Computer and Network Systems (CNS): Core Programs

PROGRAM SOLICITATION
NSF 12-582

REPLACES DOCUMENT(S):
NSF 11-555

National Science Foundation

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

Submission Window Date(s) (due by 5 p.m. proposer's local time)**:**

September 20, 2012 - October 09, 2012

September 15 - September 30, Annually Thereafter

MEDIUM Projects

November 01, 2012 - November 30, 2012

November 1 - November 30, Annually Thereafter

LARGE Projects

December 03, 2012 - December 17, 2012

December 3 - December 17, Annually Thereafter

SMALL Projects

IMPORTANT INFORMATION AND REVISION NOTES

Revision Summary: This is a revision of NSF 11-555, the solicitation for the CISE/CNS core programs. The revisions include: (1) A description of "Breakthrough Proposals" that may be submitted to the core programs, (2) A clarification of how to submit proposals that may cut across research programs in CISE, (3) New 20-page limit for Project Description for Large proposals, (4) New 2-page limit for Collaboration Plan for Large and Medium proposals, (5) Added reminder of allowable supplementary documents, and (6) Slight revisions of the core program descriptions.

Review Process Pilot: CNS will be piloting an asynchronous panel review process this fiscal year. A limited number of "small" panels will be conducted this way. Please see the Review and Selection Process section of this solicitation for more information

Social-Computational Systems: The NSF is no longer accepting proposals for the Social-Computational Systems (SoCS) Program. However, the NSF continues to welcome proposals on SoCS-related topics. Such proposals may be submitted to the program in the Directorate for Computer and Information Science and Engineering (CISE) or the Directorate for Social, Behavioral and Economic Sciences (SBE) that is most closely related to the proposal topic. Joint consideration by two or more programs may also be appropriate; if the proposer envisions review by multiple programs, more than one program may be designated on the Proposal Cover Sheet.

Important Reminders

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

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. Plans must not exceed two pages in length. 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. For specific guidance for proposals submitted to the Directorate for Computer and Information Science and Engineering (CISE) see: http://www.nsf.gov/cise/cise_dmp.jsp.

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Computer and Network Systems (CNS): Core Programs

Synopsis of Program:

CISE's Division of Computer and Network Systems (CNS) supports research and education projects that develop new knowledge in two core programs:

- Computer Systems Research (CSR) program; and
- Networking Technology and Systems (NeTS) program.

Proposers are invited to submit proposals in three project classes, which are defined as follows:

- Small Projects - up to $500,000 total budget with durations up to three years;
- Medium Projects - $500,001 to $1,200,000 total budget with durations up to four years; and
- Large Projects - $1,200,001 to $3,000,000 total budget with durations up to five years.

A more complete description of the three project classes can be found in section *II. Program Description* of this document.

CISE investments in Small, Medium and Large projects complement the directorate's investments in the Expeditions in Computing program, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503169&org=CISE&from=home, where projects are funded at levels of up to $10,000,000 total for durations up to 5 years.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Anita J. La Salle, Point of Contact, Computer Systems Research (CSR), 1175, telephone: (703) 292-8950, email: alasalle@nsf.gov
- Theodore Baker, CSR Program Director, 1175, telephone: (703) 292-8950, email: tbaker@nsf.gov
- Helen Gill, CSR Program Director, 1175, telephone: (703) 292-8950, email: hgill@nsf.gov
- Krishna Kant, CSR Program Director, 1175, telephone: (703) 292-8950, email: kkant@nsf.gov
- Ralph Wachter, CSR Program Director, 1175, telephone: (703) 292-8950, email: rwachter@nsf.gov
- Darleen L. Fisher, Point of Contact, Networking Technology and Systems (NeTS), 1175, telephone: (703) 292-8950, email: dlfisher@nsf.gov
- Joseph B. Lyles, NeTS Program Director, 1175, telephone: (703) 292-8950, email: jlyles@nsf.gov
- Thyagarajan Nandagopal, NeTS Program Director, 1175, telephone: (703) 292-8950, email: tnandago@nsf.gov
- Min Song, NeTS Program Director, 1175, telephone: (703) 292-8950, email: msong@nsf.gov

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

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 80 to 120 - It is anticipated that up to 120 awards will be made each year.

Anticipated Funding Amount: $60,000,000 each year, dependent upon the availability of funds.

Eligibility Information

Organization Limit:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

In any contiguous September through December period, an individual may participate as PI, Co-PI or Senior Personnel in **no more than two Small, Medium or Large** proposals submitted in response to the *coordinated solicitation* (where *coordinated solicitation* is defined to include the *Computer and Network Systems (CNS): Core Programs*, the *Information and Intelligent Systems (IIS): Core Programs* and the *Computing and Communication Foundations (CCF): Core Programs* solicitations). For example, between September 2012 and December 2012, an individual may participate as PI, co-PI or Senior Personnel in one proposal submitted to a core program in CCF and in a second proposal submitted to a core program in CNS, or an individual may participate as PI, co-PI or Senior Personnel in two proposals submitted to an IIS core program, etc.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission (i.e., the first two proposals received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

The limit on the number of proposals per PI, co-PI or Senior Personnel applies only to the *coordinated solicitation.*

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

- **Submission Window Date(s)** (due by 5 p.m. proposer's local time)**:**

  September 20, 2012 - October 09, 2012

  September 15 - September 30, Annually Thereafter

  MEDIUM Projects

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  December 3 - December 17, Annually Thereafter

  SMALL Projects

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.

TABLE OF CONTENTS

I. INTRODUCTION

The Division of Computer and Network Systems (CNS) supports research and education activities that invent new computing and networking technologies and that explore new ways to make use of existing technologies. The Division seeks to develop a better understanding of the fundamental properties of computer and network systems and to create better abstractions and tools for designing, building, analyzing, and measuring future systems.

II. PROGRAM DESCRIPTION

CNS supports two core programs as described below -- Computer Systems Research (CSR) and Networking Technology and Systems (NeTS).

- **Computer Systems Research (CSR)**

  The Computer Systems Research (CSR) program supports transformative research in computer systems including: multi-core architectures, operating systems, middle-ware and run-time support systems, programming models and tools, storage and file systems, hybrid and embedded systems, web-based systems, datacenters, distributed systems, parallel systems, large scale grids, wireless systems, mobile systems, and sensor systems.

  CSR proposals should address problems that are appropriate to the **CSR Core Area** or to one of this year's highlighted areas. Note that proposals that address problems in the CSR highlighted areas **are not targeted for special handling or funding** - they simply represent emerging areas or areas of current national interest.

  - **CSR Core Areas**

    The CSR program supports transformative research, whether foundational or in computing systems, ranging from multi-core architectures and operating systems to mobile and sensor systems. Research in computer systems is typically complicated by two factors. First, modern systems are increasingly large, complex, and heterogeneous. Second, they are usually required to provide, during their executions, high degrees of availability, responsiveness, fault-tolerance, and security. Some are safety-critical. Other system properties of interest include speed, storage requirements, energy consumption, and real-time constraints.

    Research in the CSR Core Area involves developing methodologies, techniques, heuristics, and tools for the analysis, design, construction, optimization, and certification of computing systems to meet specified goals, as well as hardware and software execution platforms and environments.

    The CSR core supports and sustains progress in the contributing disciplinary areas that underlie computing systems, including: distributed systems; high performance computing; operating systems and middleware; design and programming models; and real-time, embedded, and hybrid systems.

  - **CSR Highlighted Areas**

    For this solicitation, there are four CSR highlighted areas: **Cloud Computing (CC), Embedded and Hybrid Systems (EHS), Pervasive Computing (PC), and Sustainable Computing (SC)**. These four areas are described below.

    - **Cloud Computing**

Cloud computing is a computing paradigm of on-demand access (as a service) to computing, data, and software utilities. It is based on an abstraction of unlimited availability of virtual resources, and a model of usage-based billing where users essentially "rent" virtual resources and pay only for the virtual resources that they rent.

The main focus of the CC highlight area is to stimulate and promote basic, applied, and experimental research in several directions, in the area of cloud computing, that includes (but is not limited to): cloud architectures and systems; network support for cloud computing; data replication, consistency, availability, and management; programming models for the cloud; cloud self-monitoring, prediction, and autonomic control; fault-masking and reliability; cloud security, privacy, authorization, and auditing; debugging, certification, diagnosis, and update in the cloud; data portability, inter-operability, and standardization; green clouds; and cloud test-beds.

- **Embedded and Hybrid Systems**

  Embedded and hybrid systems control devices and physical or engineered systems that range from hearing aids and pacemakers to automobiles, aircraft, chemical processing plants, electrical power grids, and global aviation infrastructure. The EHS highlight area supports research and education in scientific foundations and technology that will revolutionize the design and development of such systems.

  The goal is to supply technologies for designing and building increasingly capable and certifiably dependable embedded and control systems, with real-time, interoperability, survivability, reliability, and security guarantees. A central challenge is to create unified foundations for interacting physical and computational systems.

  Specific topics of interest include: embedded systems software and programming methods; real-time services and platforms; foundations and technology for hybrid (discrete and continuous) control; innovative embedded hardware technology; scalable support for embedded sensing; architecture and design principles for complex embedded systems; and resource management and optimization.

- **Pervasive Computing**

  The dynamic and heterogeneous nature of ubiquitous, distributed and pervasive computing systems, coupled with their interactions with humans and devices, gives rise to unique scientific and socio-technical challenges. At the core of these challenges is the need for new abstractions, models, methodologies, languages, tools and systems.

  Support for pervasive and distributed access to systems, ranging in size and complexity from the personal to very large-scale, requires new approaches to: creating system software; configuring architectures, networks, and connectivity; management; and metrics. The PC highlight area funds activities that address the challenges posed by PCs which may include: pervasive and distributed system modeling and design; techniques for remote access to systems, devices and data; context-aware, smart and adaptive environments; scalability, performance and fault tolerance; security and trust; quality of service; energy management; and other aspects affecting the realization, operation, and use of pervasive and distributed systems.

- **Sustainable Computing**

  The SC highlight area addresses fundamental advances in methods and models to address power, thermal and sustainability issues in the design and operation of computing devices at all scales (from PDAs to large servers and storage boxes) and at all levels (from chips to entire data centers) that are essential to reduce the carbon footprint of fast expanding computing technologies and to deliver the performance that customers and applications demand. As energy generation becomes more distributed and relies on renewable sources, integration of energy generation and consumption by IT becomes an important aspect to consider. With energy consumption of IT systems becoming a major issue, tradeoffs between energy efficiency, performance, and other factors such as reliability or space become essential.

Both the CSR Core and the CSR highlighted areas seek proposals focused on advances in system computing and systems programming that are particular to an application domain or a specific hardware platform as well as generic across domains and platforms. Investigators interested in the CSR program may also wish to consider the Software and Hardware Foundations (SHF) program, which supports research on the design, verification, operation, utilization, and evaluation of computer hardware and software through novel approaches, robust theories, high leverage tools, and lasting principles.

- **Networking Technology and Systems (NeTS)**

  Computer and communication networks need to be available anytime and anywhere, and be accessible from any device. Networks need to evolve over time to incorporate new technologies, support new classes of applications and services, and to meet new requirements and challenges; networks need to scale and adapt to unforeseen events and uncertainties across multiple dimensions, including types of applications, size and topology, mobility patterns, and heterogeneity of devices and networking technologies. Networks need to be easily controllable and manageable, resource and energy efficient, secure and resilient to failures and attacks.

  The Networking Technology and Systems (NeTS) program supports transformative research on fundamental scientific and technological advances leading to the development of future-generation, high-performance networks and future Internet architectures. The scope of the program includes enterprise, core, and optical networks; peer-to-peer and application-level networks; wireless, mobile, and cellular networks; networks for physical infrastructures; and sensor networks. The program also seeks innovative networking research proposals within application domains such as smart grids, compute grids, clouds, and data centers.

  NeTS proposals should address problems that are appropriate to the **NeTS Core Area** or to one of this year's **Highlighted Areas**. Note that proposals that address problems in the NeTS highlighted areas **are not targeted for special handling or funding** - they simply represent emerging areas or areas of current national interest.

  - **NeTS Core Area**

The NeTS program seeks fundamental scientific understanding of and advances in large-scale complex, heterogeneous networks, including but not limited to, resource allocation and traffic engineering, topology discovery and control, context-aware service discovery, naming and addressing, routing and congestion control, network economics, opportunistic networking, network and mobility management at different levels and granularities, virtualization and programmability at-scale and at all levels of the network architecture. NeTS also supports research that brings the network closer to autonomy, where the need for human intervention is minimal.

In the area of wireless networks, NeTS seeks research projects on novel frameworks, architectures, protocols, methodologies and tools for the design and analysis, deployment, operation and management of robust and highly dependable cellular, mobile ad-hoc, vehicular, mesh, sensor, body area, and underwater networks. The program seeks projects that enable energy-efficient operation with low control and communication overhead in wireless networks, such as sensors, cellular and autonomous swarm networks (aerial/terrestrial/underwater).

- **NeTS Highlighted Areas:**

  For this solicitation, there are three highlighted area: **Networks Leveraging or Advancing New Technologies, Networks that Address Emerging National Needs and Trends, and Meta-Networking Research.** These three areas are described below.

  - **Networks Leveraging or Advancing New Technologies**

    With innovations in lower layer technologies such as dynamic optical channels, optical Orthogonal frequency-division multiplexing (OFDM), flexible optical channelization, high-speed wireless physics layer (PHY), multiple-input and multiple-output (MIMO), full-duplex wireless, etc., there is an emerging need to re-visit network design strategies and develop better protocols and control frameworks that leverage these improved technologies while coupling application-layer capacity and reliability demands to the lower layers. One example is networking research that uses dynamic lower layers such as dynamically switched optical networks, and that includes the needed routing protocols and control frameworks to provide applications with millisecond-level access to dynamically installed capacity. Another aspect of such research includes a combination of hardware and software designs to scale wired and wireless network research systems to approach closely the capabilities in high-end commercial hardware without sacrificing programmability, with special emphasis on the design of such networks for application specific support.

  - **Networks that Address Emerging National Needs and Trends**

    The growth in social networks, mobile computing, and ubiquitous communication has raised key research challenges as it pertains to networking. Four such challenges are:

    a. Can we design better higher-layer services and applications that inform or are informed by the underlying communication network?

    b. What protocols and network architectures are needed to achieve massive reductions in power consumption for the Internet, enterprise, mobile and home networking without sacrificing user functionality?

    c. What are the networking innovations that can help improve per-user data rates seen in cellular networks by a factor of 1000, specifically improve per-user edge throughput from the current 100 kbps or less to 100 Mbps?

    d. Cognitive radio is traditionally considered only as a physical layer technology used to achieve dynamic spectrum access, but more is needed to meet the nation's broadband goals. What novel cognitive radio architectures are required to enable rich networking functionalities, while providing adequate incentive and co-existence mechanisms?

  - **Meta-Networking Research**

    There is a vital need for methodologies for scientific evaluation of communication networks that include an understanding of network instrumentation and measurements as well as the development of rigorous scientific methods for planning and assessing networking experiments. There is also a need for solid network management tools that include semantically rich descriptions of network configuration (i.e. rich network configuration, security, network management, application overlays, fault tolerance and resilience).

PROJECT CLASSES

Proposals submitted to this solicitation must be consistent with one of three project classes defined below. Proposals will be considered for funding within their project classes.

- **SMALL Projects:**

  Small Projects, with total budgets up to $500,000 for durations of up to three years, are well suited to one or two investigators (PI and one co-PI or other Senior Personnel) and at least one student and/or postdoc.

- **MEDIUM Projects:**

  Medium Projects, with total budgets ranging from $500,001 to $1,200,000 for durations up to four years, are well-suited to one or more investigators (PI, co-PI and/or other Senior Personnel) and several students and/or postdocs. Medium project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual

contributions. Rationale must be provided to explain why a budget of this size is required to carry out the proposed work. Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, **a Collaboration Plan is required for all Medium proposals with more than one investigator**. Up to 2 pages are allowed for Collaboration Plans. The length of and level of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. **If a Medium proposal with more than one investigator does not include a Collaboration Plan, that proposal will be returned without review.** Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.

- **LARGE Projects:**

  Large Projects, with total budgets ranging from $1,200,001 to $3,000,000 for durations of up to five years, are well-suited to two or more investigators (PI, co-PI(s), or other Senior Personnel), and a team of students and/or postdocs. Large project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual contributions. Large projects will typically integrate research from various areas, either within a cluster or across clusters, or tackle ambitious goals not feasible with smaller projects. Rationale must be provided to explain why a budget of this size is required to carry out the proposed work. Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, a **Collaboration Plan is required for all Large proposals.** Up to 2 pages are allowed for Collaboration Plans. The length of and degree of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. **If a Large proposal does not include a Collaboration Plan, that proposal will be returned without review.** Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.

CISE investments in Small, Medium and Large projects complement the Directorate's investments in the Expeditions in Computing program, where projects are funded at levels of up to $10,000,000 total for durations of up to 5 years. Additional information on the Expeditions program can be accessed at:
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503169

BREAKTHROUGH PROPOSALS:

CISE encourages proposals that promise extraordinary outcomes, with a possibly corresponding increase in uncertainty in the research plan and overall risk of success relative to traditional submissions, such as: revolutionizing entire disciplines, creating entirely new fields, disrupting accepted theories and perspectives, and solving widely recognized, long-standing and important challenging problems. In order to encourage the submission of proposals possessing one or more of these characteristics, we are offering the opportunity to submit and identify such projects as *"**Breakthrough Proposals**."* CISE expects that the total number of awards to such proposals will be relatively small and urges prospective PIs to consider this option carefully.

Breakthrough proposals may be submitted to all CISE (CCF/CNS/IIS) core programs and may be Small, Medium, or Large. They must be submitted in accordance with the deadlines for Small, Medium, and Large proposals. Submission of a *breakthrough proposal* will count as one against the limit of two proposals per PI as described in the previous sections. The proposal preparation instructions, budgetary limits, and requirements for these proposals are identical to other proposals submitted to CISE (CCF/CNS/IIS) core programs under each of three size categories ***with the following exceptions:***

1. The word "breakthrough" must be listed as the first keyword in the submitted list of keywords.
2. A statement, of **up to two pages**, explaining why the proposed research can be described as "breakthrough" and how any associated uncertainty and risk will be managed, **must be submitted as a document under Supplementary Documentation.** A breakthrough proposal must include this statement in order to be considered as a breakthrough proposal. **If it does not include this statement, that proposal will be considered as a regular proposal.**

PROPOSALS FOR CONSIDERATION BY MULTIPLE CISE PROGRAMS

Proposals that intersect more than one CISE research program are welcome. In such cases, PIs must identify the most relevant programs in the proposal submission process (for information about submission and how to identify such proposals, see *Proposal Preparation Instructions* later in this document). CISE Program Officers will ensure that these proposals are co- reviewed as appropriate.

IMPORTANT PROJECT CHARACTERISTICS

The submission of far-reaching, creative research and education projects is encouraged. Funds will be used to support potentially transformative research with high-impact potential. In this way, CISE will catalyze exciting new research activities with the potential to make significant advances in the state-of-the-art.

Interdisciplinary, international and/or academic-industry collaborations that promise to result in major science or engineering advances are welcome. The directorate hopes to attract proposals from faculty at a broad range of academic institutions, including faculty at minority-serving and predominantly undergraduate institutions.

Proposals submitted should demonstrate that rich learning experiences will be provided for a diverse population of students, and may propose the development of innovative curricula or educational materials that advance literacy about and expertise in areas supported by CISE.

III. AWARD INFORMATION

Approximately $60 million will be available each year to support up to 120 awards, pending the availability of funds.

IV. ELIGIBILITY INFORMATION

Organization Limit:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

In any contiguous September through December period, an individual may participate as PI, Co-PI or Senior Personnel in **no more than two Small, Medium or Large** proposals submitted in response to the *coordinated solicitation* (where *coordinated solicitation* is defined to include the *Computer and Network Systems (CNS): Core Programs*, the *Information and Intelligent Systems (IIS): Core Programs* and the *Computing and Communication Foundations (CCF): Core Programs* solicitations). For example, between September 2012 and December 2012, an individual may participate as PI, co-PI or Senior Personnel in one proposal submitted to a core program in CCF and in a second proposal submitted to a core program in CNS, or an individual may participate as PI, co-PI or Senior Personnel in two proposals submitted to an IIS core program, etc.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission (i.e., the first two proposals received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

The limit on the number of proposals per PI, co-PI or Senior Personnel applies only to the *coordinated 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 following information SUPPLEMENTS (not replaces) the guidelines provided in the NSF Grant Proposal Guide (GPG).

Proposal Titles: Proposal titles must begin with an acronym that indicates the most relevant core program. Select an acronym from the following list:

- Computer Systems Research: CSR

- Networking Technology and Systems: NeTS

The acronym should be followed with a colon, then the project class followed by a colon, then the title of your project. For example, if you are submitting a Small proposal to the Networking Technology and Systems core program, then your title would be **NeTS: Small: Title**. If you submit a proposal as part of a set of collaborative proposals, the title of the proposal should begin with the acronym that indicates the most relevant core program followed by a colon, then the project class followed by a colon, then "Collaborative Research" followed by a colon, and the title. For example, if you are submitting a collaborative set of proposals for a Medium project to the Computer Systems Research core program, the title of each would be **CSR: Medium:Collaborative Research: Title.**

Proposals from PIs in institutions that have RUI (Research in Undergraduate Institutions) eligibility should have a proposal title that begins with the acronym that indicates the most relevant crosscutting program, followed by a colon then the project class, followed by a colon then "RUI", followed by a colon and then the title, for example, **CSR: Medium: RUI: Title.**

PIs submitting Grant Opportunities for Academic Liaison with Industry (GOALI) proposals should have a proposal title that begins with the acronym that indicates the most relevant crosscutting program, followed by a colon then the project class, followed by a

colon then "GOALI", followed by a colon and then the title, for example, **NeTS: Medium: GOALI: Title**.

Proposals that extend beyond the scope of one CISE core program or area are welcome. Proposals should be submitted in response to the solicitation for the CISE division (CCF, CNS or IIS) that inclues the most relevant core program. In such cases, PIs should identify the acronym for the **most relevant** core program or area, followed by any other relevant program acronym(s) separated by colons (for example, **CSR: HCC: Medium: Title)**. In this case, the proposal would be submitted to the Division of Computer and Network Systems solicitation but would be considered by CNS/CSR and IIS/HCC. CISE Program Officers will ensure that these proposals are appropriately co-reviewed. Please see the coordinated CNS and CCF solicitations for information on other CISE core programs and the corresponding acronyms.

Project Summary: The Project Summary must include an explicit description of both the Intellectual Merit and Broader Impacts of the activities proposed, preferably in separate paragraphs titled "Intellectual Merit" and "Broader Impacts".

Please provide between 2 and 6 sets of key words at the end of the Project Summary. CISE personnel will use this information in the merit review process. The keywords should describe the main scientific/engineering areas explored in the proposal. Keywords should be prefaced with "Keywords" followed by a colon and each key word set should be separated by semi-colons. Keywords should be of the type used to describe research in a journal submission. They should be included at the end of the project summary and might appear, for example, as **Keywords: energy-aware computing; formal logic; computer graphics; sensor networks; information visualization; privacy. "Breakthrough proposals" should have the word "breakthrough" as the first keyword in the submitted list of keywords.**

Project Description:

Length of Project Description - Describe the research and education activities to be undertaken in **15 pages or less for Small and Medium proposals and in 20 pages or less for Large proposals**. Describe curriculum development activities in a separate section (included in these page limits) titled "Curriculum Development Activities."

Collaboration Plans for Medium and Large Proposals - Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, **all Medium proposals that include more than one investigator and all Large proposals must include a Collaboration Plan**. While the length of the Project Description for Small and Medium proposals is limited to 15 pages and for Large proposals to 20 pages, **for Medium and Large proposals up to 2 additional pages are allowed for Collaboration Plans**. Collaboration Plans should be included at the end of the Project Description in a section entitled "Collaboration Plan". The length of and degree of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Where appropriate, the Collaboration Plan might include: 1) the specific roles of the project participants in all organizations involved; 2) information on how the project will be managed across all the investigators, institutions, and/or disciplines; 3) identification of the specific coordination mechanisms that will enable cross-investigator, cross-institution, and/or cross-discipline scientific integration (e.g., yearly workshops, graduate student exchange, project meetings at conferences, use of the grid for videoconferences, software repositories, etc.), and 4) specific references to the budget line items that support collaboration and coordination mechanisms. **If a Large proposal, or a Medium proposal with more than one investigator, does not include a Collaboration Plan of up to 2 pages, that proposal will be returned without review.**

Supplementary Documents: In the Supplementary Documents Section, upload the following information where relevant:

1. *List of Project Personnel and Partner Institutions (Note - In collaborative proposals, only the lead institution should provide this information),*

   Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage conflicts of interest. The list should include all PIs, Co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

   1. Mary Smith; XYZ University; PI
   2. John Jones; University of PQR; Senior Personnel
   3. Jane Brown; XYZ University; Postdoc
   4. Bob Adams; ABC Inc.; Paid Consultant
   5. Mary White; Welldone Institution; Unpaid Collaborator
   6. Tim Green; ZZZ University; Subawardee

2. *Postdoctoral Researcher Mentoring Plan (if applicable)*

   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. In no more than one page, the mentoring plan must describe the mentoring that will be provided to all postdoctoral researchers supported by the project, irrespective of whether they reside at the submitting organization, any subawardee organization, or at any organization participating in a simultaneously submitted collaborative project. 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 (http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpg_2.jsp#IIC2j) of the GPG for further information about the implementation of this requirement.

   Proposals that include Postdoctoral Mentoring Plans exceeding one page in length will be returned without review.

3. *Data Management Plan (required)*

   Proposals must include a supplementary document of no more than two pages labeled "Data Management Plan". This supplementary document should describe how the proposal will conform to NSF policy on the dissemination and sharing of research results.

   See Grant Proposal Guide (GPG) Chapter II.C.2.j for full policy implementation.

   For additional information see: http://www.nsf.gov/bfa/dias/policy/dmp.jsp

and for specific guidance for proposals submitted to the Directorate for Computer and Information Science and Engineering (CISE) see: http://www.nsf.gov/cise/cise_dmp.jsp

Proposals that include Data Management Plans exceeding two pages in length will be returned without review.

4. *Requirement for "Breakthrough" Proposals Only*

   A statement, of **up to two pages**, explaining why the proposed research can be described as "breakthrough," and how any associated uncertainty and risk will be managed, **must be submitted as a document under Supplementary Documentation.** A breakthrough proposal must include this statement in order to be considered as a breakthrough proposal. **If it does not include this statement, that proposal will be considered as a regular proposal.**

5. *Documentation of collaborative arrangements of significance to the proposal through letters of commitment.*

   Any substantial collaboration with individuals not included in the budget should be described and documented with a letter from each collaborator, which should be provided in the supplementary documentation section. Letters of commitment that promise access to facilities or resources (such as data sets or databases) should also be provided.

6. *Other Specialized Information*

   RUI Proposals: PIs from predominantly undergraduate institutions should include a Research in Undergraduate Institutions (RUI) Impact Statement and Certification of RUI Eligibility in this Section.

   GOALI proposals: PIs submitting GOALI proposals should include industry-university agreement letters on intellectual property in this section.

7. ***No other supplementary documents, except as permitted by the Grant Proposal Guide, are allowed.*** In particular, ***other letters of support not included in (5) above should not be submitted*** as they are not a standard component of an NSF proposal.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. proposer's local time)**:**

  September 20, 2012 - October 09, 2012

  September 15 - September 30, Annually Thereafter

  MEDIUM Projects

  November 01, 2012 - November 30, 2012

  November 1 - November 30, Annually Thereafter

  LARGE Projects

  December 03, 2012 - December 17, 2012

  December 3 - December 17, Annually Thereafter

  SMALL Projects

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

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

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

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

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

technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

A. NSF Merit Review Criteria

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

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

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

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

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

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

Additional Solicitation Specific Review Criteria

For Large and relevant Medium proposals, reviewers will be asked to:

- Comment on the extent to which the project scope justifies the level of investment requested, and the degree to which the Collaboration Plan (if required) adequately demonstrates that the participating investigators will work synergistically to accomplish the project objectives.

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

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

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

B. Review and Selection Process

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

CNS will be piloting an asynchronous panel review process this fiscal year. A limited number of "small" panels will be conducted this way. Rather than a face-to-face panel, the reviewers will conduct an asynchronous discussion on an access-controlled, moderated

message board of the proposals that have been submitted. The most competitive proposals will then move on to a virtual panel review via teleconference for final recommendations. This pilot will be evaluated within the larger context of NSF merit review pilots being conducted this year.

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

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

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

C. Reporting Requirements

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

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

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

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Anita J. La Salle, Point of Contact, Computer Systems Research (CSR), 1175, telephone: (703) 292-8950, email: alasalle@nsf.gov
- Theodore Baker, CSR Program Director, 1175, telephone: (703) 292-8950, email: tbaker@nsf.gov
- Helen Gill, CSR Program Director, 1175, telephone: (703) 292-8950, email: hgill@nsf.gov
- Krishna Kant, CSR Program Director, 1175, telephone: (703) 292-8950, email: kkant@nsf.gov
- Ralph Wachter, CSR Program Director, 1175, telephone: (703) 292-8950, email: rwachter@nsf.gov
- Darleen L. Fisher, Point of Contact, Networking Technology and Systems (NeTS), 1175, telephone: (703) 292-8950, email: dlfisher@nsf.gov
- Joseph B. Lyles, NeTS Program Director, 1175, telephone: (703) 292-8950, email: jlyles@nsf.gov
- Thyagarajan Nandagopal, NeTS Program Director, 1175, telephone: (703) 292-8950, email: tnandago@nsf.gov
- Min Song, NeTS Program Director, 1175, telephone: (703) 292-8950, email: msong@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.

In addition to the *coordinated solicitation* discussed in this document, NSF provides funding opportunities for the computing community via the following programs and their solicitations:

Discovery Research Programs

CAREER: Faculty Early Career Development,
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503214&org=NSF&sel_org=XCUT&from=fund

CISE-MPS Interdisciplinary Faculty Program in Quantum Information Science,
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504743&org=CISE&from=home

Collaborative Research in Computational Neuroscience (CRCNS),
http://nsf.gov/funding/pgm_summ.jsp?pims_id=5147

Core Techniques and Technologies for Advancing Big Data Science and Engineering (BIGDATA),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504767&org=CISE&from=home

Cyber-Physical Systems (CPS),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286&org=NSF&sel_org=NSF&from=fund

Engineering Research Centers (ERCs), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5502

Expeditions in Computing, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503169

Grant Opportunities for Academic Liaison with Industry (GOALI),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504699

Industry/University Cooperative Research Centers Program (I/UCRC),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5501&org=CISE&sel_org=CISE&from=fund

Innovation Corps Program (I-Corps),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504672&org=CISE

National Robotics Initiative (NRI), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503641

Partnerships for International Research and Education (PIRE),

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12819&org=CISE&sel_org=CISE&from=fund

Research in Undergraduate Institutions (RUI),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5518&org=CISE&sel_org=CISE&from=fund

Science and Technology Centers (STCs),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5541&org=CISE&sel_org=CISE&from=fund

Science, Engineering and Education for Sustainability (SEES),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707

Science of Learning Centers (SLCs),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5567&org=CISE&sel_org=CISE&from=fund

Secure and Trustworthy Cyberspace (SaTC), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504709

Smart Health and Wellbeing (SHB), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504739

Education and Workforce Development Programs

ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers,
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5383&from=fund

Advanced Technological Education (ATE), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5464

Computing Education for the 21st Century (CE21),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503582&org=CNS&from=home

Cyberlearning: Transforming Education (CTE):
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503581&org=CISE

Discovery Research K-12 (DR-K12),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=500047&org=EHR&sel_org=EHR&from=fund

Federal Cyber Service: Scholarship for Service (SFS),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5228

Graduate Research Fellowships (GRF),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=6201&org=DGE&from=home

Integrative Graduate Education and Research Training (IGERT),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12759

Information Technology Experiences for Students and Teachers (ITEST),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5467&org=EHR&sel_org=EHR&from=fund

International Research Experiences for Students (IRES),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12831&org=CISE&sel_org=CISE&from=fund

NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5257&org=EHR&sel_org=EHR&from=fund

Research Experiences for Teachers (RET) in Engineering and Computer Science,
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5736

Research Experiences for Undergraduates (REU) Sites and Supplements,
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&from=fund

Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5488&org=EHR&sel_org=EHR&from=fund

Transforming Undergraduate Education in Science (TUES),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5741

Research Infrastructure Programs

CISE Computing Research Infrastructure (CRI),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12810&org=NSF&sel_org=NSF&from=fund

Major Research Infrastructure (MRI), http://www.nsf.gov/od/oia/programs/mri/

Software Infrastructure for Sustained Innovation (SI^2),
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503489&org=NSF&sel_org=XCUT&from=fund

For more information on these programs, please consult the NSF web site.

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

research.

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

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.

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