

EMERGING FRONTIERS IN RESEARCH AND INNOVATION (EFRI)

1. **Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI)**
2. **Cellular and Biomolecular Engineering (CBE)**

Program Solicitation NSF 06-596



National Science Foundation

Directorate for Engineering

Letter of Intent Due Date(s) (optional):

October 16, 2006

Preliminary Proposal Due Date(s) (required):

November 17, 2006

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

April 30, 2007

REVISION NOTES

In furtherance of the President's Management Agenda, in Fiscal Year 2006, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via Grants.gov or via the NSF FastLane system.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Emerging Frontiers in Research and Innovation (EFRI)

1. Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI)

2. Cellular and Biomolecular Engineering (CBE)

Synopsis of Program:

The Directorate for Engineering at the National Science Foundation has established the Office of Emerging Frontiers in Research and Innovation (EFRI) to serve a critical role in focusing on important emerging areas in a timely manner. The EFRI Office is launching a new funding opportunity for interdisciplinary teams of researchers to embark on rapidly advancing frontiers of fundamental engineering research. For this solicitation, we will consider proposals that aim to investigate emerging frontiers in the following two specific research areas: (1) Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI) and (2) Cellular and Biomolecular Engineering (CBE). EFRI seeks proposals that represent an opportunity for a significant leap or a paradigm shift in fundamental engineering knowledge. The proposals must also meet the detailed requirements delineated in this solicitation.

Cognizant Program Officer(s):

- Sohi Rastegar, Contact for general questions about the EFRI Office and administration of this solicitation, telephone: (703) 292-5379, email: srastega@nsf.gov
- TOPIC 1, AUTONOMOUSLY RECONFIGURABLE ENGINEERED SYSTEMS ENABLED BY CYBERINFRASTRUCTURE (ARES-CI), telephone: (703)292-7061, email: adeshmuk@nsf.gov
- Abhijit Deshmukh, Program Director, Division of Design and Manufacturing Innovation, Directorate for Engineering, 550 S, telephone: (703) 292-7061, email: adeshmuk@nsf.gov
- Mario Rotea, Program Director, Division of Civil and Mechanical Systems, Directorate for Engineering, 545 N, telephone: (703) 292-8360, email: mrotea@nsf.gov
- Maria Burka, Program Director, Division of Chemical and Transport Systems, Directorate for Engineering, 525 N, telephone: (703) 292-7030, email: mburka@nsf.gov
- Bruce Hamilton, Program Director, Division for Bioengineering and Environmental Systems, Directorate for Engineering, 565 S, telephone: (703) 292-8320, email: bhamilto@nsf.gov
- Usha Varshney, Division Director, Division of Electrical and Communications Systems, Directorate for Engineering, 675 N, telephone: (703) 292-8339, email: uvarshne@nsf.gov
- TOPIC 2, CELLULAR AND BIOMOLECULAR ENGINEERING (CBE), telephone: (703)292-7020, email: jhsia@nsf.gov
- Jimmy Hsia, Program Director, Division of Civil and Mechanical Systems, Directorate for Engineering, 545 S, telephone: (703) 292-7020, fax: (703)292-9053, email: jhsia@nsf.gov
- Lenore Clesceri, Program Director, Division of Bioengineering and Environmental Systems, Directorate for Engineering, 565 S, telephone: (703) 292-5313, fax: (703)292-9098, email: lclescer@nsf.gov
- Frederick Heineken, Program Director, Division of Bioengineering and Environmental Systems, Directorate for Engineering, 565 S, telephone: (703) 292-7944, fax: (703)292-9098, email: fheineke@nsf.gov
- Lynn Preston, Deputy Division Director, Division of Engineering Education & Centers, Directorate for Engineering, 585 N, telephone: (703) 292-5358, fax: (703)292-9051, email: lpreston@nsf.gov
- Robert Wellek, Deputy Division Director, Division of Chemical and Transport Systems, Directorate for Engineering, 525 N, telephone: (703) 292-8370, fax: (703)292-9054, email: rwellek@nsf.gov

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

- 47.041 --- Engineering

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 11 (4-year awards)

Anticipated Funding Amount: \$22,000,000 in FY 2007 pending the availability of funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- EFRI proposals may be submitted by a single organization or a group of organizations consisting of a lead organization in partnership with one or more partner organizations. Only U.S. academic institutions with significant research and degree-granting education programs in disciplines normally supported by NSF are eligible to be the lead organization. Principal investigators are encouraged to form synergistic collaborations among researchers, and with private and public sector organizations, government laboratories, and scientists and engineers at foreign organizations where appropriate, though no funds will be provided to those organizations.

PI Limit:

Principal Investigators must be at the faculty level or equivalent and the lead PI must have a primary appointment in an engineering department. The PI and at least two co-PIs, all from different disciplines and with funded time committed in the budget, must be listed on the cover page or on the budget page of the proposal.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

Each PI/co-PI may participate in only one proposal in response to this solicitation.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is optional. Please see the full text of this solicitation for further information.
- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **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

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

- **Letter of Intent Due Date(s) (optional):**

October 16, 2006

- **Preliminary Proposal Due Date(s) (required):**

November 17, 2006

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

April 30, 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: Additional award conditions apply. Please see the full text of this solicitation for further information.

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

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I. INTRODUCTION

The Directorate for Engineering at the National Science Foundation has established the Office of Emerging Frontiers in Research and Innovation (EFRI) to serve a critical role in focusing on important emerging areas in a timely manner. The role of the EFRI Office is to fund research opportunities that would be difficult to fund with the current funding mechanisms of Small Grants for Exploratory Research (SGER), typical core awards, or large research center awards. It is expected that EFRI support will represent higher risk opportunities with high potential payoffs leading to new research directions, potential new industries or capabilities that result in a leadership position for the country, or significant progress on a national need or a grand challenge.

EFRI is launching a new funding opportunity for interdisciplinary teams of researchers to embark on rapidly advancing frontiers of fundamental engineering research. For this solicitation, we will consider proposals that aim to investigate emerging frontiers in the following two specific research areas: (1) Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI) and (2) Cellular and Biomolecular Engineering (CBE). EFRI seeks proposals that represent an opportunity for a significant leap or a paradigm shift in fundamental engineering knowledge. The proposals will also have to meet the additional requirements delineated in this solicitation.

Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI)- Complex engineered systems, ranging from micro-embedded devices to critical infrastructures, operate under uncertainty. Autonomous reconfigurability is a promising concept for ensuring appropriate operational levels during and after unexpected natural or man-made events that could impact critical engineered systems in unforeseen ways or to take advantage of unexpected opportunities. Cyberinfrastructure and other advances in engineering and information sciences provide unprecedented capabilities for embedding reconfigurability into engineered systems. EFRI's ARES-CI program will fund projects that advance the fundamental understanding of reconfigurability, and allow the analysis and design of autonomously reconfigurable engineered systems integrating physical, information, and human domains. ARES-CI will enable realization of systems that will be able to sense, diagnose, and reconfigure to function uninterrupted during and after unplanned events.

Cellular and Biomolecular Engineering (CBE)- The 21st century is witnessing unparalleled advances in understanding complex biological systems. Recent advances in biology, genomics, cellular level modeling methods, multiscale simulation capabilities, new technologies for imaging and measuring biological phenomena and for functionalizing and patterning surfaces, and molecular level interfacial characterization tools present the engineering community with unique opportunities to advance the understanding of these biological systems to deliver desired functions. The basic unit of complex biological systems is the living cell for which there is incomplete engineering understanding. This lack of engineering understanding is compounded when cell-to-cell interactions and the interaction of the cell with its environment through the interface are factored in. A complex systems analysis approach to cellular and bio-related interfacial phenomena can enable manipulation and control of cellular and interfacial behavior to produce desired functions. To achieve this, there is a need for a comprehensive, fundamental engineering understanding of cellular and biomolecular responses to stimuli at the molecular level, within and between cells, as well as with surrounding materials and the environment. Additionally, there is a need to understand how this desired functionality can eventually be exploited and integrated over larger scales and complexities through fabrication and manufacturing considerations. This understanding will be a key to enabling future bio-based systems and products.

The EFRI Office plans to convene an information workshop on September 19, 2006, to answer any questions about the EFRI Office and this solicitation. Details will be posted on the NSF Website <http://www.nsf.gov/eng/efri> as they become available.

II. PROGRAM DESCRIPTION

Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI)

US economic and technological leadership is built on engineered systems, examples of which include implantable medical devices and smart sensors, automobiles and commercial/defense aircraft, enterprise supply chains, and critical infrastructures. These systems engage almost every element of our society, ranging from manufacturing, agriculture, healthcare, banking and finance, defense and the environment. Society depends profoundly on smooth and efficient functioning of these systems in presence of unpredictable events, both good and bad.

Most engineered systems are increasingly becoming highly complex (e.g. massive integration and interconnection between components and subsystems, feedback and redundancy). Complexity in these systems is in part due to the need to perform predictably and operate despite design flaws, human error, random faults, and other disturbances or perturbations. These complex systems guarantee robust operation only to the events that have been anticipated and accounted for during the design, modification, or renewal stages. Unfortunately, unforeseen or unanticipated perturbations can completely disable a complex system. As our complex engineered systems continue to evolve, the threats and opportunities available to them become more difficult to predict and characterize. Complexity alone is not sufficient to manage engineered systems under largely unpredictable scenarios. To ensure optimal operational levels when the threats or opportunities are realized, a new paradigm for design, analysis and synthesis of engineered systems is needed.

This solicitation seeks to develop the concept of *autonomous reconfigurability* as the fundamental mechanism for ensuring robust system operation to unforeseen events. Autonomous reconfigurability refers to a system's ability to change its structure and operations or both in response to an unforeseen event in order to meet its objectives. Autonomous reconfigurability is a promising concept for attaining appropriate operational levels during and after unexpected disturbances. This concept can be realized using the powerful next generation *cyberinfrastructure*, which includes a collection of devices, networks, software, and ubiquitous computation providing the capability for embedding reconfigurability into engineered systems. The next generation cyberinfrastructure has the potential of serving as an artificial nervous system for engineered systems and critical infrastructures pervading the entire U.S. economy, and providing the capability to reconfigure in case of disruptions.

The objective of the Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI) program of EFRI is to establish a fundamental understanding of reconfigurability and develop rigorous methods, integrating physical, information, and knowledge domains, for the design of autonomously reconfigurable engineered systems. The research funded under this solicitation presents unprecedented opportunities to develop novel methods to sense, diagnose, and auto-reconfigure the system to function uninterrupted when subjected to unplanned failure events or unforeseen opportunities. *Key advances in theoretical foundations and methods and tools for analysis and synthesis are sought.*

To achieve a transformational effect, EFRI's ARES-CI program will support interdisciplinary teams that integrate frontier research across the computational, algorithmic, and engineered system domains into a single theoretical framework for the analysis and synthesis of systems that are adaptive, evolving and reconfigurable. Each proposal is expected to address the following three areas: 1) Theoretical and Algorithmic Foundations, 2) Methods for Analysis and Synthesis, and 3) Reconfigurable System Test Beds. A few examples of specific research challenges in each of these areas are listed below. (This is a partial list; PI's are encouraged to identify research challenges that are best suited for their proposed research)

A. Theoretical and Algorithmic Foundations

- Paradigms: reconfiguration / evolution as a paradigm - evolvable hardware / software / algorithms; artificial immune systems - dealing with intentional or unintentional attacks or degradation; formalizing the notion of reconfigurability at different levels of granularity;
- Representation: representation of reconfigurable systems; models of various levels of reconfigurable engineered systems; modeling across spatial and temporal scales;
- Metrics: metrics for reconfigurability, robustness, modularity and evolvability; relationship between reconfigurability metrics and system performance; and
- Algorithms: inference, decision, and control architectures; algorithms adapting to observations; algorithms for optimal reconfiguration of systems of heterogeneous components; integrating research in disparate areas to develop algorithms that evolve and adapt, achieve the appropriate mix of centralized or distributed computation, and take advantage of parallelism.

B. Methods for Analysis and Synthesis

- Analysis: performance analysis of reconfigurable engineered systems; effects of connectivity on performance; environmental uncertainty and decision to adapt / reconfigure / evolve; scalability of performance prediction approaches for large-scale reconfigurable systems; validation and

verification of dynamically reconfigurable systems;

- Synthesis: design methodologies for optimal reconfigurable or evolving systems; identification of decision rules and algorithms; tradeoffs between flexibility and performance; optimal allocation of system reconfigurability for multiple end-user needs; adaptive topologies.

C. Reconfigurable System Test Beds

- Engineered system test beds: development of engineered system test-beds to evaluate the efficacy of theoretical and algorithmic advances for reconfigurable systems; projects aimed at showing how integration of new hardware, decision methods or software allows new capabilities or applications beyond the scope of current systems;
- Cyberinfrastructure for reconfigurable systems: demonstration of the use of cyberinfrastructure in the design, analysis and verification of reconfigurable systems, through the use of networks of sensors and actuators, dynamic decision architectures, common interfaces and knowledge representation techniques.

To be competitive, proposals must:

- Address all three areas listed above in an integrated manner;
- Involve a multi-disciplinary team covering engineered systems, algorithmic and computational domains; and
- Propose transformative rather than incremental research.

The ARES-CI program will result in the development of a *common set of theoretical frameworks, metrics, analysis and synthesis tools, technologies, and services* that will form a foundation for the design and control of reconfigurable systems that leverage the computation-intensive, information-intensive and instrumentation-rich capabilities provided by the next generation cyberinfrastructure.

D. Cellular and Biomolecular Engineering (CBE)

The objective of the Cellular and Biomolecular Engineering (CBE) program of EFRI is to establish an experimental and computational understanding of the biological impact of the interactive effects of mechanical, electrical, and chemical factors that influence molecular, cellular, and interfacial behavior in healthy, stressed, or diseased states. This will provide the fundamental understanding of genes and other molecules and cells and their responses to internal and external stimuli, and biomolecular interfaces both internal and external to the cell and bioengineered surfaces. Collectively, this knowledge will enable the design and fabrication of engineered cells and both biomolecular surfaces and interfaces that are responsive to external stimuli. These stimuli would signal internal cellular functions to direct the cell to generate or express desired behaviors and/or interact with the external environment to yield new devices and products. These stimuli may take the form of specific chemical, bio-substance, deformation, mechanical load, electrical charge, thermal fluctuation, or magnetic or photonic signals. A key challenge is to engineer appropriate synthetic surface biomolecules, with grafted responsive molecular sites, to enable us to achieve that goal.

Because of the disciplinary approach to most academic research, our understanding of the full complexity of the cell, the intercellular/intracellular behavior, and the effects of biomolecules at interfaces is fragmented. *To deliver desired functions, the goal is to bring engineering methodologies to bear on investigating the interactive role of combined biochemical, chemical, mechanical, electrical, and thermal stimuli and interfacial phenomena at the molecular, intracellular, and intercellular levels, as well as with the external environment.* Such transformative, interdisciplinary research will have significant, far-reaching impacts on new medical diagnostic tools and treatment technologies, new drug delivery systems, new biomaterials, new sensing technologies, alternative energy sources, new cell-based manufacturing processes, new technologies for detecting environmental pollutants and bio/chemical terrorism agents, and new products yet to be discovered.

To achieve these goals, EFRI's CBE program will support interdisciplinary teams to pursue innovative research that includes modeling, simulation, and experimentation to produce transformative knowledge and technology by working at the frontiers of disciplines.

Teams of investigators may submit proposals that address one of the following two sets of topics:

A. Knowledge of the Cell and Interfacial Responses

Studies that integrate efforts around the following challenges to:

- Enhance knowledge of cellular and biomolecular behavior as an interactive function of a combination of coupled physical (e.g., mechanical deformation and electric charge) and biochemical stimuli;
- Develop new or utilize existing experimental tools or both to measure and manipulate the cellular and biomolecular interfacial responses to multiple, interactive stimuli (force, electrical current, biochemical reaction rate, etc.); and
- Develop quantitative modeling and simulation methods that faithfully replicate the complexity of the cell and cellular interactions based on experimental data and deal creatively with the hierarchical and nonlinear nature of cellular systems.

B. Knowledge of the Interaction of Biomolecules with Cells and the Environment

Studies that integrate efforts around the following challenges to:

- Build on integrative knowledge of cellular and biomolecular functions to design, develop, and fabricate biomolecules to achieve tunable biological, chemical, and mechanical functions;
- Design and fabricate biomolecular interfaces to control the role of multiple stimuli (force, electrical current, biochemical reaction rate, etc.) on biological activities to regulate cellular functions; and
- Understand the complexity of the interface of cells and surfaces and their environment -- as well as integrative issues enabling functionality across larger scales -- to design and fabricate biomolecules to sense, identify, and mitigate undesired responses or produce desired responses.

Proposals will not be competitive if they:

- Address a problem from the view point of a single discipline;
- Position their work as only incremental from the current state of the art;
- Do not address each challenge under topic A or B;
- Do not integrate experimental work with modeling work; or
- Do not include an integrated educational component.

This EFRI CBE funding will jump-start an interdisciplinary approach to understanding complex cellular and interfacial phenomena to enable manipulation and control of cellular, interfacial, and biomolecular behavior needed to produce desired responses, devices, and products.

III. AWARD INFORMATION

- Anticipated Type of Award: Standard Grant
- Estimated Number of Awards: 11, 4-year awards.
- Anticipated Funding Amount: A total of up to \$22,000,000 in FY 2007 pending the availability of funds. Anticipated Funding Level: It is anticipated that 11 or more standard grants will be made in FY 2007. Each project team may receive support of up to a total (direct plus indirect cost) of \$500,000 per year for up to four years. It is not expected that all awards will receive the maximum amount; the size of awards will depend upon the type of research program proposed.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- EFRI proposals may be submitted by a single organization or a group of organizations consisting of a lead organization in partnership with one or more partner organizations. Only U.S. academic institutions with significant research and degree-granting education programs in disciplines normally supported by NSF are eligible to be the lead organization. Principal investigators are encouraged to form synergistic collaborations among researchers, and with private and public sector organizations, government laboratories, and scientists and engineers at foreign organizations where appropriate, though no funds will be provided to those organizations.

PI Limit:

Principal Investigators must be at the faculty level or equivalent and the lead PI must have a primary appointment in an engineering department. The PI and at least two co-PIs, all from different disciplines and with funded time committed in the budget, must be listed on the cover page or on the budget page of the proposal.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

Each PI/co-PI may participate in only one proposal in response to this solicitation.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent(*optional*):

A one-page letter of intent is encouraged but optional. Letters of Intent are not reviewed. The letter should be submitted via FastLane no later than the date specified in this solicitation. The subject heading of the letter should include a brief title of the proposal and the name of the lead institution. Each letter must include the following:

1. THE TITLE- Title of the EFRI proposal preceded by the words "EFRI-ARESCI" or "EFRI-CBE" as appropriate.
2. THE TEAM- Names, departmental and university affiliation, and disciplinary expertise of the Principal Investigator and at least two co-Principal Investigators from at least three different disciplines.
3. THE SYNOPSIS (AIMS)- Brief description of the specific aims of the proposal (maximum of 250 words).

These letters of intent help NSF anticipate review requirements for preliminary proposals. They are not used as pre-approval mechanisms for the submission of preliminary proposals and no feedback is provided to the submitters.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- SPO Submission is Not Required when submitting Letters of Intent
- A Minimum of 2 and Maximum of 4 Other Senior Project Personnel are allowed
- A Minimum of 0 and Maximum of 3 Other Participating Organizations are allowed
- Submission of multiple Letters of Intent are Not allowed

Preliminary Proposals(*required*):

Submission of a preliminary proposal is required. Preliminary proposals must be submitted via FastLane in accordance with the instructions below. Proposals that are not compliant with the guidelines will be returned without review. It is the submitting organization's responsibility to ensure that the proposal is compliant with all applicable guidelines. Preliminary proposals must contain the items listed below and strictly adhere to the specified page limitations. No additional information may be provided as an appendix or by links to web pages. Figures and tables must be included within the applicable page limit. All elements of the proposal, including legends and tables, must meet the formatting requirements for font size, characters per inch, margins, etc. as specified in the NSF Grant Proposal Guide (GPG).

Preliminary proposals will be reviewed by panels of outside experts. Based on the reviews, a limited number of PIs will be invited to submit full proposals. By February of 2007, successful PIs should expect to receive an invitation from the EFRI Office to submit full proposals.

Preliminary proposals should provide a brief overview of the project and should include sufficient information to allow assessment of the main ideas and approaches and how it is appropriate as an EFRI proposal as opposed to existing programs. Preliminary proposals must include the following items:

Cover Sheet: Select the EFRI program solicitation number from the pull down list. Check the box indicated for preliminary proposal. Entries on the Cover Sheet are limited to the principal investigator and a maximum of four co-principal investigators. Additional project leaders or senior personnel should be listed on the Project Summary page and entered into FastLane as senior investigators.

Title of Proposed Project: The title for the proposed EFRI project must begin with **EFRI-ARESKI Preliminary Proposal:** or **EFRI-CBE Preliminary Proposal:**, as appropriate. The title must state clearly and succinctly the major emerging frontier in research and innovation that is the focus for the project.

Project Summary: May not be more than one page in length and must consist of three parts: (1) At the top of this page include the title of the project, the name of the PI and the lead institution or organization or both, and a list of co-PIs and senior personnel along with their institutions or organizations or both; (2) provide a succinct summary of the intellectual merit of the proposed project. This should include the transformative nature of the proposed research the significant leap or a paradigm shift in fundamental engineering knowledge it will achieve; and (3) describe the broader impacts of the proposed work including the potential long-term impact on national needs or a grand challenge. **Proposals that do not separately address in the project summary both intellectual merit and broader impacts will be returned without review.**

Project Description. Project Description of the Preliminary Proposals is limited to five pages and will include the following three sections:

1. **Vision and Aims-** Describe the vision and specific aims of the proposed research in approximately one page.
2. **Approach and Methodology-** Describe in approximately three pages the approach and methodology that will be used to achieve the vision and goals.
3. **Impact-** Describe in approximately one page how the coming together of the different experts from different disciplines in the proposed research will achieve a significant shift in fundamental engineering knowledge and will have a strong potential for long term impact on national needs or a grand challenge.

References Cited. Indicate with an asterisk any cited publications that resulted from prior research funded by NSF for the PI, or co-PI (s).

Biographical sketches. The standard NSF 2-page biographical sketches must be prepared for the PI, co-PIs and other Senior Personnel listed on the Project Summary page.

Current and Pending Support for the PI, co-PIs, and Senior Personnel must be included.

Budget: The preliminary proposal will include a budget for each of the four years proposed. FastLane will automatically provide a cumulative budget. Preliminary proposals should not include any subcontracts; however the budget justification should include planned levels for subcontracts to any partner institution. Enter the anticipated total level of subcontract support on line G5, Subawards.

In the Special Information and Supplementary Documentation section, include the following:

1. List of key personnel involved (maximum one page), with a succinct description of what each person uniquely brings to the project and how they are integrated to produce positive synergies; and
2. A list, in a single alphabetized table, with the full names and institutional affiliations of all people with conflicts of interest for all senior personnel (PI and co-PI's) and any named personnel whose salary is requested in the project budget. Conflicts to be identified are (1) PhD thesis advisors or advisees, (2) collaborators or co-authors, including postdoctoral researchers, for the past 48 months, and (3) any other individuals with whom or institutions with which the PIs have financial ties (please specify type).

In addition to the FastLane instructions, the proposers must send the following two documents via email immediately after submission of their proposal. After receipt of the proposal number from FastLane, send an email to efri2007@nsf.gov. The subject heading of the email should note the proposal number and the lead institution. Attach the following documents prepared on templates that will be available at <http://www.nsf.gov/eng/efri>:

1. An Excel spreadsheet containing two lists: one lists the last names, first names and institutional affiliations of all senior personnel (PI and co-PI's) and any named personnel whose salary is requested in the project budget; the second one lists the full names and institutional affiliations of all people having conflicts of interest with any senior personnel (PI and co-PI's) or named personnel whose salary is requested in the project budget. These lists will be used by NSF to check for conflicts of interest in assembling the review community
2. A single Power Point slide summarizing the vision of the EFRI proposal. This will be used during review panel discussions.

Remember to email these two documents; do not use FastLane.

Full Proposal 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.

Based on the review of preliminary proposals, a limited number of PIs will be invited to submit full proposals. The review of invited full proposals will include both ad hoc and panel reviews.

The following exceptions and additions to the GPG or the NSF Grants.gov Application Guide apply to full proposals submitted to this Program:

Full proposals will be accepted only from PIs who have submitted Preliminary proposals in the current review cycle. Submission of full proposals by PIs whose preliminary proposals received a review recommendation of 'Not Invited' will be returned without review.

Cover Sheet:

- FastLane Users: Select the EFRI program solicitation number from the pull down list. Check the box indicated for full proposal. Entries on the cover sheet are limited to the principal investigator and a maximum of four co-principal

investigators. Additional project leaders or senior personnel should be listed on the Project Summary page and entered into FastLane as senior investigators.

- **Grants.gov Users:** The EFRI program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page. NSF allows one principal investigator and a maximum of four co-principal investigators to be identified on a proposal. Instructions for entering additional senior project participants are included in Section V.5. of the NSF Grants.gov Application Guide.

Title of Proposed Project: The title for the proposed EFRI project must begin with **EFRI-ARESCI:** or **EFRI-CBE:**, as appropriate. The title must state clearly and succinctly the major emerging frontier in research and innovation that is the focus for the project.

Project Summary (one-page limit): Provide the following information: (1) the title of the project, the name of the PI and the lead institution or organization, and a list of co-PIs and Senior Personnel along with their institutions and organization or both; (2) a succinct summary of the intellectual merit of the proposed project. This should include the transformative nature of the proposed research, and the significant leap or a paradigm shift in fundamental engineering knowledge; and (3) the broader impacts of the proposed work, including the potential long-term impact on national needs and a grand challenge or both. Proposals that do not separately address in the project summary both intellectual merit and broader impacts will be returned without review.

Project Description (maximum 15 pages) must include the following subsections.

1. **Results from Prior Research:** Describe prior research of PI or co-PIs funded by NSF that is directly relevant to the proposed project.
2. **Proposed Research:** Describe the vision and goals of the proposed research, approaches and methodologies to attain the goals, and the expected outcomes. Project Description should end with a subsection labeled **Impact** that describes how the proposed project will lead to significant shift in fundamental engineering knowledge and have strong long term potential for significant impact on a national need or a grand challenge. Concisely articulate unifying and integrative aspects of the proposed research as well as the innovative ideas of the research.

References Cited. Indicate with an asterisk any cited publications that resulted from prior research funded by NSF for the PI, or co-PI(s).

Biographical sketches for key personnel (PI, co-PIs, and each of the senior personnel listed on the Project Summary page). Use the standard format.

Current and Pending support information must be provided for the PI and each of the co-PIs and Senior Personnel listed in the Project Summary page.

Budget. Develop a realistic project budget that is consistent with the proposed activities. Provide detailed budget justifications separately for the lead institution's budget (up to 3 pages of budget justification), and for each subawardee budget (up to 3 pages of budget justification for each subaward). Proposed budgets must include funds for travel by the PI and one researcher or a student to attend an annual EFRI grantees' meeting.

Facilities and Equipment: Provide a description of available facilities and priorities for its use. For EFRI projects requiring additional equipment, justify the need for these resources in the context of the innovative work proposed.

In the Special Information and Supplementary Documentation section, include the following:

1. List of key personnel involved (maximum three pages), with description of what each person uniquely brings to the project and how they are integrated to produce positive synergies;
2. Provide a detailed management plan (maximum three pages) including means of communication and data tracking or management within the group, management of intellectual property resulting from the project, and timeline of activities;
3. Proposals that would generate significant digital data for preservation must include a data management plan (maximum one page). The contents of the data management plan should include: (1) the types of data to be produced, (2) the standards that would be applied for data format and metadata content, and (3) access policies and provision.

4. Means of sharing the outcome of the research with the rest of the scientific community, e.g. publications, web sites, and significant data bases, etc. (maximum two pages). The description should be specific and describe what, how, and when the community would have access to the outcome of the project. This is particularly important for the projects that will produce tangible research tools and resources;
5. A list, in a single alphabetized table, with the full names and institutional affiliations of all people with conflicts of interest for all senior personnel (PI and co-PI's) and any named personnel whose salary is requested in the project budget. Conflicts to be identified are (1) PhD thesis advisors or advisees, (2) collaborators or co-authors, including postdocs, for the past 48 months, and (3) any other individuals or institutions with which the investigator has financial ties (please specify type).

In addition, proposers must send the following two documents via email immediately after submission of their proposal. After receipt of the NSF proposal number, send an email to efri2007@nsf.gov. The subject heading of the email should note the proposal number and the lead institution. Attach an Excel spreadsheet (use template available at <http://www.nsf.gov/eng/efri>) containing two lists: one lists the last names, first names and institutional affiliations of all senior personnel (PI and co-PI's) and any named personnel whose salary is requested in the project budget; the second one lists the full names and institutional affiliations of all people having conflicts of interest with any senior personnel (PI and co-PI's) or named personnel whose salary is requested in the project budget. These lists will be used by NSF to check for conflicts of interest in assembling the review community. Remember to email this document; do not use FastLane or Grants.gov.

B. Budgetary Information

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

C. Due Dates

- **Letter of Intent Due Date(s) (optional):**

October 16, 2006

- **Preliminary Proposal Due Date(s) (required):**

November 17, 2006

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

April 30, 2007

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:

1. Autonomously Reconfigurable Engineered Systems enabled by Cyberinfrastructure (ARES-CI)

In addition to the two NSF review criteria (intellectual merit and broader impact), the following criteria will be used in the review of ARES-CI proposals:

Responsiveness to all of the three ARES-CI areas listed in the program description (Theoretical and Algorithmic Foundations, Methods for Analysis and Synthesis, and Reconfigurable System Test-beds);

Potential of transforming fundamental knowledge and research approaches in the area of reconfigurable systems;

Multidisciplinary team integrating engineered systems, algorithmic and computational domains; and

Effectiveness of the proposed management plan.

2. Cellular and Biomolecular Engineering (CBE)

In addition to the two review criteria (intellectual merit and broader impacts), the following criteria will be used for review of the CBE proposals:

Responsiveness to one of the two themes of the CBE program listed in the program description;

Potential for transforming fundamental knowledge and research approaches by bringing engineering methodologies to bear on the study of cells, biomolecules, and interfaces;

Integration of experimental and modeling research;

Interdisciplinary team integrating knowledge from appropriate disciplines to address its goals; and

Effectiveness of the team's management plan.

B. Review and Selection Process

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

Special Award Conditions: Awardees must include in the proposal budget funds for travel by PI and one researcher or a student to attend an annual EFRI grantees' meeting.

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.

Awardees will be required to attend and present their research results and plans annually at an annual EFRI grantees' conference for the duration for their award.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Sohi Rastegar, Contact for general questions about the EFRI Office and administration of this solicitation, telephone: (703) 292-5379, email: srastega@nsf.gov
- TOPIC 1, AUTONOMOUSLY RECONFIGURABLE ENGINEERED SYSTEMS ENABLED BY CYBERINFRASTRUCTURE (ARES-CI), telephone: (703)292-7061, email: adeshmuk@nsf.gov
- Abhijit Deshmukh, Program Director, Division of Design and Manufacturing Innovation, Directorate for Engineering, 550 S, telephone: (703) 292-7061, email: adeshmuk@nsf.gov
- Mario Rotea, Program Director, Division of Civil and Mechanical Systems, Directorate for Engineering, 545 N, telephone: (703) 292-8360, email: mrotea@nsf.gov
- Maria Burka, Program Director, Division of Chemical and Transport Systems, Directorate for Engineering, 525 N, telephone: (703) 292-7030, email: mburka@nsf.gov
- Bruce Hamilton, Program Director, Division for Bioengineering and Environmental Systems, Directorate for Engineering, 565 S, telephone: (703) 292-8320, email: bhamilto@nsf.gov
- Usha Varshney, Division Director, Division of Electrical and Communications Systems, Directorate for Engineering, 675 N, telephone: (703) 292-8339, email: uvarshne@nsf.gov
- TOPIC 2, CELLULAR AND BIOMOLECULAR ENGINEERING (CBE), telephone: (703)292-7020, email: jhsia@nsf.gov
- Jimmy Hsia, Program Director, Division of Civil and Mechanical Systems, Directorate for Engineering, 545 S, telephone: (703) 292-7020, fax: (703)292-9053, email: jhsia@nsf.gov
- Lenore Clesceri, Program Director, Division of Bioengineering and Environmental Systems, Directorate for Engineering, 565 S, telephone: (703) 292-5313, fax: (703)292-9098, email: lclescer@nsf.gov
- Frederick Heineken, Program Director, Division of Bioengineering and Environmental Systems, Directorate for Engineering, 565 S, telephone: (703) 292-7944, fax: (703)292-9098, email: fheineke@nsf.gov
- Lynn Preston, Deputy Division Director, Division of Engineering Education & Centers, Directorate for Engineering, 585 N, telephone: (703) 292-5358, fax: (703)292-9051, email: lpreston@nsf.gov
- Robert Wellek, Deputy Division Director, Division of Chemical and Transport Systems, Directorate for Engineering, 525 N, telephone: (703) 292-8370, fax: (703)292-9054, email: rwellek@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, 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** (NSF Information Center): (703) 292-5111

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

- **To Order Publications or Forms:**

Send an e-mail to: pubs@nsf.gov
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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