

# High-Performance Computing for Science and Engineering Research and Education: Operations (User Support, System Administration and Maintenance) (HPCOPS)

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## Program Solicitation

NSF 06-599



National Science Foundation

Office of Cyberinfrastructure

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

November 28, 2006

## REVISION NOTES

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In furtherance of the President's Management Agenda, in Fiscal Year 2006, 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:**

High-Performance Computing for Science and Engineering Research and Education: Operations (User Support, System Administration and Maintenance) (HPCOPS)

**Synopsis of Program:**

This solicitation seeks to support research and education in science and engineering that requires the use of

high-performance computing systems by providing support for the operation of existing HPC systems. This solicitation is a competitive opportunity for institutions that have significant HPC systems with an expected useful life that extends beyond 2007 and which they wish to make available, through the TeraGrid, to the science and engineering community without restriction to discipline.

**Cognizant Program Officer(s):**

- Stephen Meacham, telephone: (703) 292-8970, email: [smeacham@nsf.gov](mailto:smeacham@nsf.gov)

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

- 47.080 --- Office of Cyberinfrastructure

**Award Information**

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**Anticipated Type of Award:** Cooperative Agreement

**Estimated Number of Awards:** 4

**Anticipated Funding Amount:** \$28,000,000 Subject to availability of funds.

**Eligibility Information**

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**Organization Limit:**

Proposals may only be submitted by the following:

- **Universities and colleges:** U.S. universities and two- and four-year colleges (including community colleges). **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. FFRDC's affiliated with agencies other than the National Science Foundation are NOT eligible to submit a proposal to this competition.

**PI Limit:**

None Specified

**Limit on Number of Proposals per Organization:** 1

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

None Specified

**Proposal Preparation and Submission Instructions**

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**A. Proposal Preparation Instructions**

- **Letters of Intent:** Not Applicable
- **Full Proposals:**
  - Full Proposals submitted via FastLane: 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 by NSF.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

## C. Due Dates

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

November 28, 2006

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

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

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## I. INTRODUCTION

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The potential impacts of access to advanced high-performance computing (HPC) on science and engineering research have been well documented in recent reports from academia, industry, and the federal government. With high-performance computing, researchers study the properties of minerals at the extreme temperatures and pressures that occur deep within the Earth. They simulate the development of structure in the early Universe. They probe the structure of novel phases of matter such as the quark-gluon plasma. HPC capabilities enable the modeling of life cycles that capture interdependencies across diverse disciplines and multiple scales to create globally competitive manufacturing enterprise systems. And they examine the way proteins fold and vibrate after they are synthesized inside an organism. Sophisticated numerical simulations permit scientists and engineers to perform a wide range of *in silico* experiments that would otherwise be too difficult, too expensive or impossible to perform in the laboratory.

High-performance computing is also essential to the success of research conducted with sophisticated experimental tools. For example, without the waveforms produced by numerical simulations of black hole collisions and other astrophysical events, gravitational wave signals cannot be extracted from the data produced by the Laser Interferometer Gravitational-wave Observatory; high-resolution seismic inversions from the higher density of broad-band seismic observations furnished by the EarthScope project are necessary to determine shallow and deep Earth structure; simultaneous integrated computational and experimental testing is conducted on the Network for Earthquake Engineering Simulation to improve seismic design of buildings and bridges; and HPC will be essential to extracting the signature of the Higgs boson and supersymmetric particles – two of the scientific drivers of the Large Hadron Collider – from the petabytes of data produced in the trillions of particle collisions.

Beginning in FY06, NSF is funding HPC acquisitions on two tracks, through open competitions. Track 2 is aimed at mid-range HPC systems, has a deadline once each fiscal year, and is described in [NSF 05-625](#), Track 1 is a petascale acquisition and is described in [NSF 06-573](#). In both the Track 1 and Track 2 competitions, submitting organizations provide a plan and budget for acquisition and deployment, and a plan and budget for operations, including maintenance and user support, that cover the expected useful lifetime of the system being acquired. Both sets of plans and budgets are reviewed together and, for each system acquired, a pair of linked awards is made, one to fund acquisition and deployment, the other to fund operations.

Prior to 2006, NSF funding of operations costs of HPC systems intended for use by the broad science and engineering research and education community have been provided through a combination of two models: TeraGrid Resource Provider awards and Core Center awards. In some cases, the duration of these awards is less than the projected lifetime of the computing systems. Some TeraGrid Resource Provider awards provide operations support for computing systems that were not acquired through direct use of funds from NSF but which have been made available, through the TeraGrid, by the institutions that own them, for use by the general, academic science and engineering community; others provide support for systems acquired with NSF funding.

This solicitation is intended to be a competitive opportunity for institutions that have significant HPC systems with an expected useful life that extends beyond 2007 and which they wish to make available, through the TeraGrid, to the science and engineering community without restriction to discipline. It is intended to complement the Track 1 and Track 2 approaches to the provision of HPC services while the number of Track 2 systems grows to an equilibrium level. It is not anticipated that there will be a similar solicitation in the year following this solicitation.

## II. PROGRAM DESCRIPTION

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This solicitation seeks to support research and education in science and engineering that requires the use of high-performance computing systems by providing support for the operation of existing systems. It encompasses only “widely shared HPC systems.” These are defined here to be HPC systems that are, or will be, made available to the broad academic science and engineering research and education community, without any restriction to specific disciplines, and on which time is allocated via the national allocation process described at <http://www.ci-partnership.org/Allocations/>.

**Operations costs may include:** the cost of maintenance contracts; the cost of power and physical security; the cost of network connectivity; costs associated with leasing machine room space, if necessary, and any other necessary operating costs; personnel costs associated with system administration, account administration, user support and consulting services, user training, activities designed to enhance the participation of under-represented groups, networking, cyber-security, and project management. Operations costs may include the basic costs of providing long-term storage of users' files directly associated with their use of the high-performance computing systems. Additional costs associated with maintaining a general-purpose data archive or digital library should not be included. Proposals for operations costs should not include major hardware purchases.

Awards made under this solicitation will be TeraGrid Resource Provider awards. The TeraGrid is a collaborative infrastructure consisting of resource providers (RPs) and a Grid Infrastructure Group (GIG). The GIG is responsible for coordinating TeraGrid planning and management, and for providing some central services. The TeraGrid system itself is an integrated and coordinated set of resources that provide advanced capabilities to science and engineering researchers and educators. The system design and implementation are driven by the requirements of scientists and engineers, and the system's functionality is delivered through a variety of software, middleware, policy, and support functions.

Integrating and operating a computational resource as part of the TeraGrid involves a set of required and optional activities and services. At present, required components include:

- support for TeraGrid data movement services;
- participation in the coordinated implementation of security practices and policies;
- assistance in problem resolution for issues related to local resources;
- support for the Coordinated TeraGrid Software and Services specification;
- participation in verification and validation processes; and
- participation in the resource allocation and accounting processes.

Information on what is involved in integrating a resource into the TeraGrid may be found at <http://www.teragrid.org/>.

Proposals should be submitted by institutions that wish to provide HPC resources to the science and engineering community, without restriction to discipline, by operating existing HPC systems that have an expected useful life that extends beyond 2007. If an institution currently operates several systems that were acquired with funds provided by NSF for the express purpose of acquiring systems for use by the broad science and engineering community, then all such systems that are expected to be viable and cost-effective after 2007 should be included within the scope of a single proposal. If an institution has significant HPC systems that were not acquired with NSF funds but which the institution wishes to make available, through the TeraGrid, for use by the general science and engineering research and education community, then at least 50% of the resources associated with each such system included in the proposal should be made available for allocation through the national allocation process described at <http://www.ci-partnership.org/Allocations/>. The total computational capacity of the computational resources included in a proposal and made available for allocation should be greater than 5 teraflop/s sustained as measured by the HPCC HPL benchmark. (Details of the HPCC benchmarks may be found at <http://icl.cs.utk.edu/hpcc/>.)

Ideally, in addition to contributing HPC resources, proposals from institutions that are not already part of the TeraGrid should also contribute qualities that complement the existing TeraGrid. For example, user support expertise in areas of science or engineering that are not currently strongly represented amongst TeraGrid consultants, or an HPC architecture that is distinctive from those represented by the existing TeraGrid production resources. NSF is particularly interested in production HPC resources that feature hybrid architectures, such as those in which general purpose processors are coupled with distinctive co-processors. However, a hybrid architecture is not a requirement.

Proposals should be requests for any additional support required to cover the costs of operating those parts of the institution's portfolio of systems that are expected to still be useful to researchers and educators in all or part of the period October 2007 – September 2009. "Additional" here means in addition to any other partial support from NSF for operations, for example, small TeraGrid awards or sub-awards, or any operations support provided by other funding sources. This solicitation is not intended as an opportunity to supplement large HPC operations awards in effect during this period; for example, large TeraGrid awards or Track2 awards.

## **Budget**

Proposal budgets should be in the range \$2M - \$10M per year. For example, proposals that contribute a portfolio of systems and a high total computing capacity might be near the upper end of this range while proposals that contribute only a modest computing capacity associated with part of a single system might be near the lower end of this range. Proposal budgets must not exceed \$10M per year. Total, fully-burdened, personnel costs for operations, including those involved in providing user support, should not exceed \$7M per year. The award duration requested should be consistent with the expected useful lifetime of the systems being provided but should not exceed two years. The anticipated start dates for awards are between

July 2007 and October 2007.

## Access

Allocations of resources will be made using the national, community-run Large and Medium Resource Allocation Committee (xRAC) process established by NSF. Consistent with the current TeraGrid allocation policy, the operating organizations may also provide small development allocations to users.

## Renewal

There will be no commitment by NSF to an awardee to make a future award to upgrade or replace an aging HPC system. Awardees will be eligible to compete in NSF competitions for new HPC systems on the same basis as other proposing organizations.

## III. AWARD INFORMATION

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Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 4

Anticipated Funding Amount: \$28,000,000

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

## IV. ELIGIBILITY INFORMATION

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### Organization Limit:

Proposals may only be submitted by the following:

- **Universities and colleges:** U.S. universities and two- and four-year colleges (including community colleges). **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. FFRDC's affiliated with agencies other than the National Science Foundation are NOT eligible to submit a proposal to this competition.

### PI Limit:

None Specified

**Limit on Number of Proposals per Organization: 1**

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

None Specified

## 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 exceptions and additions to the guidelines in the GPG or the NSF Grants.gov Application Guide apply to proposals submitted to this competition:

**Proposers are reminded that letters of endorsement should not be included with proposals.** Letters of commitment from individuals who are described in the Project Description as involved in the project in a senior capacity but who are not members of the proposing organization or a sub-awardee are allowable, as are letters of commitment from authorized representatives of institutions or organizations collaborating with the lead institution. Such letters of commitment should be included in the Supplementary Documents section and do not count toward overall page limits.

The Project Description must include the following six sections.

- **HPC System Specification**
- **HPC System Performance on Science and Engineering Applications**
- **HPC System Reliability and Usability**
- **Implementation and Project Management**
- **Quality of the Physical Infrastructure**
- **Effective User Support and Operating Costs**

Information to be provided in each section is described below.

### **HPC System Specification**

Briefly describe the technical aspects of the system(s) that will be operated in sufficient detail that reviewers will be able to assess the likely impact of the proposed resource(s) on science and engineering research and education. Include a description of any aspects of the proposed system that are likely to influence the performance of science and engineering research codes. Please include information about the computational hardware, including the interconnect and I/O sub-system, the machine area network, secondary and tertiary storage, and file system(s). Describe how the compute engine, local disk, longer-term mass storage systems, and machine-room network are integrated to provide an environment that is well configured to support scientific and engineering computation.

Describe when the system or systems was/were deployed and the anticipated useful lifetime of the system(s).

### **HPC System Performance on Science and Engineering Applications**

Provide an explanation of why the proposed system(s) is/are well suited to science and engineering research and education. Include data for the performance of the system(s) on the following subset of the benchmarks described in [NSF 0605](#): (a) the HPC suite of synthetic benchmarks; (b) the application benchmarks PARATEC, WRF, MILC and HOMME.

### **HPC System Reliability and Usability**

Describe the software environment and how the software and tools will respond to the needs of users and system administrators.

Please provide data about the statistical distribution of the size and duration of jobs run over the past year on the systems for which support is requested.

Please provide data showing the number of times each system (including major components such as file systems) was restarted each week over the past year. For the past year, please provide monthly totals of the amount of time each system was available to users and of the cpu-hours used. Please provide monthly averages of the secondary and tertiary storage used.

For the past year, please provide monthly averages or totals, as appropriate, of the number of users, the distribution of job sizes and durations, the wait time in each queue, the number of trouble tickets received, the mean and variance of resolution time, and the mean and variance of the number of people involved in resolving trouble tickets. If the proposing institution is already a TeraGrid Resource Provider, then please give the fraction of trouble tickets resolved with input from TeraGrid user support services outside of the proposing institution.

### **Implementation and Project Management**

Please provide a description of how operations, including user support, will be managed and indicate lines of responsibility.

If the system or systems proposed have not previously been made available through the TeraGrid, please provide a project execution plan covering integration of the system with the TeraGrid and the integration of user support with TeraGrid user support.

### **Quality of the Physical Infrastructure**

Describe the physical facility that houses the system(s), including floor space, power, cooling, fire suppression, and any other emergency equipment. Describe the expected impacts of power interruptions and how these will be managed. Please provide an analysis of the implications of a sudden loss of power to, or catastrophic failure of, either the computing, storage or primary cooling systems and describe what emergency systems are in place to minimize damage to personnel and equipment.

Describe the present external network connectivity and any plans for modifying this. Describe how the system(s) is/are logically and physically connected to the external network(s). In general, TeraGrid providers of HPC resources should have at least one 10Gbps connection to the TeraGrid network. Major TeraGrid resource providers (sites with leading-edge resources and a large base of users) should have at least two independent high bandwidth (of at least 10 Gbps each) network connections between the Resource Provider site and one or more appropriate national networks.

High-performance applications can produce large amounts of data. Describe how these data will be handled, how data integrity will be maintained, what backup and contingency procedures and schedules will be provided and how they will be implemented. Describe also what issues associated with data access and the protection of confidentiality, privacy and intellectual property are anticipated and how policies and procedures will be developed to deal with these.

### **Effective User Support and Operating Costs**

Provide a plan for user support that includes a description of the anticipated requirements of the science and engineering research community, a description of how system resources will be allocated operationally (e.g. the structure of the queuing system and prioritization schemes used), and any other operational details likely to have an impact on user access or usage of the system(s).

Describe the number and anticipated qualifications of the types of personnel that will be involved with the provision of user support. In addition, describe the user training opportunities that will be made available. Describe the expected availability of



dedicated time on the system for both science and engineering applications and systems testing, and the fraction of system resources that will be consumed in moving users on and off the system, or reconfiguring it for dedicated use.

Describe which aspects of operations support, if any, will be provided on a 24/7 basis and which will be provided on a more limited basis.

Describe the experience of the proposing organization in operating HPC systems. Include a description of whether operational support was provided on a 24/7 basis or was provided on a more limited basis. Please describe the number and type of users, the types of computation performed, and the nature of the user support provided. Describe the processes used to evaluate management performance, determine user needs, and evaluate user satisfaction.

Describe how user feedback will be obtained and used to guide system operations. Describe how the proposing organization will evaluate the quality of the operational support provided and overall project performance during the lifetime of the award.

Briefly describe the maintenance contract(s).

In the Budget Justification, please include a description of: the cost of any maintenance contract(s); the cost of power and physical security; the cost of network connectivity; costs associated with leasing machine room space, if necessary; any other necessary operating costs; the staff involved and their roles.

## Supplementary Documents

Proposals should include the following sections as Supplementary Documents:

- A list of all institutions and companies involved in the project;
- A single, alphabetically ordered list of all people, in the academic or professional computing community, who have collaborated with (within the last 48 months), or have been a Ph.D. advisee or advisor of, any of the personnel involved in the proposed project. In this list, please include, next to the name of each conflicted individual, that individual's institution or company and the name of the project member with whom he or she has the conflict of interest. It is not necessary to list, as collaborators, personnel who are employees of an institution or company clearly involved in the project; and,
- Letters of commitment from individuals described in the Project Description as involved in the project in a senior capacity but who are not staff members of proposed awardees or sub-awardees, or from authorized representatives of institutions or organizations collaborating with the lead institution.

## B. Budgetary Information

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**Cost Sharing:** Cost sharing is not required by NSF in proposals submitted to the National Science Foundation.

**Other Budgetary Limitations:** Proposal budgets should be in the range \$2M - \$10M per year. For example, proposals that contribute a portfolio of systems and a high total computing capacity might be near the upper end of this range while proposals that contribute only a modest computing capacity associated with part of a single system might be near the lower end of this range. Proposal budgets must not exceed \$10M per year. Total, fully-burdened, personnel costs for operations, including those involved in providing user support, should not exceed \$7M per year.

## C. Due Dates

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

November 28, 2006

## 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 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:**

#### **Meeting the Needs of Computationally-Challenging Science and Engineering Applications**

How well does the system or systems discussed match the requirements of the science and engineering research and education community for HPC resources and services? Is it likely that use of the system(s) discussed will generate new, breakthrough, science and engineering discoveries?

#### **System Reliability and Usability**

Are the system(s) and the plans for operations likely to provide a robust, reliable, high-productivity computational environment for users? Does the environment in which the system(s) will be embedded include adequate capability for the remote analysis of output from high-end computations?

#### **Implementation and Project Management**

Is the management plan described sound and likely to ensure that the proposed system(s) will be available for use by the science and engineering research and education community? Does the proposing organization have the capability to manage the award and any associated sub-awards? Does the PI have the capability to manage the project? If the system(s) is not already integrated into the TeraGrid, is the plan for such integration well designed and will it be effective?

#### **Quality and Availability of the Physical Infrastructure**

Are the physical facilities described by the proposing organization adequate to ensure productivity of the systems described? Is the physical infrastructure sufficient to mitigate the risk of potential hazards?

#### **Effective User Support**

What are the qualifications and experience of the PI and the proposing organization in regard to managing an HPC resource and providing effective user support? Is the user support plan well designed? Does the proposal identify appropriate personnel for user support (either current staff or staff to be hired)?

#### **Operations Costs**

Are the budget and roster of personnel for operations and user support adequate and reasonable? Is the proposed investment worthwhile in light of the advances in science and engineering that are likely to result? Is the proposed duration consistent with the projected useful lifetime(s) of the system(s) being provided?

## B. Review and Selection Process

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Proposals submitted in response to this program solicitation will be reviewed by Adhoc Review or Panel Review or Site Visit Review or Reverse Site Review.

Review will be by a panel of reviewers. If necessary, this may be supplemented with reviews from *ad hoc* reviewers and/or site visits and/or reverse site visits. If site visits are required, it is anticipated that these will occur in January or February, 2007.

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 *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at <http://>

### Special Award Conditions:

Additional award conditions appropriate for the proper management and oversight of a complex agreement will be negotiated with the proposing organization prior to award and incorporated into the special terms and conditions of the award. It is anticipated that these will be dependent on the nature of the project proposed.

### 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.

Additional reporting requirements will be negotiated with the proposing organization prior to award and incorporated into the special terms and conditions of the award. At a minimum, these are likely to include, monthly reports of financial data and basic statistics about operations, more detailed quarterly or semi-annual reports, site visits, and periodic project reviews. It is anticipated that the latter will be annual but the review schedule will be based on the details of the project.

### VIII. AGENCY CONTACTS

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General inquiries regarding this program should be made to:

- Stephen Meacham, telephone: (703) 292-8970, email: [smeacham@nsf.gov](mailto:smeacham@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).
- Priscilla Bezdek, telephone: (703) 292-8962, email: [pbezdek@nsf.gov](mailto:pbezdek@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.

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

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

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

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

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

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

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

Send an e-mail to: [pubs@nsf.gov](mailto:pubs@nsf.gov)

or telephone: (703) 292-7827

## PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

Suzanne H. Plimpton  
Reports Clearance Officer  
Division of Administrative Services  
National Science Foundation  
Arlington, VA 22230

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