop report titled "Relocatable Atmospheric Observatory: April 7-8 Workshop Report". A link to this report can be found at <http://transport.sri.com/AMISR/Sections/Introduction>. Generally, the AMISR system at Poker Flat will be used to investigate auroral processes, such as the origin and nature of auroral arcs, diffuse aurora, pulsating aurora, and westward traveling surges. The radar will measure the height profile of ionospheric properties, which can be used to study energy balance in the upper atmosphere and the exchange of mass and energy between the thermosphere and magnetosphere. The location at Poker Flat is also ideal for studying the auroral electrojet and how the high latitude ionosphere is electrodynamically coupled to the solar wind and magnetosphere.

At Resolute Bay, the AMISR system will observe polar cap arcs and how they relate to and reflect the magnetic structure of the magnetosphere. The development and motion of polar auroral forms are intricately tied to variations in the solar wind. The electric fields in the polar cap are also a direct consequence of magnetic coupling to the solar wind. AMISR will observe the polar wind, which is an important source of ionospheric ions in the magnetosphere. Ionospheric structure observed by AMISR will help scientists understand the origin and evolution of large-scale plasma clouds that originate in the dayside and are convected anti-sunward across the poles. This large-scale plasma structure is related to small-scale structure that produces scintillation of radio signals.

This solicitation is to provide support for two types of activities that will enhance AMISR-related research: support for graduate student participation in AMISR research and support for optical instrumentation to enhance AMISR observations.

**Graduate Student Support.** Realization of the AMISR scientific goals requires highly-qualified graduate students who are trained in incoherent scatter theory and understand the practical challenges of designing and executing radar experiments. Because incoherent scatter theory and practice is not a part of traditional undergraduate or graduate course curricula, training of graduate students is typically accomplished as part of their research experience. To enhance this exposure, the student must (1) be conducting research that is highly dependent on incoherent scatter radar data, and (2) have an advisor with the necessary knowledge and experience to provide the proper mentorship. This solicitation is aimed at university researchers who have the required experience to properly instruct graduate students in incoherent scatter-related research, as well as the theory and practice of the incoherent scatter technique.

Awards resulting from this solicitation will be for three years and will cover graduate student expenses plus no more than one month of support for the student's advisor. The advisor should have demonstrated experience in conducting research and performing experiments using incoherent scatter radars. The particular graduate student to be supported need not be identified in the proposal, but if not identified, a clear and convincing recruitment plan should be included in the project description. The proposal should describe a well-focused research plan involving one or both of the AMISR systems, with a

reasonable schedule for completion and closure of the research within the three years of the award. Proposers should carefully describe the type and quantity of AMISR observations necessary for conducting the proposed research. If proposing AMISR observations beyond the scope typically available from existing incoherent scatter radars, proposers should ensure that the required radar operations are possible. Information about AMISR can be found at <http://isr.sri.com/iono/amisr/> which also contains points of contact for question regarding AMISR operations.

Optical Instrumentation. Ancillary optical observations are an important aspect of incoherent scatter radar observations, and coordinated optical and radar measurements offer the means to measure comprehensive properties of the upper atmosphere and ionosphere. Existing optical instrumentation at Poker Flat and Resolute Bay are described at the following web sites: <http://www.pfrr.alaska.edu/> and <http://www.isr.sri.com/iono/epco/epco.html>, respectively. These web sites contain points of contact for more detailed information about instrumentation operating at the two sites. Proposers should not assume that the presence of a particular instrument at a site prevents the deployment of a similar instrument. The operational status of existing instruments and the extent to which the data are made available for general use should be considered in evaluating the need for additional instrumentation. Proposers may also deploy instruments at locations at sites close to, but not collocated with, instruments at Poker Flat and Resolute Bay, provided the nearby observations can be scientifically justified in terms of their potential to enhance AMISR research projects.

Awards resulting from this solicitation will cover the cost of acquisition, design, development, and deployment, as appropriate. Funding for operation of the instrument and conducting associated research using the data from the instrument should not be proposed to this solicitation. However, the type of research enabled by the instrument should be carefully described and adequately justified. New instruments should be described in terms of their heritage and technical feasibility. Proposers should specify expected performance levels after deployment so that the adequacy of the instrument to achieve research objectives can be assessed. A plan for data processing and dissemination should be included, but only to quantify the effort involved in making the data available for scientific use. Autonomous operation is an important, but not required, aspect of the instrument design, as is ease of data acquisition, processing, and dissemination. If an instrument requires on-site operation and maintenance, the level of such support should be described in detail. In some cases, proposers should consider obtaining a letter of support from points of contact responsible for either the Poker Flat or Resolute Bay (see above), particularly if operation of the instrument might represent a significant demand on facility staff time.

### III. ELIGIBILITY INFORMATION

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The categories of proposers identified in the [Grant Proposal Guide](#) are eligible to submit proposals under this program announcement/solicitation. However, proposals for graduate student support should be from academic institutions, or include a co-investigator from an academic institution, to ensure the graduate student research will be part of a university-approved Ph. D. degree program.

### IV. AWARD INFORMATION

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Estimated program budget, number of awards and average award size/duration are subject to the availability of funds. In FY06, approximately \$600,000 will be available for one to six standard grants for proposed optical instrumentation activities. For graduate student support, approximately \$300,000 per year is available for four or five three-year continuing grants.

### V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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#### A. Proposal Preparation Instructions

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##### Full Proposal Instructions:

Proposals submitted in response to this program announcement/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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg). Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

Proposers are reminded to identify the program announcement/solicitation number (05-564) in the program announcement/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

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## Cost Sharing:

Cost sharing is not required in proposals submitted under this Program Solicitation.

## C. Due Dates

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Proposals must be submitted by the following date(s):

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

June 03, 2005

## D. FastLane Requirements

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Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal 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](mailto: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 announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

*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. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: <http://www.fastlane.nsf.gov>

## VI. PROPOSAL REVIEW INFORMATION

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### A. NSF Proposal Review Process

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Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 ([NSB 97-72](#)). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued [Important Notice 127](#), Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the [Grant Proposal Guide](#) Chapter III.A

for further information). 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 he/she is qualified to make judgments.

**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 and original 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?

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

***Integration of Research and Education***

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

***Integrating Diversity into NSF Programs, Projects, and Activities***

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

**Additional Review Criteria:**For graduate student support, the knowledge and experience of the principal investigator in incoherent scatter theory and practice will be important factors in evaluating the merits of the proposals. Proposals for optical instrumentation will be evaluated according to the scientific objectives, the technical merits of the instrument design, the extent to which the instrument can be operated reliably at remote locations, and the ease with which data can be collected, analyzed, and disseminated for broad scientific use.

**B. Review Protocol and Associated Customer Service Standard**

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All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Ad Hoc and/or panel review.

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

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 Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

NSF is striving to be able to tell proposers whether their proposals have been declined or recommended for funding within six months. The time interval begins on the closing date of an announcement/solicitation, or the date of proposal receipt, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

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

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### A. Notification of the Award

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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 Division 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.A. for additional information on the review process.)

### B. Award Conditions

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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 (NSF-GC-1); \* or Federal Demonstration Partnership (FDP) Terms and Conditions \* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

\*These documents may be accessed electronically on NSF's Website at <http://www.nsf.gov/awards/managing/>. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpm](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpm). The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at <http://www.gpo.gov>.

### C. Reporting Requirements

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For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. 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. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, 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.

## VIII. CONTACTS FOR ADDITIONAL INFORMATION

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General inquiries regarding this program should be made to:

- Robert M. Robinson, Program Manager, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8529, fax: (703) 292-9022, email: [rmrobin@nsf.gov](mailto:rmrobin@nsf.gov)
- Robert Kerr, Program Director, Directorate for Geosciences, Division of Atmospheric Sciences, 790 N, telephone: (703) 292-8529, fax: (703) 292-9023, email: [rkerr@nsf.gov](mailto:rkerr@nsf.gov)

- Kile B. Baker, Program Director, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8519, fax: (703) 292-9022, email: [kbaker@nsf.gov](mailto:kbaker@nsf.gov)
- Richard A. Behnke, Section Head, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8518, fax: (703) 292-9022, email: [rbehnke@nsf.gov](mailto:rbehnke@nsf.gov)

For questions related to the use of FastLane, contact:

- Ruth E. Joel, Program Assistant, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8522, fax: (703) 292-9022, email: [rjoel@nsf.gov](mailto:rjoel@nsf.gov)

## IX. OTHER PROGRAMS OF INTEREST

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The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF *E-Bulletin*, which is updated daily on the NSF Website at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's *MyNSF News Service* (<http://www.nsf.gov/mynsf/>) to be notified of new funding opportunities that become available.

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

*Facilitation Awards for Scientists and Engineers with Disabilities* (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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:**

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