Enhancing Access to the Radio Spectrum (EARS)

PROGRAM SOLICITATION
NSF 12-546

REPLACES DOCUMENT(S):
PD 10-7976

National Science Foundation

Directorate for Mathematical & Physical Sciences
Division of Astronomical Sciences
Division of Mathematical Sciences
Division of Materials Research

Directorate for Engineering
Division of Electrical, Communications and Cyber Systems

Directorate for Computer & Information Science & Engineering
Division of Computer and Network Systems

Directorate for Social, Behavioral & Economic Sciences
Division of Social and Economic Sciences

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

June 14, 2012

IMPORTANT INFORMATION AND REVISION NOTES

Important Reminders

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), NSF 11-1, was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in NSF 11-1 apply to proposals submitted in response to this funding opportunity. Proposers who opt to submit prior to January 18, 2011, must also follow the guidelines contained in NSF 11-1.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: *Grant Proposal Guide (GPG)* Chapter II.C.2.g(xi) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/dmp.jsp. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Enhancing Access to the Radio Spectrum (EARS)
Opportunities for interdisciplinary research that increases the efficiency with which radio spectrum is used or expands access to wireless-enabled services for all Americans.

Synopsis of Program:

The National Science Foundation's Directorates for Mathematical and Physical Sciences (MPS), Engineering

(ENG), Computer and Information Science and Engineering (CISE), and Social, Behavioral, and Economic Sciences (SBE) are coordinating efforts to identify bold new concepts with the potential to contribute to significant improvements in the efficiency of radio spectrum utilization, and in the ability for traditionally underserved Americans to benefit from current and future wireless-enabled goods and services. EARS seeks to fund innovative collaborative research that transcends the traditional boundaries of existing programs, such as research that spans disciplines covered by two or more of the participating NSF directorates.

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.

- Andrew W. Clegg, MPS Program Officer & EARS Program Director, telephone: (703) 292-4892, email: aclegg@nsf.gov
- Zhi Tian, ENG Program Officer, telephone: (703) 292-2210, email: ztian@nsf.gov
- George Haddad, ENG Program Officer, telephone: (703) 292-8897, email: ghaddad@nsf.gov
- Juan E. Figueroa, ENG SBIR/STTR Program Officer, telephone: (703) 292-7054, email: jfiguero@nsf.gov
- Min Song, CISE Program Officer, telephone: (703) 292-8950, email: msong@nsf.gov
- Michael Reksulak, SBE Program Officer, telephone: (703) 292-7266, email: mreksula@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.075 --- Social Behavioral and Economic Sciences

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 25

Approximately 25 in FY 2012. Each proposal may request up to $500,000 in total funding over a period of up to three years.

Anticipated Funding Amount: $11,000,000

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

A proposer may be a Principal Investigator (PI) or co-PI on up to two proposals.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

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

B. Budgetary Information

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

C. Due Dates

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

  June 14, 2012

Proposal Review Information Criteria

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

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

The radio spectrum is a finite but exceedingly valuable natural resource that facilitates a tremendous variety of applications and services. Some of the most prevalent examples include radio and television broadcasting, cellular phones, Wi-Fi, Bluetooth, broadband wireless Internet access, GPS, radar, weather satellites, and military/government/public safety communications, among a multitude of others. During the past two decades, the use of the radio spectrum has intensified and expanded enormously. Wireless systems have proven to be a major productivity tool for every sector of the national economy and have become integrated into the fabric of our society. As they have proliferated and new applications emerge, precious spectrum resources are in ever-greater demand.

In 2010, the President of the United States issued a memorandum entitled "Unleashing the Wireless Broadband Revolution," which, among other directives, calls on the Federal Government to identify 500 MHz of spectrum to be made available for wireless broadband use, and specifically calls on the NSF to work with the Department of Commerce and other federal agencies to "create and implement a plan to facilitate research, development, experimentation, and testing by researchers to explore innovative spectrum-sharing technologies..." In the American Recovery and Reinvestment Act, Congress directed the Federal Communications Commission to devise a plan "to ensure that all people of the United States have access to broadband capability." The resulting National Broadband Plan was released in 2010 and, among many other recommendations, calls on the NSF to fund wireless

research and development that will advance the science of spectrum access.

NSF seeks to help reach the nation's broadband goals and the larger objective of alleviating growing pressure on limited spectrum resources. Innovative approaches, technologies, and policies will be required to enable more flexible and efficient access to the radio spectrum. In August, 2010, NSF funded a workshop on the topic of Enhancing Access to the Radio Spectrum (EARS). The charge to the workshop was "to identify interdisciplinary research opportunities that will lead to future enhancements in the efficiency by which the radio spectrum is used, and that will enhance the ability of all Americans to access broadband wireless services and realize other benefits derived from efficient spectrum use." The workshop was attended by researchers with relevant expertise in a wide variety of disciplines, including physical sciences, mathematics, engineering, computer science, economics, and public policy. A key objective was to identify the intersections of the individual disciplines relevant to radio spectrum efficiency and access. The final report of the workshop is available at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503480.

II. PROGRAM DESCRIPTION

While NSF funds a variety of wireless research and development within specific disciplines across the Foundation, the EARS workshop identified challenges and opportunities from an interdisciplinary perspective. As a result, the EARS program targets innovative and potentially transformational research that carefully considers the interplay of science, engineering, technology, applications, economics, social sciences, and public policy on spectrum efficiency and access. A unique merit review criterion for the EARS program is how a proposed research endeavor addresses the program's objectives across two or more traditional disciplinary boundaries. Such considerations should be addressed through substantive components of the proposed research. Collaboration between PIs and co-PIs with expertise in separate disciplines is highly encouraged. We are particularly interested in supporting non-trivial collaborations in areas where such interdisciplinary collaboration is presently uncommon, and to support the initiation of new collaborations. *Projects supported under EARS must include a clear description of the nature of the collaboration as a separate component of the project description.*

The key research areas of interest to the EARS program include, but are not limited to, those that impact a wide range of technologies, applications, and users. Some broad examples and general topic areas include, *but are not limited to*:

- Spectral efficiency. Suitable topic areas include, but are not limited to, innovations that improve spectral efficiency on an instantaneous basis, such as mitigation of unwanted emissions, improvements in filter technology, interference cancellation, etc.; and improvements on a system-wide basis, such as dynamic spectrum access, frequency re-use, and innovative millimeter wave and THz frequency devices and systems. Advanced spectrum sensing techniques are needed to quickly and accurately identify transmission opportunities over a very wide spectrum pool that may host a large number of different wireless services.
- Reconfigurable wireless platforms, including, but not limited to, cognitive radio, software-defined radio, novel hardware/software co-design, adaptive antennas, etc., to dynamically implement incentive mechanisms and spectrum policy, facilitate the coexistence of multiple dynamic spectrum access networks, and optimize network performance.
- Security of wireless signals and systems in the context of spectrum sharing.
- Coexistence with legacy systems, including, but not limited to, backwards and forward interoperability and compatibility. A major challenge of moving to a new and more efficient spectrum-use model will be a lengthy and complex transition period that will allow for the co-existence of novel new systems and regulations with the multitude of existing legacy systems and regulations.
- Special-purpose wireless systems may be difficult to accommodate within bold new spectrum-use models because of fundamental limitations on frequency agility due to basic operational requirements, extreme sensitivity to interference, or potentially drastic consequences due to failure of an RF link. Innovative solutions for accommodating such systems are needed. These systems may include medical devices, surveillance, remote sensing, and passive systems such as radio telescopes.
- Wireless system tests, measurements, and validation. New technology that can result in improvements in spectrum efficiency and access will require new test & measurement solutions and standards and regulatory validation. In addition, measurements and metrics to establish existing and future levels of spectrum occupancy and efficiency will be required.
- Economic models for spectrum resource sharing. There exists a need for interdisciplinary research in the areas of market and non-market-based mechanisms for spectrum access and usage to efficiently organize the sharing of scarce spectrum resources. Examples of research themes include, but are not limited to, real-time auctions, market design, spectrum valuation, spectrum management for the home user and managing mixed-rights spectrum.
- New and novel measurement-based spectrum management techniques, including agent-based systems, policy-based spectrum management, local and scalable spectrum management.

Proposers may also wish to refer to Section 7 of the EARS workshop report for more details and additional areas of interest. However, these lists are not meant to be limiting. EARS will give full consideration to all cross-cutting proposals with viable innovative ideas for increasing radio spectrum efficiency and access.

It is the intent of the EARS program to develop a broad portfolio across the various topical areas in physical sciences, engineering, computer and information science, and social, behavioral, and economic sciences. New areas of collaboration are strongly encouraged. The aim of the EARS program is to support projects for which the collective effort by a group of researchers with complementary expertise is necessary to reach the scientific goals. The researchers in the group may come from more than one institution or organization. Awards made under EARS are intended to foster synergy between the disciplines and between the researchers in the group that cannot easily be achieved with individual grants. Proposals will be judged in part by the level of collaboration involved, and awardees will be expected to show evidence of collaboration in their annual progress reports. One measure of interdisciplinarity is the extent to which the proposed research spans disciplines covered by two or more of the participating NSF directorates.

Prospective investigators in the EARS program should carefully consider whether a planned proposal is best suited for the EARS program or for an existing disciplinary program, keeping in mind that NSF does not accept substantially overlapping proposals that are submitted to different programs simultaneously without prior approval. Potential PIs are encouraged to contact one of the cognizant program officers before submitting a proposal.

Important: The EARS program will not provide support for:

- Research and development of a specific wireless system, unless the results of the research are directly applicable to the broader goals of the EARS program and that connection is clearly established in the proposal
- The acquisition of general wireless infrastructure
- Ongoing operating costs of existing wireless facilities
- The acquisition of new or updated radio systems

- Routine spectrum management functions
- Legal fees related to the creation or protection of intellectual property rights

Proposals requesting funding for any of these items will be considered not responsive to this solicitation and returned without review.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: Approximately 25 in FY 2012. Each proposal may request up to $500,000 in total funding over a period of up to three years.

Anticipated Funding Amount: $11,000,000 in FY 2012

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

A proposer may be a Principal Investigator (PI) or co-PI on up to two proposals.

Additional Eligibility Info:

Synergistic collaborations or partnerships with industry or government are encouraged where appropriate, though no NSF funds will be provided to these organizations. Researchers from foreign academic institutions who contribute essential expertise to the project may participate as senior personnel but may not receive NSF support.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

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

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

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

In the event of conflicting instructions between the GPG and this solicitation, the instructions in this solicitation should be followed.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

Budget Preparation Instructions: The budget must request funding for travel to Washington DC for the PI and up to one co-PI or other senior personnel to attend a two-day EARS PI conference.

C. Due Dates

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

  June 14, 2012

Full proposal deadline.

D. FastLane / Grants.gov Requirements

- For Proposals Submitted Via FastLane:

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

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

- For Proposals Submitted Via Grants.gov:

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program 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 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, 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.

Additional Solicitation Specific Review Criteria

Increasing spectrum efficiency and access requires careful consideration of the interplay of physical sciences; engineering; computer and information science; technology; applications; the social, economic and behavioral sciences; and public policy. Reviewers will be asked to consider the extent to which a proposal addresses the issue across two or more traditionally separate disciplines. Such considerations should be addressed through substantive components of the proposed research. Collaboration between PIs and co-PIs with expertise in separate disciplines is highly encouraged. One measure of interdisciplinarity may be the extent to which the proposed research spans disciplines covered by two or more of the participating NSF directorates.

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.

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

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:

- Andrew W. Clegg, MPS Program Officer & EARS Program Director, telephone: (703) 292-4892, email: aclegg@nsf.gov
- Zhi Tian, ENG Program Officer, telephone: (703) 292-2210, email: ztian@nsf.gov
- George Haddad, ENG Program Officer, telephone: (703) 292-8897, email: ghaddad@nsf.gov
- Juan E. Figueroa, ENG SBIR/STTR Program Officer, telephone: (703) 292-7054, email: jfiguero@nsf.gov
- Min Song, CISE Program Officer, telephone: (703) 292-8950, email: msong@nsf.gov
- Michael Reksulak, SBE Program Officer, telephone: (703) 292-7266, email: mreksula@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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