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

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):

August 27, 2007

REVISION NOTES

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

In response to this program solicitation, proposers may opt to submit proposals via Grants.gov 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

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 and engineering. Linked to create a comprehensive cyberinfrastructure, the systems, tools, and services emerging from these new technologies are 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 and engineering requires the formation of a 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, training and professional development, and must be extended to all interested individuals and communities.

The CI-TEAM program supports projects that position the national science and engineering community to engage in integrated research and education activities promoting, leveraging and utilizing cyberinfrastructure systems, tools and services. CI-TEAM awards will:

- Prepare current and future generations of scientists, engineers, and educators to design and develop as well as adopt and deploy, cyber-based tools and environments for research and learning, both formal and informal.
- Expand and enhance participation in cyberinfrastructure science and engineering activities of diverse groups of people and organizations, with particular emphasis on the inclusion of traditionally underrepresented individuals, institutions, and communities as both creators and users of cyberinfrastructure.

This solicitation seeks **two** types of project proposals, both aimed at the preparation of a diverse, cyberinfrastructure-savvy science and engineering workforce. One type of proposal, the *Demonstration Project,* is exploratory in nature and may be somewhat limited in scope and scale. *Demonstration Projects* have the potential to serve as exemplars to effective larger-scale implementation activities in the future. The other project type, the *Implementation Project*, is generally larger in scope or scale and draws on prior experience with the activities or the teams proposed. *Implementation Projects* are expected to deliver sustainable learning and workforce development activities that complement ongoing NSF investment in cyberinfrastructure.

All CI-TEAM projects seek to broaden and diversify the population of individuals and institutions participating in cyberinfrastructure activities specifically and, thereby, science and engineering more generally. Toward that goal, both types of projects consist of 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 evaluation plans. Following merit review of the proposals received, NSF expects to select for support 12 to 15 *Demonstration Projects* at up to $250,000 total each and 7 to 12 *Implementation Projects* at up to $1,000,000 total each that together constitute a rich portfolio of cyberinfrastructure-related workforce development activities.

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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

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 15 to 25   It is anticipated that between 12 and 15 will be Demonstration Project awards, and between 7 and 12 will be Implementation Project awards. Ultimately, the total number of awards will depend on the relative number of Demonstration and Implementation 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 Projects since award sizes vary significantly with project type.)

Anticipated Funding Amount: $10,000,000 to $12,150,000 pending availability of funds. Under this solicitation, individual Demonstration Projects, including all subawards and/or collaborative proposals, may request funding up to $250,000 total over a project duration of one to two years; individual Implementation Projects, including all subawards and/or collaborative proposals, may request funding up to $1,000,000 total over a project duration of two to three years.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- The categories of proposers identified in the Grant Proposal Guide (GPG) are eligible to submit *Demonstration* Project proposals under this program solicitation. However, for *Implementation* Projects, the proposing organization of a non-collaborative project or the lead partner in a collaborative project must be a university or college (two- or four-year college) degree-granting, academic institution of higher learning located in the U.S., its territories or possessions. Non-lead partners in collaborative *Implementation* Project proposals are those identified in the GPG.

PI Limit:

Principal Investigators (PIs), co-PIs, other senior personnel or investigators involved in FY05 or FY06 CI-TEAM *Demonstration Projects* funded by NSF are eligible to submit *Demonstration* or *Implementation Projects* to this competition, but will be expected to comply with NSF's requirement to report results from prior funding. FY05 or FY06 CI-TEAM grants are not a prerequisite for submission to this CI-TEAM competition in either category.

Limit on Number of Proposals per Organization:

An organization may submit only one proposal (either a CI-TEAM Implementation or Demonstration Project) 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

- **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.

    - 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:** Not Applicable

C. Due Dates

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

     August 27, 2007

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. 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 services are also creating transformational opportunities in education by promoting ubiquitous cyber-based learning environments and potentiating cognitive and metacognitive gains at all ages and in various settings, both formal and informal.

The power of cyberinfrastructure to enhance education and provide new learning opportunities is such an expansive and beneficial feature of these and other combined capacities that we must be sure to create the conditions for synergy between research and learning from the outset. Ambitious cyber-related projects 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 services are empowering these communities to undertake bold new lines of inquiry and inventive forms of hands-on instruction simultaneously. 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 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; but, at the same time, will necessarily move beyond, for example, 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/pubs/2007/nsf072/index.jsp. 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.*)

II. PROGRAM DESCRIPTION

This solicitation supports *Demonstration* and *Implementation Projects* aimed at positioning the national science and engineering community to more effectively engage in national and global research and education activities that promote and leverage cyberinfrastructure. CI-TEAM awards will:

- Prepare current and future generations of scientists, engineers, and educators to design and develop as well as adopt and deploy cyber-based tools and environments for research and learning, both formal and informal; and
- Expand and enhance participation in cyberinfrastructure science and engineering activities of diverse groups of people and organizations, with particular emphasis on the inclusion of traditionally underrepresented individuals, institutions, and communities as both creators and users of cyberinfrastructure.

The preparation of a diverse science and engineering workforce with both the appropriate technical skills and the necessary content knowledge is essential to informing the design and deployment as well as the utilization and application of state-of-the-art cyberinfrastructure. This includes individuals interested in or already pursuing professional cyberinfrastructure careers (e.g., database curation, tool development, portal design) as well as a broad spectrum of current and future users who will employ the capabilities of cyber-enabled environments to transform the world of research and discovery as well as learning and education.

A. Project Types

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

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

- Goals and strategies to broaden and diversify the population of individuals and institutions participating in cyberinfrastructure activities specifically and, thereby, science and engineering more generally;
- Activities that focus on achieving cyber-related science and engineering workforce development through the integration of research and learning at and across different levels of education (e.g., university, college, K-12, professional, lifelong learning);
- Strong science and engineering-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; not-for-profit organizations such as professional societies and museums; industry; federal, state and local government agencies or organizations; and international partners;
- Procedures and arrangements to leverage current or extant cyber-based tools, services and systems as well other state-of-the-art NSF investments, both domestic and international, to expand and enhance the deployment and employment 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 disciplinary domain with that of computer or information sciences and education or social sciences so as to inform project activities from an appropriately interdisciplinary knowledge base;
- In addition to sound implementation and management plans, a well-specified evaluation plan that describes 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*);
- A long-term vision for wide replicability and potential scalability to national and international levels; 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 and *Implementation Projects*, however, differ in scope and scale in ways described below.

Demonstration Projects

This solicitation seeks *Demonstration Project* proposals that 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-TEAM program with new and creative activities, teams, or tool deployments that promise to serve as exemplars to effective larger-scale implementation activities in the future. *Demonstration Project* design should show promise for future integration with or evolution into an *Implementation Project*. *Demonstration Projects* with outcomes that may be transferred across disciplines are also encouraged.

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. The multidisciplinary collaboration or partnership 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 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.

Implementation Projects must be implemented *over multiple scales or across multiple disciplines* to show continued prospects for replicability and scalability to a national level or, if appropriate, at a global 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.

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 *Implementation* or *Demonstration Project*. They are not meant to be comprehensive nor suggestive of specific projects.

- Developing faculty expertise in two-year or community colleges to use cyberinfrastructure effectively to promote learning and advance discovery;
- Designing a new online interactive and integrative research and learning program to prepare students in the use of cyberinfrastructure capabilities such as simulation, modeling, and data visualization;
- Building international networks of university faculty and students as well as secondary teachers and students trained in the use of cyber-based tools (e.g., portals, monitoring devices, visualization tools) to gather, depict, compare and even reuse data which are collected from local sites and contributed to a common scientific investigation;
- Devising new programs to train and/or retool digital librarians in the development, deployment, and support of cyberinfrastructure tools and services;
- Creating new participatory informal or formal learning environments (e.g., online games, professional-amateur collaborations, virtual worlds, open source ecosystems) that engage individuals in inquiry-based, problem-solving activities related to science and engineering;
- Partnering cyberinfrastructure-experienced institutions with communities, organizations, groups and/or individuals new to cyberinfrastructure in order to share and, thereby, extend infrastructural, technological and logistical resources;
- Connecting teams of faculty and students across disciplines, institutions, cultures, and/or continents through the improved effectiveness of collaboratories and with the express purpose of collectively addressing a research problem, question, task, etc in a virtual learning environment;
- Supporting activities to learn how to use, advance, and create cyberinfrastructure tools and services via novel mentoring programs and mechanisms, including but not limited to reverse mentoring, cross-functional mentoring, citizen scientist mentoring, AI-based tutoring, or peer-to-peer mentoring;
- Exploring the complementary roles that for-profit and not-for-profit organizations play in supporting and sustaining cyberinfrastructure and the cyberinfrastructure workforce;
- Implementing and analyzing collaborative reasoning tools across a distributed network of researchers to understand processes and outcomes of information sharing, knowledge production, and scientific argumentation under synchronous and asynchronous technologically-mediated conditions;
- Designing new instruments, metrics, and methods that can be embedded into the technologies themselves to assess cognitive gains of cyberinfrastructure users and learners; 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 and FY06 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* available at http/www.nsf.gov/pubs/2007/nsf/index.jsp and in the *Report of the Blue-Ribbon Advisory Panel on Cyberinfrastructure ("the Atkins Report")* available at http://www.nsf.gov/ od/oci/reports/toc.jsp.

III. AWARD INFORMATION

Under this solicitation, individual Demonstration Projects, including all subawards and/or collaborative proposals, may request funding up to $250,000 total over a project duration of one to two years; individual Implementation Projects, including all subawards and/or collaborative proposals, may request funding up to $1,000,000 total over a project duration of two to three years. It is expected that between 15 and 25 project awards will be made, of which 12 to 15 are anticipated to be Demonstration Project awards and 7 to 12 are anticipated to be Implementation Project awards. Ultimately, the total number of awards will depend on the relative number of Demonstration and Implementation 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 Projects since award sizes vary significantly with project type.)

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- The categories of proposers identified in the Grant Proposal Guide (GPG) are eligible to submit *Demonstration* Project proposals under this program solicitation. However, for *Implementation* Projects, the proposing organization of a non-collaborative project or the lead partner in a collaborative project must be a university or college (two- or four-year college) degree-granting, academic institution of higher learning located in the U.S., its territories or possessions. Non-lead partners in collaborative *Implementation* Project proposals are those identified in the GPG.

PI Limit:

Principal Investigators (PIs), co-PIs, other senior personnel or investigators involved in FY05 or FY06 CI-TEAM *Demonstration Projects* funded by NSF are eligible to submit *Demonstration* or *Implementation* *Projects* to this competition, but will be expected to comply with NSF's requirement to report results from prior funding. FY05 or FY06 CI-TEAM grants are not a prerequisite for submission to this CI-TEAM competition in either category.

Limit on Number of Proposals per Organization:

An organization may submit only one proposal (either a CI-TEAM Implementation or Demonstration Project) 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:

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 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.

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 information supplements the standard Grant Proposal Guide (GPG) or NSF Grants.gov Application Guide proposal preparation guidelines:

Project Description

The Project Description section for *Demonstration Projects* **must be no more than 15 pages in length***.*

The Project Description section for *Implementation Projects* **must be no more than 18 pages in length** including up to three pages elaborating a more complete management and collaboration plan*.*

The Project Description for either a *Demonstration or Implementation 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 overall aims and the strategy for accomplishing them. For *Demonstration Project* proposals, the description should include potential of the project proposed to be replicable and scalable to a more systemic level of effort; and for *Implementation Project* proposals, it should include the actual multiple scales or application domains expected to be provided.
- *Integration of research and learning.* A discussion of how the project will develop a cyber-ready workforce at the university, pre-college (including K-12 if appropriate) and practitioner levels by integrating research and learning activities.
- *Broadening participation.* A presentation of specific plans and strategies for engaging traditionally underrepresented individuals, organizations, and/or communities in cyber-based learning and workforce development activities specifically and, thereby, science and engineering more generally.
- *Implementation.* 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 these activities leverage; and, 3) timelines and milestones.
- *Management and collaboration.* 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 institutions and/or disciplines (e.g., regular meetings, tele- or video-conferencing, collaboration software, etc.). *Implementation proposals* must describe potential mechanisms and partnerships that will lead to the long-term sustainability of a CI-TEAM project.
- *Evaluation and assessment.* A specification of the resources allocated to project evaluation; estimations of the 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 related 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*).
- *Dissemination.* Description of plans to disseminate findings and lessons learned from the project, both those leading to success and otherwise, to 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.

Proposal Cover Sheet

Proposals must identify the type of proposal submitted by inserting at the beginning of the title either "CI-TEAM Demonstration Project" or "CI-TEAM Implementation Project."

B. Budgetary Information

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

C. Due Dates

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

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 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

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:

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.

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 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

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 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. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from 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://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpm.

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.

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

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

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Diana Rhoten, Program Director, OD/OCI, 1145S, telephone: 703-292-8276, fax: 703-292-9060, email: drhoten@nsf.

gov

- Amy Baylor, Program Director, CISE/IIS, 1125S, telephone: 703-292-8930, fax: 703-292-9073, email: abaylor@nsf.gov

- Janice Cuny, Program Director, CISE/CNS, 1175 N, telephone: (703) 292-8489, fax: (703) 292-9010, email: jcuny@nsf.gov

- John Cherniavsky, Senior Advisor, EHR/REC, 855S, telephone: 703-292-5136, fax: 703-292-9046, email: jchernia@nsf.gov

- Lee Zia, Lead Program Director (MATH), EHR/DUE, 835 N, telephone: (703) 292-5140, fax: (703) 292-9046, email: lzia@nsf.gov

- Jill Karsten, Program Director, GEO/OAD, 705 N, telephone: (703) 292-7718, fax: (703) 292-9042, email: jkarsten@nsf.gov

- Eva Zanzerkia, Associate Program Director, GEO/ES, 785S, telephone: 703-292-8556, fax: 703-292-9025, email: ezanzerk@nsf.gov

- Kathleen McCloud, Program Director, MPS/PHY, 1015N, telephone: 703-292-8236, fax: 703-292-9078, email: kmccloud@nsf.gov

- Randal Ruchti, Program Director, MPS/PHY, 1015 N, telephone: (703) 292-7392, fax: (703) 292-9078, email: rruchti@nsf.gov

- Cheryl Eavey, Program Director, SBE/SES, 995N, telephone: 703-292-7269, fax: 703-292-9068, email: ceavey@nsf.gov

- D. Terence Langendoen, Program Director, SBE/BCS, 1145, telephone: (703) 292-5088, fax: (703) 292-9060, email: dlangend@nsf.gov

- Deborah Jackson, Program Director, ENG/EEC, 585N, telephone: 703-292-7499, fax: 703-292-9051, email: djackson@nsf.gov

- Manfred Zorn, Program Director, BIO/DBI, 615 N, telephone: (703) 292-8470, email: mzorn@nsf.gov

- Harold Stolberg, Regional Coordinator, OD/OISE, 935 N, telephone: (703) 292-8706, fax: (703) 292-9175, email: hstolber@nsf.gov

- William Wiseman, Program Director, OD/OPP, 740S, telephone: 703-292-4750, email: wwiseman@nsf.gov

For questions related to the use of FastLane, contact:

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

- Priscilla Bezdek, Program & Technology Specialist, OD/OCI, 1160S, telephone: (703)292-8970, fax: (703)292-9060, email: 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.

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, 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

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**   (703) 292-5111
  (NSF Information Center)**:**

- **TDD (for the hearing-impaired):**   (703) 292-5090

- **To Order Publications or Forms:**

     Send an e-mail to: pubs@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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