Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM)

PROGRAM SOLICITATION
NSF 11-515

REPLACES DOCUMENT(S):
NSF 10-532

National Science Foundation

Office of Cyberinfrastructure

Directorate for Biological Sciences

Directorate for Computer & Information Science & Engineering

Directorate for Education & Human Resources

Directorate for Engineering

Directorate for Geosciences

Directorate for Mathematical & Physical Sciences

Directorate for Social, Behavioral & Economic Sciences

Office of International Science and Engineering

Office of Polar Programs

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

March 16, 2011

IMPORTANT INFORMATION AND REVISION NOTES

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

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

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

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

Revision Summary

This solicitation limits the project description section for all CI-TEAM proposal types to 15 pages. (The previous CI-TEAM solicitation permitted 18 pages for Implementation and Diffusion proposals).

For Implementation and Diffusion submissions, the program now requires a succinct management and coordination plan in the proposal project description section, and a more detailed management and coordination plan of no more than 3 pages in the supplementary documents section.

A description of the computational science and engineering domains of current and high interest to the Office of Cyberinfrastructure is added. These include the creation, use, and/or deployment of cyberinfrastructure for large data environments, high performance computing, and/or advanced networking; and distributed virtual organizations, software, algorithms, networks and other approaches, tools and environments that are developed specifically to support these two areas of interest.

Stronger language is included to solicit proposals that exhibit strong interdisciplinary teams, especially including education experts to guide rigorous educational program design and measurement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM)

Synopsis of Program:

New information, communication, and computational technologies have had profound impacts on the practice of science (in this solicitation, the term science includes the natural, mathematical, computing, and social sciences), engineering, and education. This includes the means by which citizens of all ages use science and engineering to enhance professional and private lives. The systems, tools, and services emerging from these new technologies are linked to create a comprehensive cyberinfrastructure that is enabling individuals, groups, and organizations to advance research and education in ways that revolutionize who can participate, what they can do, and how they do it. Sustaining this revolution across all areas of science, engineering, and education requires the formation of a citizenry and workforce with the knowledge and skills needed to design and deploy as well as adopt and apply these cyber-based systems, tools and services over the long-term. The opportunity for such preparation should be available at all stages of formal and informal education (K-16 and lifelong), training and professional development, and must be extended to all individuals and communities.

The CI-TEAM program supports projects that integrate science and engineering research and education activities that range from local activities to global-scale efforts, as appropriate, to promote, leverage and utilize cyberinfrastructure systems, tools and services.

Collectively, the CI-TEAM awards will:

- Increase the numbers of scientists, engineers, educators, and/or students prepared to design, develop, adopt and deploy cyber-based tools and environments for computational science and engineering research and learning, both formal and informal. This is to include individuals who are otherwise well prepared in the STEM disciplines.

- Produce curricular and pedagogical materials, learning technologies, and institutional models for preparing the cyberinfrastructure workforce that are broadly adaptable and/or adoptable, and publish related outcomes that inform others of promising educational approaches.

- Increase and broaden the participation of diverse groups of people and organizations as both creators and users of cyberinfrastructure for research and education. Currently underrepresented groups include women, those in underserved rural regions of the country, those who would be the first in their family to graduate from college, and minorities including those associated with Historically Black Colleges and Universities (HBCUs) and other Minority Serving Institutions (MSIs) and communities.

This solicitation seeks three types of project proposals, all aimed at the preparation of a diverse, cyberinfrastructure-savvy science and engineering workforce:

- Demonstration Projects are exploratory in nature and may be somewhat limited in scope and scale. Demonstration Projects have the potential to serve as exemplars for effective larger-scale implementation and diffusion activities in the future.

- Implementation Projects are generally larger in scope or scale and draw on prior experience with the activities or the teams proposed.

- Diffusion Projects are expected to inform and engage broad national and/or international audiences to build upon educational research and project outcomes to deploy promising educational strategies through cyberinfrastructure resources, models, and/or technologies.

Implementation and Diffusion Projects are expected to deliver sustainable learning or workforce development activities that complement ongoing NSF investment in cyberinfrastructure.

All CI-TEAM projects seek to create and maintain a broad and diverse population of individuals and institutions participating in cyberinfrastructure activities specifically and, thereby, science and engineering more generally. Toward that goal, all types of projects must include collaborations with expertise in multiple disciplines and involve partnerships that support integrated research and learning among diverse organizations including, as appropriate, academic institutions of higher learning, primary and secondary schools, government, industry, professional societies, other not-for-profit organizations, and international partners. Other key features of CI-TEAM projects involve a commitment to: leveraging existing or current development efforts in cyberinfrastructure technologies; open software standards and open educational resources; the integration of research and learning; institutional partnerships; and strategic implementation, management, and project evaluation plans. Following merit review of the proposals received, NSF expects to select for support 6 to 7 Demonstration Projects at up to $250,000 total each and 3 to 6 Implementation or Diffusion Projects at up to $1,000,000 total each that together constitute a rich portfolio of cyberinfrastructure-related workforce development activities.

Cognizant Program Officer(s):

- Joan Peckham, OD/OCI, telephone: (703) 292-7344, email: jpeckham@nsf.gov

- Mimi McClure, OD/OCI, telephone: (703) 292-5197, email: mmcclure@nsf.gov

- William Badecker, SBE/BCS, telephone: (703) 292-5069, email: wbadecke@nsf.gov

- Reed S. Beaman, BIO/DBI, telephone: (703) 292-8470, email: rbeaman@nsf.gov

- Kellina Craig-Henderson, SBE/BCS, telephone: (703) 292-7023, email: khenders@nsf.gov

- Scott Grissom, EHR/DUE, telephone: (703) 292-4643, email: sgrissom@nsf.gov

- Jolene K. Jesse, EHR/HRD, telephone: (703) 292-7303, email: jjesse@nsf.gov

- Jill L. Karsten, GEO/OAD, telephone: (703) 292-8500, email: jkarsten@nsf.gov

Susan C. Kemnitzer, ENG/EEC, telephone: (703) 292-5347, email: skemnitz@nsf.gov

- Janet Kolodner, CISE/IIS, EHR/DRL, telephone: (703) 292-8930, email: jkolodne@nsf.gov

- Carleen F. Maitland, OD/OISE, telephone: (703) 292-7225, email: cmaitlan@nsf.gov

- Bruce Palka, telephone: 703 292-4856, email: bpalka@nsf.gov

- Simon N. Stephenson, OD/OPP, telephone: (703) 292-8029, email: sstephen@nsf.gov

- Arlene M. de Strulle, EHR/DRL, telephone: (703) 292-5117, email: adestrul@nsf.gov

- Larry E. Suter, EHR/DRL, telephone: (703) 292-5144, email: lsuter@nsf.gov

- Sharon Tettegah, EHR/DRL, telephone: (703) 292-5092, email: stettega@nsf.gov

- Eva Zanzerkia, GEO/EAR, telephone: (703) 292-8556, email: ezanzerk@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.050 --- Geosciences
- 47.070 --- Computer and Information Science and Engineering
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- Education and Human Resources
- 47.078 --- Office of Polar Programs
- 47.079 --- Office of International Science and Engineering
- 47.080 --- Office of Cyberinfrastructure
- 47.081 --- Office of Experimental Program to Stimulate Competitive Research

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 9 to 12   It is anticipated that 6 to 7 will be Demonstration Project awards, and 3 to 6 will be Implementation and/or Diffusion Project awards. Ultimately, the total number of awards will depend on the relative number of Demonstration and Implementation and Diffusion Projects submitted and will be subject to the availability of funds. (Note: the total number of projects expected to be awarded is not a simple sum of the estimated number ranges of Demonstration and Implementation and Diffusion Projects since award sizes vary significantly with project type.)

Anticipated Funding Amount: $5,000,000   pending availability of funds. Under this solicitation, individual Demonstration Projects may request funding up to $250,000 total (including all funds for subawards and/or collaborative proposals) over a project duration of one to two years; individual Implementation or Diffusion Projects, may request funding up to $1,000,000 total (including all funds for subawards and/or collaborative proposals) over a project duration of two to three years for Implementation projects and three to four years for Diffusion Projects.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

Receipt of an earlier CI-TEAM award is not a prerequisite for submission to this CI-TEAM competition in any category. Principal Investigators (PIs), co-PIs, other senior personnel or investigators involved in CI-TEAM projects funded by NSF are eligible to submit Demonstration, Implementation or Diffusion Projects to this competition.

Limit on Number of Proposals per Organization: 2

An organization may submit a maximum of two CI-TEAM proposals as the lead organization in response to this solicitation. There is no limit to the number of proposals on which an organization may appear as a subawardee or as a non-lead organization.

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable

- **Preliminary Proposal Submission:** Not Applicable

- **Full Proposals:**

  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.

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

B. Budgetary Information

Cost Sharing Requirements: Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:** Not Applicable

- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

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

    March 16, 2011

Proposal Review Information Criteria

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

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

The practice of science and engineering at the research frontier has changed markedly in recent years, owing in large measure to the impact of increasingly powerful and pervasive information, computation, and communication technologies. Today, data curation and exploration, as well as simulation and modeling, are as important to scientific discovery and innovation as are theory and experimentation. Advances in sensor technology and the availability of affordable mass data storage devices are enabling the collection, creation, and federation of large, complex datasets; high performance environments enable the processing of larger volumes of data. Moreover, extensive networking capabilities, sophisticated middleware applications, and new collaboration platforms are simultaneously providing and improving interactive access to and analysis of these data as well as a multitude of other scientific resources. In addition to advancing research, these technological tools and resources are also creating transformational opportunities for education and learning by promoting ubiquitous cyber-based learning environments and potentiating cognitive and metacognitive gains at all ages and in various settings, both formal and informal.

Ambitious cyber-related projects and virtual organizations connecting people, institutions, information, and instrumentation across disciplinary, organizational, international, and cultural barriers on a global scale are already emerging in many science and engineering communities including all domains served by NSF directorates and offices. Beyond the productivity enhancements we have come to expect with each new generation of technology, new cyber-based tools and resources are empowering these communities to undertake bold new lines of inquiry and inventive forms of instruction. These may be founded on traditional cyberinfrastructure components such as supercomputers, clusters and workstations, as well as emerging cyberinfrastructure elements such as observing and sensing systems, intelligent and remotely operable instrumentation, handheld communication devices, virtual collaboratories, federated data archives, and digital repositories and libraries. (For examples of cyberinfrastructure projects and activities, see http://www.nsf.gov/ci-team.)

Harnessing the full power of this increasingly connected and comprehensive cyberinfrastructure system will require sustained investments in the formation of a science and engineering workforce that has the knowledge and skills needed to design and deploy as well as adopt and apply these cyber-based systems, tools, and services over the long-term. The opportunity for such preparation should be available at all stages of education, training, and professional development, and must be extended to all interested individuals and communities. The CI-TEAM program has been developed to help meet this need. A successful CI-TEAM proposal

need not leverage all possible cyberinfrastructure components. It will, for example, move beyond simply linking databases and preparing students and scientists for two-way communication toward progressively creating multi-layered systems of advanced data acquisition, storage, management, integration, mining, visualization and processing that prepare students and scientists for n-way collaboration. (For definitions and characterizations of cyberinfrastructure, see the National Science Foundation's Cyberinfrastructure Vision for 21st Century Discovery, available at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0728. For earlier visions of cyberinfrastructure, see the "Report of the Blue-Ribbon Advisory Panel on Cyberinfrastructure" the Atkins Report, available at http://www.nsf.gov/od/oci/reports/toc.jsp). Proposals that will be given the highest priority in this competition are those that address the current foci of interest to the Office of Cyberinfrastructure (OCI): computational science and engineering involving the development, deployment, and use of cyberinfrastructure for large data environments, high performance computing, and/or advanced networking. This includes distributed virtual organizations, software, algorithms, networks, tools, environments and learning and workforce approaches that are developed specifically to support the OCI areas of interest.

II. PROGRAM DESCRIPTION

To achieve these goals, NSF intends to support a portfolio of three types of CI-TEAM projects: 1) Demonstration Projects; 2) Implementation Projects; and 3) Diffusion Projects. A description of the similarities and differences among the project types follows.

All CI-TEAM Demonstration, Implementation and Diffusion Projects share certain key features:

- Goals and strategies to increase the number of individuals and institutions participating in cyberinfrastructure activities specifically and, thereby, science and engineering more generally;

- Goals and strategies to increase the participation of a diverse array of people and organizations as both creators and users of cyberinfrastructure;

- Activities that focus on achieving cyber-related science and engineering workforce development through the integration of research and learning (university, college, K-12, professional, or lifelong learning),are grounded in learning, cognitive, or social science research, support well identified and justified core computational learning objectives, and include rigorous educational program design and measurement;

- Strong science, engineering, and/or education focused partnerships that support integrated research and learning among diverse institutions, including (but not necessarily limited to) as appropriate to the project goals: academic institutions; industry; not-for-profit organizations such as professional societies and museums; federal, state and local government agencies or organizations; and international partners;

- Procedures and arrangements to leverage existing cyber-based tools, services and systems as well as other state-of-the-art NSF investments, both domestic and international, to expand and enhance the deployment and use of cyberinfrastucture environments wherever possible; (For a sampling of related cyberinfrastructure efforts and other investments, see http://www.nsf.gov/ci-team);

- Collaborative teams representing the expertise of at least one computational science or engineering domain combined with that of education and/or social science so as to inform project activities from an appropriately interdisciplinary knowledge base; the participation of experts from education is especially encouraged;

Those planning a project with an international dimension should talk with the OISE CI-TEAM program officer for guidance, as well as the appropriate disciplinary program officers (contacts are provided under "Cognizant Program Directors" above).

Because the CI-TEAM program will engage in a set of interrelated program evaluations, in addition to sound implementation and management plans, all projects must include project-level evaluation plans. These plans should be for formative and summative evaluation that assesses the impact of the project's activities, progress, and success in meeting goals. They must describe the resources allocated to project evaluation; the benchmarks used to assess the project's progress toward its scientific, educational, and outreach goals; and, the strategic mechanisms by which evaluation results will be used to improve project operations (to the extent possible for Demonstration Projects). An external evaluator who handles at least the summative evaluation is highly recommended.

In particular, NSF will carry out evaluations designed and implemented by external evaluators to track the CI-TEAM program's progress in meeting overall goals, as well as assess the overall impact on participants and on the field, and potential effects on the cyberinfrastructure workforce supply. All projects are expected to provide data and responses as requested. CI-TEAM projects should have:

- A long-term project plan with milestones, a logic model (See http://caise.insci.org/uploads/docs/Eval_Framework.pdf for information on logic models), and metrics to gauge outcomes; and

- A commitment to adopt and adhere to open standards where appropriate and whenever possible.

(Note: Projects focusing primarily on the acquisition and/or provision of new cyberinfrastructure resources and tools are more appropriately directed toward other cyberinfrastructure funding opportunities listed at http://www.nsf.gov/funding/pgm_list.jsp?org=OCI.)

Demonstration, Implementation and Diffusion Projects, however, differ in scope and scale in ways described below.

Demonstration Projects

This solicitation seeks Demonstration Project proposals that design, carry out and test the feasibility and effectiveness of preliminary, exploratory activities aimed at preparing a diverse science and engineering workforce with cyberinfrastructure knowledge and skills. New, multidisciplinary collaborations and partnerships are encouraged, including those with cross-national membership. Demonstration Projects will seed the CI education community with new and creative activities, teams, or tools with promise to serve as exemplars for effective larger-scale implementation and diffusion activities in the future. Demonstration Project design should show promise for future integration with or evolution into an Implementation or Diffusion Project. Demonstration Projects with outcomes that may be transferrable across disciplines are also encouraged.

Demonstration proposals must make a case for the potential of the proposed activities or strategies. This can be based on research about teaching, learning, workforce development and cyberinfrastructure workplace demands or on experience and professional judgement. If the proposed activities have been tried before, describe the results of studies that indicate their previous effectiveness and potential impact in new conditions and/or the proposed modifications to match the needs of the new audience.

Implementation Projects

This solicitation also invites larger-scale Implementation Project proposals that expand, complement, or otherwise leverage previously tested and assessed activities with potential for successful application in the CI-TEAM program. Such activities may be proposed in concert with other more exploratory activities. Proposals must make a case for the potential of the proposed activities or

strategies based on the results of studies that indicate their potential impact in new conditions and/or the proposed modifications to match the needs of the new audience.

Implementation Projects must be implemented with the potential for adoption over multiple scales or across multiple disciplines to show continued prospects for replicability and scalability to a national level or, if appropriate, at an international level. For instance, scaled implementation may span geographies and cultures, organizations and institutions, technological components, scientific domains, etc. The long-term sustainability of Implementation Projects must be addressed in the project description.

Diffusion Projects

Diffusion projects engage appropriate national and/or international audiences with research-based innovations in teaching and learning that utilize cyberinfrastructure or encourage broadening participation in cyberinfrastructure education and workforce development. Diffusion projects must reach large audiences with strategies that work through workshops and training or widespread campaigns that make materials and resources available. Materials or strategies must be previously tested and assessed and proposals will be evaluated in part on the evidence of effectiveness of the resources to be diffused and the proposed diffusion methods. Proposals should include a plan to document and evaluate the adaptation and customization of proven strategies as they are adopted or implemented by diverse institutions on a national or international scale.

Diffusion projects are meant to transfer the results of prior demonstration or implementation projects (or other research) to appropriate groups of practitioners (teachers, faculty, administrators, guidance counselors, informal science education specialists, etc.). Diffusion projects are encouraged to make use of cyberlearning or internet diffusion systems, public networks, or other innovative digital modes of communication to reach large audiences.

Examples of diffusion projects include projects that develop, implement and evaluate a series of training sessions or workshops to connect with extensive audiences of teachers and faculty; develop, implement and evaluate a widespread diffusion campaign that makes materials, technologies, resources, or models available to a national and/or international audience of practitioners and provides guidance and consulting services about implementation.

Multidisciplinary collaborations or partnerships should have some history of prior collaboration with demonstrated track records. By building on prior experience, Implementation Projects are expected to deliver sustainable learning and workforce development activities that complement ongoing NSF investment in cyberinfrastructure. Implementation and Diffusion Projects will assure an increase in the number and diversity of researchers, educators and students trained to utilize, integrate, and support cyberinfrastructure systems and tools in their research and education activities.

B. Project Activity Ideas

Many facets of cyberinfrastructure and their use in science and engineering are relatively new or emerging. Approaches to infusing cyberinfrastructure knowledge and skills into the workforce are similarly evolving. The following examples are illustrative of the types of activities that may be undertaken in a CI-TEAM Demonstration, Implementation or Diffusion Project. They are not meant to be comprehensive nor suggestive of specific projects.

- Developing faculty expertise in K-12, two-year, four-year and/or community colleges to use cyberinfrastructure effectively and promote STEM learning and advance discovery;

- Designing a new integrative research and learning program to prepare students in the use of cyberinfrastructure capabilities such as simulation, modeling, and data visualization while teaching core computational constructs and capabilities;

- Training university faculty, secondary and K-12 teachers and students at all levels in the use of cyber-based tools (e.g., shared databases, internet portals, monitoring devices, visualization, data collection and analysis tools) to gather, depict, compare and/or reuse data to create a cyberinfrastructure-supported and savvy scientific community;

- Developing an out of school project or program, in collaboration with informal science education institutes, that uses emerging technologies to engage participants in a range of computational science constructs that will provide them with knowledge and skills needed for the modern, cyber-enabled workforce;

- Devising new programs to train and/or retool digital librarians in the development, deployment, and support of cyberinfrastructure tools and services to support large scale data exploration;

- Increasing the exposure of undergraduate and high school student populations that are not traditional users of cyberinfrastructure simulation, modeling and data visualization tools, especially those from behavioral, cognitive, and social sciences or from groups underrepresented in STEM fields;

- Sharing cyberinfrastructure knowledge through mentoring partnerships between cyberinfrastructure-experienced institutions and communities, organizations, groups and/or individuals new to cyberinfrastructure thereby extending infrastructural, technological and logistical resources;

- Mentoring teams of faculty and students across disciplines, institutions, cultures, and/or continents to improve the effectiveness of cyberinfrastructure-enabled collaboratories addressing a research problem, question, task, etc.;

- Supporting activities to learn how to use, advance, and create cyberinfrastructure tools and services (e.g. petascale computing, open source software development, large scale database design and administration, Internet portals, multi-core programming, modeling and simulation tools) via novel programs and mechanisms, including but not limited to cross-functional mentoring, citizen scientist mentoring, AI-based tutoring, or peer-to-peer mentoring;

- Sharing best practices in supporting and sustaining cyberinfrastructure and the supporting workforce, especially between for-profit and not-for-profit organizations; and

- Instituting training on best practices in safety, security, trust, and ethics in cyberspace to complement cyberinfrastructure resource and tool use and development in other CI-TEAM activities.

Abstracts of CI-TEAM Demonstration Projects funded in FY05 - FY 10 can be found at
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12782&org=OCI&from=fund.

Additional information on cyberinfrastructure can be found in the National Science Foundation's Cyberinfrastructure Vision for 21st Century Discovery and in the Report of the Blue-Ribbon Advisory Panel on Cyberinfrastructure (the Atkins Report) both available at
http://www.nsf.gov/dir/index.jsp?org=OCI.

III. AWARD INFORMATION

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds. Under this solicitation, individual Demonstration Projects (including all funds for subawards and/or collaborative proposals) may request funding up to $250,000 total over a project duration of one to two years; individual Implementation or Diffusion Projects (including all funds

for subawards and/or collaborative proposals) may request funding up to $1,000,000 total over a project duration of two to three years for Implementation Projects and three to four years for Diffusion Projects. It is expected that between 9 and 12 project awards will be made, of which 6 to 7 are anticipated to be Demonstration Project awards and/or 3 to 6 are anticipated to be Implementation or Diffusion Project awards. Ultimately, the total number of awards will depend on the relative number and quality of Demonstration, Implementation and Diffusion Projects submitted and will be subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Organization Limit:

> None Specified

PI Limit:

> Receipt of an earlier CI-TEAM award is not a prerequisite for submission to this CI-TEAM competition in any category. Principal Investigators (PIs), co-PIs, other senior personnel or investigators involved in CI-TEAM projects funded by NSF are eligible to submit Demonstration, Implementation or Diffusion Projects to this competition.

Limit on Number of Proposals per Organization: 2

> An organization may submit a maximum of two CI-TEAM proposals as the lead organization in response to this solicitation. There is no limit to the number of proposals on which an organization may appear as a subawardee or as a non-lead organization.

Limit on Number of Proposals per PI:

> None Specified

Additional Eligibility Info:

> The categories of proposers identified in the Grant Proposal Guide (GPG) are eligible to submit proposals under this program solicitation.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

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

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

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

The Project Description section for CI-TEAM projects must be no more than 15 pages in total length, and include a concise management and coordination plan. A clearly labeled and expanded management and coordination plan of no more than 3 pages should be provided in the supplementary documents section of Implementation and Diffusion proposals. The management and coordination plan must include 1) the specific roles of the PI, co-PIs, other senior personnel and paid consultants at all institutions involved, 2) how the project will be managed across institutions and disciplines, 3) identification of the specific coordination mechanisms that will enable cross-institution and/or cross-discipline integration (e.g., yearly workshops, student or personnel exchanges, project meetings at conferences, weekly videoconferencing, knowledge or software repositories, etc.), and 4) pointers to the budget line items that support these coordination mechanisms.

The Project Description for a Demonstration, Implementation or Diffusion Project should contain the following sections:

- Vision and goals. A concise description of the project's vision within the context of the CI-TEAM principal goals, including the learning, cognitive, or social science theory on which the proposed activities are based, overall aims and the strategy for accomplishing them. For Demonstration Project proposals, the description should include the project's potential to be replicated and scaled to a more systemic level of effort. Implementation or Diffusion Project proposals, should also include the actual multiple types of target audiences and scale or application domains expected to be provided.

- Workforce development. A discussion of how the project will develop a cyber-ready workforce at the university, pre-college (including K-12 if appropriate) and/or practitioner levels. Proposals will be assessed on both scientific and educational

intellectual merit. Expected outcomes should be well articulated, the projects should be well designed, and the approaches should be well supported.

- Broadening participation. A presentation of specific plans and strategies for increasing participation of traditionally underrepresented groups, organizations, and/or communities in cyberinfrastructure learning and workforce development activities specifically and, thereby, science and engineering more generally.

- Execution. An outline of 1) how project activities will be organized, including how they draw on and differ from existing, similar approaches; 2) any existing or current development efforts in cyberinfrastructure investments that these activities leverage; and, 3) a project plan with timelines and milestones. This might include materials development, pilot testing, dissemination and adoption by partnering organizations, changes in policy or innovation in educational courses. Include plans for sustainability as appropriate and clearly show what parts of the project are sustainable and how they will be supported.

- Evaluation. A specification of the resources allocated to project evaluation; a logic model; how you will measure the expected impact on students, faculty and others reached; the benchmarks, metrics and instruments used to assess the project's progress toward its scientific and outreach goals as they relate to workforce development; and, the strategic mechanisms by which evaluation results will be used to improve project operations (to the extent possible for Demonstration Projects).

  All proposals must (1) include a clear presentation of the questions that will guide the evaluation, (2) specify indicators of impact on participants, (3) describe how the data will be collected, (4) explain the methods of analysis, (5) describe any basis for comparisons, and (6) provide the timeline for the evaluation process. If materials are developed as part of the intervention, appropriate plans for their expert review and field-testing should be included. In some cases the plan for evaluation of materials will be closely intertwined with plans to assess the effects of the project activities on desired outcomes. These plans might include expert review at key stages of the project, development of indicators to assess the delivery of the proposed activities, or assessment of the scope and impact of the activities by an independent advisory committee.

- Broader impacts. Description of broader impacts including plans to disseminate findings and lessons learned from the project, those leading to success and otherwise, for the national community.

  For activities involving cyberinfrastructure tools, the proposal should explain the existing user base as well as the user benefits and growth anticipated to result from proposed CI-TEAM activities. Open source software (including community development efforts) and distribution methods are strongly encouraged.

Implementation and Diffusion projects are required to include a management and collaboration section of no more than 3 pages in the supplementary documents section of the proposal. This must include an account of the complementary roles and contributions of each of the project PIs, co-PIs and other senior personnel in carrying out the implementation plan, as well as overall project management explaining coordination mechanisms across departments, institutions and/or disciplines if required (e.g., regular meetings, tele- or video-conferencing, collaboration software, etc.). These plans must be described in detail and include mechanisms and partnerships that will lead to the long-term sustainability of a CI-TEAM project after the award has ended.

Proposal Cover Sheet

Proposals must identify the type of proposal submitted by inserting at the beginning of the title either "CI-TEAM Demo", "CI-TEAM Impl or "CI-TEAM Diff."

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

C. Due Dates

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

  March 16, 2011

D. FastLane/Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

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

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

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

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

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

to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

A. NSF Merit Review Criteria

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

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

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

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

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

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

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

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

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

Additional Review Criteria:

In addition to the general criteria described above, peer reviewers and NSF staff will evaluate each proposal according to the CI-TEAM program goals:

- Preparing a science and engineering workforce able to exploit, enhance, and promote cyberinfrastructure to advance science and engineering research and education; and
- Broadening the participation of underrepresented groups and organizations in cyberinfrastructure activities.
- Engaging students who are otherwise well prepared in the STEM disciplines to build and deploy the nation's cyberinfrastructure and thereby enhance their skills in any scientific domain.
- Contributing to the body of promising educational strategies with measured outcomes that will inform a broad audience of adapters and adopters.

B. Review and Selection Process

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

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

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

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

decline funding.

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

C. Reporting Requirements

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

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

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

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Joan Peckham, OD/OCI, telephone: (703) 292-7344, email: jpeckham@nsf.gov

- Mimi McClure, OD/OCI, telephone: (703) 292-5197, email: mmcclure@nsf.gov

- William Badecker, SBE/BCS, telephone: (703) 292-5069, email: wbadecke@nsf.gov

- Reed S. Beaman, BIO/DBI, telephone: (703) 292-8470, email: rbeaman@nsf.gov

- Kellina Craig-Henderson, SBE/BCS, telephone: (703) 292-7023, email: khenders@nsf.gov

- Scott Grissom, EHR/DUE, telephone: (703) 292-4643, email: sgrissom@nsf.gov

- Jolene K. Jesse, EHR/HRD, telephone: (703) 292-7303, email: jjesse@nsf.gov

- Jill L. Karsten, GEO/OAD, telephone: (703) 292-8500, email: jkarsten@nsf.gov

- Susan C. Kemnitzer, ENG/EEC, telephone: (703) 292-5347, email: skemnitz@nsf.gov

- Janet Kolodner, CISE/IIS, EHR/DRL, telephone: (703) 292-8930, email: jkolodne@nsf.gov

- Carleen F. Maitland, OD/OISE, telephone: (703) 292-7225, email: cmaitlan@nsf.gov

- Bruce Palka, telephone: 703 292-4856, email: bpalka@nsf.gov

- Simon N. Stephenson, OD/OPP, telephone: (703) 292-8029, email: sstephen@nsf.gov

- Arlene M. de Strulle, EHR/DRL, telephone: (703) 292-5117, email: adestrul@nsf.gov

- Larry E. Suter, EHR/DRL, telephone: (703) 292-5144, email: lsuter@nsf.gov

- Sharon Tettegah, EHR/DRL, telephone: (703) 292-5092, email: stettega@nsf.gov

- Eva Zanzerkia, GEO/EAR, telephone: (703) 292-8556, email: ezanzerk@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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

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

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

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

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

- **Location:**	4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center)**:**	(703) 292-5111
- **TDD (for the hearing-impaired):**	(703) 292-5090
- **To Order Publications or Forms:**	
Send an e-mail to:	nsfpubs@nsf.gov
or telephone:	(703) 292-7827
- **To Locate NSF Employees:**	(703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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

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The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

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