

# Emerging Models and Technologies for Computation (EMT)

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## Program Solicitation

NSF 08-517

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*Replaces Document(s):*

NSF 07-523

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**National Science Foundation**

Directorate for Computer & Information Science & Engineering  
Division of Computing and Communication Foundations

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

March 13, 2008

## REVISION NOTES

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In furtherance of the President's Management Agenda, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via [Grants.gov](http://Grants.gov) or via the [NSF FastLane](#) system. In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the [NSF FastLane](#) system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

## SUMMARY OF PROGRAM REQUIREMENTS

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### General Information

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**Program Title:**

Emerging Models and Technologies for Computation (EMT)

**Synopsis of Program:**

The goal of the EMT program is to enable radical innovations in the software, hardware and architecture of computing and communication systems through the support of projects that capitalize upon research opportunities at the intersection of computing and biological systems, nanoscale science and engineering, quantum information science, and other promising areas of science and technology. Interdisciplinary collaborations involving computer scientists, engineers in various fields, physicists, chemists, mathematicians, and biologists are highly encouraged.

Competitive proposals will move beyond incremental and evolutionary technological advances, stimulating seminal discoveries and innovations that will allow computing and communication systems to both work in radically different ways and make much greater contributions to society. In addition to advancing the research frontiers of computing and communications, the EMT program supports the development of innovative curricula and courseware that will help train future generations of engineers and scientists in emerging models and technologies for computation and communication.

In FY 2008, the EMT program will fund research projects of three different types:

- Large - These projects typically involve four or more Principal Investigators (PIs) working in complementary fields of science or engineering, and their associated postdoctoral fellows and/or students;
- Medium - These projects typically involve two to four PIs with complementary research expertise and their associated postdoctoral fellows and/or students; and
- Small - These projects typically consist of a single PI and associated postdoctoral fellow and/or students

**Cognizant Program Officer(s):**

- Pinaki Mazumder, Program Director, telephone: (703) 292-8910, email: [pmazumde@nsf.gov](mailto:pmazumde@nsf.gov)
- Tatsuya Suda, Program Director, telephone: (703)292-8910, email: [suda@nsf.gov](mailto:suda@nsf.gov)

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

- 47.070 --- Computer and Information Science and Engineering

**Award Information**

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**Anticipated Type of Award:** Standard Grant or Continuing Grant

**Estimated Number of Awards:**

20 awards will be made.

Up to 8 Small awards will be made with an average award size of \$150,000/year for up to three years. Up to 8 Medium awards are anticipated with an average award size of \$330,000/year for up to three years. Up to 4 Large awards will be made, each with a budget up to \$1,000,000/year for up to three years.

**Anticipated Funding Amount:** \$16,000,000 in fiscal year 2008, pending the availability of funds.

**Eligibility Information**

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**Organization Limit:**

None Specified

**PI Limit:**

None Specified

**Limit on Number of Proposals per Organization:**

None Specified

**Limit on Number of Proposals per PI:**

An individual may participate as PI, co-PI or Senior Personnel in at most two EMT proposals submitted in response to this solicitation, of which no more than one may be a Small proposal.

## Proposal Preparation and Submission Instructions

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### 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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg).
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: <http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf>)

### B. Budgetary Information

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

### C. Due Dates

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

March 13, 2008

## Proposal Review Information Criteria

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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 goal of the Emerging Models and Technologies for Computation (EMT) program is to enable radical innovations in the software, hardware and architecture of computing and communication systems through the support of projects that capitalize upon research opportunities at the intersection of computing and biological systems, nanoscale science and engineering, quantum information science, and other promising areas of science and technology. Interdisciplinary collaborations among computer scientists, engineers in various fields, physicists, chemists, mathematicians, and biologists are highly encouraged.

Competitive EMT proposals will move beyond incremental and evolutionary technological advances, stimulating seminal discoveries and innovations that will allow computing and communication systems to both work in radically different ways and make much greater contributions to society. In addition to advancing the research frontiers of computing and communications, the EMT program supports the development of innovative curricula and courseware that will help train future generations of engineers and scientists in emerging models and technologies for computation and communication.

# II. **PROGRAM DESCRIPTION**

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The EMT program supports research and education projects that investigate innovative computing and communication systems, explore novel ideas, theory and experiments, and transcend the boundaries of computing and biological systems, quantum information science, nanoscale science and engineering or other promising areas of science and technology. Competitive proposals will be exploratory, will explicitly address how the project promises to advance computing and communication systems, and will include both research and education components.

Anticipated research activities include, but are not limited to: modeling and simulation of biological computing and communication systems; design of computing and communication models based on desirable features of biological systems; investigation of various aspects of quantum-based approaches to processing information and data communication; and investigation of innovative nanoscale science and engineering approaches that promise radical innovations in computing and communication systems.

Because of the exploratory nature of the research supported by the EMT program, the research areas described in this solicitation are illustrative of the research areas that the EMT program seeks to fund. In addition, while each research area described below deals with a set of specific topics internal to the research area, research issues inevitably straddle artificially imposed boundaries. The EMT program encourages projects that transcend the confines of each of the research areas elaborated below.

## **II-1. Biological Systems Science and Engineering (BSSE)**

The EMT program is interested in research that explores opportunities at the intersection of biology and computer science, with a specific focus on activities that advance our understanding of computing and communication processes in biological systems in order to recreate or use them as models for, or demonstrations of, innovative computing and communication systems.

There are many sources of inspiration in the biological system that suggest new models of computation (biologically inspired computing), such as understanding the relationships between parallel architectures and the range of cell and tissue signaling systems. Another example is the exploitation of the parallel, distributed and emergent computational capabilities of particular genomic systems such as bacteria, yeast and C elegans to develop robust, adaptive and evolving computing systems. Systemic metaphors provide a basis for model development and a general framework for integrating a range of key constructs, such as hierarchy and organization. The idea of cognitive systems as metaphors may provide a basic conceptual structure to encapsulate general notions about networks, hierarchies and nesting across scale and time. Self-governance properties such as self-configuration, self-maintenance and self-optimization of nervous systems may offer insights on designing and managing large complex and dynamical computing systems.

The EMT program is also interested in biologically inspired networks that draw inspiration from biology to create new models of communication and networking. For instance, food-seeking behavior of biological organisms (such as ants and slime mold) may provide inspiration for the design of innovative routing algorithms and communication protocols. Many biological organisms (such as bees) autonomously interact and maintain a large-scale society, and software service components mimicking such autonomous interaction in the service oriented network architecture may present an innovative approach to the design of scalable network services. Biologically inspired computing theories, models and algorithms developed from systemic metaphors provide a basis for developing a model and a framework for new communication and networking systems

Also of interest is the development of innovative techniques for mathematical modeling, simulation and empirical investigation of biological computing and communication processes. Although advances in computational science have resulted in the modeling and simulation of living systems at multiple scales (e.g., at the atomic scale, at the molecular scale, at the organism scale), techniques currently available fail to consider key aspects of biological computing and communication processes (such as utilizing and benefiting from environmental noise). Current techniques are also limited by their need for high-end computing and communication systems. A wide-spectrum of new mathematical and computational methods is required to more fully understand biological computing and communication processes. The EMT program is also supports empirical investigation of biological computing and communication processes that may lead to computing and communication systems based on biological materials.

Examples of sub-areas of interest include, but are not limited to:

- Modeling of protein structures and genetic and biochemical networks at various scales to understand biological computing and communication processes;
- Increased understanding of desirable features (e.g., self-organization, adaptation, robustness, and scalability) and mechanisms (e.g., mechanisms to deal with environmental noise, to encode information onto molecules, and to realize probabilistic behaviors) of computing and communication processes in biological systems;
- Innovative modeling, analytical and simulation techniques and tools designed to better understand the complexity of biological computing and communication processes;
- Control and partial recreation of propagation of information-encoded molecules at various levels of biological systems (e.g., at the molecular-motor-based intra-cell signaling level, at the calcium-based inter-cell signaling level, at the neuron signaling level);
- System and component designs and new information models for molecular computing and molecular communication;
- Theories and models of computation that exploit biological properties, such as evolution, self-organization or redundancy, and show promise for new kinds of computing systems;
- Computation models inspired by small multi-cellular organisms for better rendering of a small set of vital biological functions;
- Computer and communication architectures inspired by biological phenomena such as immune system components and processes or the neurophysiological basis of behavior to provide self organization, adaptation, robustness, scalability, and other desirable biological features; and
- Innovative approaches to sensor network topology management, inspired by the pattern creation process of slime mold.

## **II-2 Quantum Information Science (QIS)**

The goal of this area is to explore disruptive innovations in computing and communication systems by drawing upon new insights and understanding in Quantum Information Science (QIS), ultimately leading to the stronger unification of information sciences, quantum physics, and molecular biology.

This research area includes quantum computers, quantum communication, quantum optics, and other quantum-based and related approaches to processing, understanding and communicating information. There are two fundamental, long-term issues in QIS: (1) research that probes the physical foundations that are relevant not only to QIS but to other areas of possible future technology; and (2) strategies to develop quantum computing principles for general-purpose computing and systems-level computing design, as well as special-purpose algorithms that transcend the limitations of special purpose algorithms now available for niche applications such as cryptography and number theory.

Examples of sub-areas of interest include, but are not limited to:

- Better understanding of novel types of entanglement;
- Development of a broad and general collection of quantum algorithms;
- Extension of concepts of information theory to the realm of quantum foundations and experiments;
- Architectural modeling and design of quantum computers and systems;
- Use of quantum information in communication and networking; and
- Novel approaches to fault tolerance and to managing the stochastic errors in quantum systems.

### **II-3 Nanotechnology for Computing and Communication (NANO)**

The EMT program supports research that aids and advances the physical design/realization of novel, nanoscale computing, communication and information processing models. There is considerable evidence that building a physically stable structure, molecule by molecule, is quite feasible. For example, self-assembly - a method of fabrication that relies on chemicals forming larger structures without centralized or external control - is potentially an important technique for producing computing components at the nanoscale. Both theoretical and experimental research is encouraged.

Examples of sub-areas of interest include, but are not limited to:

- Nanoscale revolutionary computing and communication architectures;
- New technologies for ultra-fast data communication in a VLSI chip;
- Silicon-compatible mesoscale systems to improve performance;
- Theoretical principles of nanoscale circuits and systems;
- Hierarchical CAD tools for nanoscale systems;
- Multi-scale modeling techniques for nanoscale devices;
- Molecular computing and communication for nanoscale machines; and
- Unconventional experimental system technologies at the nanometer scale.

### **II-4 Other Emerging Models and Technologies for Computing and Communication (MISC)**

In addition to the three main areas of emerging models and technologies so far described in the solicitation (i.e., Biological Systems Science and Engineering, Quantum Information Science, Nanotechnology for Computing and Communication), the EMT program also supports innovative projects that apply other emerging models and technologies to create fundamentally new computing and communication systems.

## **III. AWARD INFORMATION**

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Approximately 20 new awards will be made in FY 2008. Up to 8 Small awards will be made with an average award size of \$150,000/year for up to three years. Up to 8 Medium awards are anticipated with an average award size of \$330,000/year for up to three years. Up to 4 Large awards will be made, each with a budget of up to \$1,000,000/year for up to three years. Competitive Large and Medium proposals will include interdisciplinary teams of PIs with synergistic research expertise.

## **IV. ELIGIBILITY INFORMATION**

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### **Organization Limit:**

None Specified

### **PI Limit:**

None Specified

### **Limit on Number of Proposals per Organization:**

None Specified

### **Limit on Number of Proposals per PI:**

An individual may participate as PI, co-PI or Senior Personnel in at most two EMT proposals submitted in

response to this solicitation, of which no more than one may be a Small proposal.

## V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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### A. Proposal Preparation Instructions

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**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](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 this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (<http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf>). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

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

**Collaborative Proposals.** All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

#### **THE FOLLOWING PROPOSAL PREPARATION INSTRUCTIONS APPLY TO PROPOSALS SUBMITTED IN RESPONSE TO THIS SOLICITATION.**

- When preparing an EMT proposal in Fastlane, PIs must include a project title that begins with "EMT/BSSE:", "EMT/QIS:", "EMT/NANO:", or "EMT/MISC:", consistent with the proposed project's research and education focus. If the research focus overlaps two or more of the research areas explicated in Section II of this solicitation, the proposal title should begin with "EMT/MISC:".
- PIs submitting Medium or Large EMT proposals MUST include 1-page Collaboration Plans within their 15-page Project Descriptions.

### B. Budgetary Information

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

### C. Due Dates

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

March 13, 2008

### D. FastLane/Grants.gov Requirements

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- **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](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 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](mailto: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

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Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF 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 with the proposer.

### A. NSF Merit Review Criteria

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

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

#### **What is the intellectual merit of the proposed activity?**

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

#### **What are the broader impacts of the proposed activity?**

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research



and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

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

NSF staff 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 Medium and Large proposals only:

- Comment on the extent to which the project scope justifies the level of investment requested, and the degree to which the participating investigators will work synergistically to accomplish the project objectives.
- Comment on the proposers' Collaboration Plan.

## **B. Review and Selection Process**

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Proposals submitted in response to this program solicitation will be reviewed by Panel Review.

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

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

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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 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

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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 (GC-1); \* or Federal Demonstration Partnership (FDP) Terms and Conditions \* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

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

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

## C. Reporting Requirements

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

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

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

## VIII. AGENCY CONTACTS

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General inquiries regarding this program should be made to:

- Pinaki Mazumder, Program Director, telephone: (703) 292-8910, email: [pmazumde@nsf.gov](mailto:pmazumde@nsf.gov)
- Tatsuya Suda, Program Director, telephone: (703)292-8910, email: [suda@nsf.gov](mailto:suda@nsf.gov)

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: [fastlane@nsf.gov](mailto:fastlane@nsf.gov).
- Velma Lawson, Integrative Activities Specialist, telephone: (703) 292-8910, email: [vlawson@nsf.gov](mailto:vlawson@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](mailto:support@grants.gov).

## IX. OTHER INFORMATION

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The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, MyNSF (formerly the Custom News Service) is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. MyNSF also is available on NSF's Website at <http://www.nsf.gov/mynsf/>.

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

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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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.

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