EMERGING FRONTIERS IN RESEARCH AND INNOVATION 2008 (EFRI-2008)

Program Solicitation

NSF 07-579

Replaces Document(s):

NSF 06-596

National Science Foundation

Directorate for Engineering
Emerging Frontiers in Research and Innovation

Letter of Intent Due Date(s) ***(required):***

September 25, 2007

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

October 26, 2007

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

April 30, 2008

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. Cognitive Optimization and Prediction: From Neural Systems to Neurotechnology (COPN)

2. Resilient and Sustainable Infrastructures (RESIN)

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) Cognitive Optimization and Prediction: From Neural Systems to Neurotechnology (COPN), and (2) Resilient and Sustainable Infrastructures (RESIN). EFRI seeks proposals with transformative ideas that represent an opportunity for a significant shift in fundamental engineering knowledge with a strong potential for long term impact on national needs or a grand challenge. The proposals must also meet the detailed requirements delineated in this solicitation.

INFORMATION WEBCAST: The EFRI Office plans to hold an information workshop on September 5, 2007, to answer any questions about the EFRI Office and this solicitation. Details will be posted on the EFRI website (www.nsf.gov/eng/efri) as they become available.

Cognizant Program Officer(s):

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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 2008, pending the availability of funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Academic Institutions located in the U.S.: U.S. universities and colleges located in the U.S.

PI Limit:

Principal Investigators (PI) 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 required. 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 Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf/)

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

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

  September 25, 2007

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

  October 26, 2007

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

  April 30, 2008

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 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) Cognitive Optimization and Prediction: From Neural Systems to Neurotechnology (COPN) and (2) Resilient and Sustainable Infrastructures (RESIN). 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.

Cognitive Optimization and Prediction: From Neural Systems to Neurotechnology (COPN) - This EFRI topic provides partnership opportunities for engineers and neuroscientists to address two goals.The first goal is to understand how massively parallel circuits in brains address complex tasks in adaptive optimal decision-making and prediction, and to understand the system identification circuits in the brain which help make it possible. The second goal is to use this understanding to develop new general-purpose designs or algorithms for optimal decision-making over time, or prediction, or both, powerful enough to work existing benchmark challenges in simulation or in physical testbeds taken from engineering. This EFRI topic does not include all aspects of cognitive science or cognitive engineering. The focus is on subsymbolic intelligence, because it is a difficult and important prerequisite to a deeper understanding of human intelligence. Engineers have unique qualifications to address optimal decision-making and prediction over time under uncertainty. A grand challenge is to develop new concepts of anticipatory optimization that can cope with spatial complexity in time and nonconvexity as required to improve probability of survival in nonlinear, stochastic environments. Transformative benefits expected are: (1) to put science firmly on the path to a truly functional, unified mathematical and systems understanding of intelligence in the brain – an objective as important as the search for unified models in physics; (2) new designs for optimal decision-making

which can handle complexity beyond the capacity of today's methods, as required for truly optimal rational management of complex engineered systems; (3) improved performance in specified simulation testbeds; and (4) development of new and more general ways to harness the potential power of massively parallel "supercomputers on a chip."

Resilient and Sustainable Infrastructures (RESIN) - Infrastructures, such as drinking water and wastewater treatment systems; energy generation, transmission, and distribution; chemical production and distribution; communications; transportation; agriculture and food; and public health networks, are critical to our nation's welfare, security, and ability to compete in a global economy. Over the past century, these critical "backbone" infrastructures have evolved into highly coupled and interacting, or interdependent, networks and systems - through complex physical, natural resource, cyber, information, geographic, human, social, and logical connections. Design, construction, and operation of these interdependent infrastructures in the twenty-first century are major national challenges. Many infrastructures are legacy systems facing degradation and coping with integrating new technologies. Recent catastrophic events and their associated costs for response and recovery have highlighted the vulnerability of interdependent infrastructures to natural and technological disasters; they must be re-engineered to be more resilient. These systems consume a significant portion of the nation's nonrenewable energy and materials and natural resources and, hence, are not sustainable over the long term. Therefore, the research frontier for the RESIN topic is complex and multidisciplinary. Research is needed to expand the theoretical frameworks for understanding, modeling, and simulating interdependent infrastructure systems at multiple time scales, i.e., under short-term disturbances and over the longer term. Research is also needed to advance the fundamental engineering science that will enable interdependent infrastructures to be both resilient and sustainable. Researchers should take an integrative approach to address interdependent infrastructure modeling and engineering science for resiliency and sustainability in the context of specific interdependent critical infrastructures. The overall goal of this topic area is to transform the nation's capacity to build, renew, expand, monitor, and control critical interdependent infrastructures to be both resilient and sustainable.

II. PROGRAM DESCRIPTION

1. **Cognitive Optimization and Prediction: From Neural Systems to Neurotechnology (COPN)**

   Vertebrate brains, from fish to the smallest rodents, show an amazing ability to learn how to maximize probability of survival under all kinds of diverse, complex and unexpected circumstances. The first goal of this topic is to mobilize systems engineers (as defined below) to lead partnerships which help us understand how massively parallel circuits in vertebrate brains can learn to address such complex tasks through adaptive optimal decision-making, and through the prediction or system identification circuits in the brain which help make it possible. The goal is to achieve the kind of understanding which can be represented as new general-purpose designs or algorithms for optimal decision-making over time, or prediction, or both, powerful enough to work on existing benchmark challenges or testbeds taken from engineering. Prediction in the brain includes and unifies capabilities such as pattern recognition, state estimation and memory.

   This topic does not include all aspects of cognitive science or cognitive engineering. For example, it does not address how mirror neurons, empathy and symbolic reasoning give human brains additional hard-wired capabilities beyond the part which we inherit from the mouse. It does not address phenomena like social or collective intelligence. This topic focuses on subsymbolic intelligence and learning, because it is a difficult and important prerequisite to a deeper understanding of human intelligence, and because engineers have unique qualifications to address optimal decision-making and prediction over time under uncertainty. Many engineers have focused on a narrow, deterministic or even linear concept of optimization, which cannot address challenges like maximizing a probability of survival in a nonlinear environment, where it is impossible to prove a theorem that survival can be guaranteed. The second goal of this topic is to stimulate and enlarge the important emerging communities of engineers who work on truly stochastic optimization and prediction, who use quality of service concepts to translate reliability issues into an optimization problem, and who are finding ways to use new massively parallel chips with teraflops on a chip.

   This topic will fund new crossdisciplinary teams, led by systems engineers, to reverse-engineer the brain s general-purpose domain-independent ability to converge towards optimal decisions when confronted with spatial complexity, temporal complexity, or challenges which require a high degree of creativity (*nonconvex* optimization). All teams ***must*** include at least three types of expertise, led by a systems engineer: (1) systems engineering, such as control theory, artificial neural networks, signal processing, nonlinear dynamical systems or operations research, with capabilities in stochastic optimization tasks requiring foresight; (2) relevant neuroscience, such as cognitive systems, computational neuroscience, or behavioral neuroscience; (3) device or systems technology for studying the brain or systems of neurons (e.g., novel neural recording technology, technology for probing systems of neurons on a chip or intracellular sensing) or massively parallel neuromorphic chips like Cellular Neural Network (CNN) chips.

All proposals ***must*** have the potential to make significant contribution in both of two areas:

A. **Progress towards understanding of learning in the vertebrate brain.**

The long-term goal is to move closer to a truly functional, unified mathematical and systems understanding of learning in the brain a transformation as important in its way as the Newtonian revolution was to physics. Proposals will not be expected to accomplish this revolution in four years, but will be judged by how much they really bring us closer to it. Thus all proposals ***must*** address empirical data from neuroscience areas, and include co-PIs who have participated in projects collecting such data.

Proposals need not include the development of new devices for recording from neural systems. If they do, however, they will be judged on the basis of the new knowledge which may result from using these devices as part of the project; device development for its own sake will not be funded. No projects will be funded which include development or use of neural implants to stimulate living whole brains.

B. **Progress towards handling spatial or temporal complexity in technology, or replicating brain-like creativity.**

The long-term goal is to develop general-purpose engineering designs capable of learning to perform optimization or prediction, using massively parallel computing hardware, in the face of complexity, nonconvexity and nonlinearity so severe that absolute guarantees of stability are impossible. Projects will be judged on the basis of whether they effectively address the challenge of getting us to that goal as soon as possible. Thus all projects must include the use of a difficult benchmark challenge for technology. This could be a challenge in simulation or in real hardware, but the benchmarking and the level of difficulty are what really test the relevance of technology. Even such testbeds as the game of Go would be acceptable, so long as the models to be tested are both general and linked to biological testing.

There are many new and emerging opportunities to bring engineering and neuroscience together in the bold way that is called for by this topic; here are just a few examples:

- Reverse-engineering the circuits which learn to predict in the thalamo-cortical systems. This would build on work on the barrel system of rats, for which it has been shown that certain thalamic cells predict other cells and relearn to predict when the initial circuit is disrupted. Millisecond-level multielectrode data might show waves of information during calculation and adaptation similar to those in artificial nonlinear estimation systems, drawing on systems concepts such as time-lagged recurrent networks, extended Kalman filtering, real-time least squares and seasonal adjustment, and gating based on encoder/decoder designs. (Seasonal adjustment addresses the presence of multiple lags, such as 100 millisecond delays induced by the alpha rhythm pacemaker cells, and local codes based on the strengths of bursts at discrete time intervals.)

- Reverse-engineering cultures/circuits of multiple types of neurons on a chip, where two-way chemical and electrical stimulation and real-time imaging or sending is possible. A key question is how to persuade such cultures to learn to address a menu of optimization or prediction tasks provided by an engineer. Controlled experiments in this venue may allow rapid progress in understanding the capabilities of various types of neurons. Progress in replicating capabilities similar to those of an entire brain may help us understand what kinds of cells, conditions and connections are necessary to achieve (and enhance) such capabilities.

- Development of a new system which uses new biologically-grounded models of learning to train a CNN chip to learn the non-Euclidean image transformations essential to improved performance on face-recognition tasks. Research on biological face recognition by humans, other mammals or birds could play a crucial role here, and help elucidate the role of symmetry properties and attention to objects in coping with spatial complexity.

- Understanding how phenomena like chemically-encoded *memory* can *interact* with

larger-scale prediction circuits, in order to make the multilevel system perform so well in difficult prediction tasks. Just as the equations of the Kalman filter are a *general-purpose* system for estimation and prediction of linear, stochastic systems, the cerebro-thalamic system appears to include a general-purpose ability to learn to predict the entire input vector of sensory information registered in the thalamus, the movie screen of the upper brain."

Please pay special attention to the additional review criteria in Section VI.A.

2. **Resilient and Sustainable Infrastructures (RESIN)**

Critical infrastructures enable the reliable flow of products and services essential to the welfare, defense, and economic security of the United States, the smooth functioning of governments at all levels, and society as a whole. These backbone infrastructure systems have evolved over the past century through both public and private investments and are now technologically aging and degrading. They are vulnerable to disasters and rely on patterns of resource use that threaten the earth s natural systems. The magnitude of technological and societal innovations and financial investments needed in the twenty-first century to renew these infrastructures and build new infrastructures is staggering. These infrastructures have evolved to function as highly interdependent networks and systems comprising identifiable components/assets, institutions (including people, processes, and procedures), and distribution capabilities. These interdependencies, both intentional and unintentional, have led to unanticipated fragility and failure modes that are not exhibited by each infrastructure in isolation. They also create opportunities for mutually reinforcing robust performance and synergies in design. The frameworks for modeling how these interdependencies occur, propagate, and should influence system design and performance are not yet established.

Incremental advances in engineering knowledge and technology will not meet the challenges for resilient and sustainable infrastructure design, construction, and operation. The EFRI Resilient and Sustainable Infrastructures (RESIN) topic requires bold and visionary research. The research challenge to be addressed through the RESIN topic is to develop underpinning scientific and engineering systems-level bases for new knowledge and technologies that will enable innovations for twenty-first century interdependent infrastructures in the United States to be both resilient ***and*** sustainable. Resilient infrastructures recover rapidly from natural or technological performance disturbances. Sustainable infrastructures enable the longer term persistence of function through the use of renewable energy and materials and preservation and renewal of natural capital**.** Responding to the National Science Foundation s Investing in America s Future, Strategic Plan FY 2006-2011, the RESIN topic seeks transformational, multidisciplinary research that has the potential to produce economically important technologies, processes, and techniques for interdependent critical infrastructures that improve the nation's ability to live both resiliently and sustainably on earth. The vision for the RESIN topic is to provide the catalyst for research that could define a new multidisciplinary engineering field for interdependent resilient and sustainable infrastructures. This new engineering field might be comparable to the relatively new fields of bioengineering and nanotechnology in establishing its foundation from the integration of many scientific and engineering domains.

The RESIN research challenge is complex because innovations require advances in understanding and engineering three system features: interdependency, resiliency, and sustainability. Because of the disciplinary approach to most research, much of the current understanding of the topics embodied in RESIN is fragmented, and traditionally research has focused on either resiliency, or sustainability, or a single infrastructure. However, addressing resiliency in the absence of sustainability, or vice versa, or resiliency and sustainability for only single infrastructure would not be a RESIN topic. Adding to this complexity are a number of external factors: the magnitude of expenditures associated with provisioning and operating critical infrastructures; the large number of public and private owners; the extensive network of existing infrastructures; the national dependency on natural resources both domestically and abroad; the costs and complexity associated with addressing resiliency for many different types of hazards; current societal norms; existing public policy; the lack of fundamental knowledge of how interdependent infrastructures function; and the lack of economically viable technological and societal solutions for the path forward in the twenty-first century.

The RESIN topic seeks research that will establish a new engineering field enabling interdependent infrastructures to be both resilient and sustainable by addressing multi-infrastructure, multi-physics, multi-scale (spatial, temporal), and multi-resource phenomena. Examples of needed scientific bases include, but are not limited to: (1) fundamental principles to characterize and quantify both resiliency and sustainability across many sets of interdependent infrastructures; (2) methodologies to analyze and forecast how infrastructures grow, interact, renew, and ultimately function as interdependent resilient and sustainable systems; (3) theoretical foundations for how interdependencies among infrastructures either provide or detract from both resiliency and sustainability; and (4) performance metrics for interdependency

vulnerabilities for shorter term, disruptive events and longer term sustainability. Examples of other research challenges include, but again are not limited to: (1) risk analysis and life cycle frameworks that will enable communities and infrastructure providers in the public and private sectors to assess and compare the resiliency and sustainability of different interdependent infrastructure technology alternatives; (2) cyber-enabled simulation technologies for nonlinear dynamic networks that predict and control changes in demands across multiple interdependent infrastructures and time scales, with the ability to handle the volume of data needed to model interdependent infrastructure systems to a reasonable degree of fidelity; (3) engineered solutions that contain, mitigate, and defend against interdependency-related interruptions over multiple time-scales, such as cascading, escalating, latent, cross-infrastructure, and supply chain failures; and (4) sustainable technologies for the design, analysis, and construction of resilient physical infrastructure networks that can be deconstructed and reconfigured or recycled without generating waste and that require orders of magnitude less nonrenewable resources for their function.

Required RESIN Proposal Elements: To advance the RESIN frontier, proposals must explicitly address all of the following six elements:

- Identify the critical infrastructures to be investigated; these must include at least two separate infrastructures other than the banking and finance infrastructure;
- Identify the specific types of interdependencies among those selected infrastructures that will be investigated;
- Address compelling resiliency and sustainability goals for the selected infrastructures;
- Identify metrics (existing, new, or both) for both resiliency and sustainability for the selected infrastructures;
- Identify the data sets that will be used or generated for any modeling and model validation; and
- Engage in basic research that integrates engineering advances with advances in other scientific disciplines for developing new knowledge or innovative technologies to meet the goals of both resiliency and sustainability for the selected infrastructures.

The RESIN topic also encourages consideration of the following:

- Proposed technological breakthrough integration with existing infrastructures. If a new technology is proposed to change an interdependency, e.g., such as introducing a new technology into legacy infrastructures, then the proposal must address either how the new technology will cause the selected infrastructures to have more benign interactions (with an explicit metric for measuring improvement) or how this could decouple the selected infrastructures.
- Interaction with natural systems that provide goods and services in the form of resource formation and consumption, regulation and buffering, and cycling. The preservation and expansion of natural capital should be an explicit part of the proposal. Natural systems should be considered as an additional component and may not be counted as one of the two selected infrastructures. Measuring impacts on natural systems for sustainability metrics is different from the consideration of natural goods and services.
- Deployment of *de novo* infrastructures, if they address a need for which a current infrastructure does not exist. The deployment issues will be of secondary consideration compared to the objectives of resiliency and sustainability that must be addressed in all proposals.
- Generalization of models developed as part of the research for one set of interdependent infrastructures to other types of infrastructures or interdependencies.

Proposals will be judged on the relevance of the engineering disciplines to the advances and interdependencies of the infrastructures chosen for study. The rapid convergence of certain infrastructures, such as voice and data communication, makes the study of these currently separate infrastructures, as interdependent systems, less innovative and not competitive as a RESIN proposal. Issues of security of infrastructures are of marginal interest to this solicitation. Addressing resiliency and sustainability inherently and integrally must draw upon advances from the social, behavioral, and economic sciences. The quality of and advances in social, behavioral, and economic sciences research will be used as part of the proposal

evaluation. The integration of different disciplinary knowledge, methodologies, and technology must be described as part of the synthesis of the multidisciplinary approach to the RESIN topic, and the quality of overall integration will be evaluated.

The nation s diverse critical infrastructures must be engineered to embed the goals of both resiliency and sustainability in their design and operation. The transformative research supported by the RESIN topic will establish scientific and technological foundations for infrastructures that use synergies between them to improve the quality of services provided at all times without degrading the earth s natural systems.

Please pay special attention to the additional review criteria at the end of Section VI.A.

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 2008 pending the availability of funds. Anticipated Funding Level: It is anticipated that 11 or more standard grants will be made in FY 2008. 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:

- Academic Institutions located in the U.S.: U.S. universities and colleges located in the U.S.

PI Limit:

Principal Investigators (PI) 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*(required):*

A one-page Letter of Intent is required. Letters of Intent are not reviewed but are used to judge the overall response and requirements for reviewers. 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-COPN” or “EFRI-RESIN” 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 (GOALS) - Brief description of the specific goals 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 2008, 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, as appropriate, with **EFRI-COPN Preliminary Proposal:** or **EFRI-RESIN Preliminary Proposal:**. 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 and a list of co-PIs and senior personnel along with their institutions; (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 Goals -** Describe the vision and specific goals 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 synergy of experts from different disciplines in the proposed research will achieve a significant advancement 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 two-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) Ph.D 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 efri2008@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, as appropriate, with **EFRI-COPN:** or **EFRI-RESIN:**. 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, if applicable. 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) Ph.D. 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, the proposers **must send the following two documents via email immediately after submission of their proposal**. After receipt of the proposal number from FastLane or Grants.gov, send an email to efri2008@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 to efri2008@nsf.gov; do not use FastLane or Grants.gov. Please submit these documents even if the information has not changed since submission of the preproposal.

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)** ***(required):***

  September 25, 2007

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

  October 26, 2007

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

  April 30, 2008

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

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

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

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation

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

A. NSF Merit Review Criteria

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

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

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

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

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

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

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

Additional Review Criteria:

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

  TRANSFORMATIVE - Does the proposed research represent an opportunity for a significant leap or paradigm shift in fundamental engineering knowledge?

  NATIONAL NEED/GRAND CHALLENGE - Is there potential for making significant progress on a current national need or grand challenge?

- **The following additional criteria will be used in the review of COPN proposals:**

- Progress towards understanding of learning in the vertebrate brain, as discussed in the project description.
- Progress towards handling spatial or temporal complexity, or replicating brain-like creativity, in technology, as discussed in the project description.
- Compliance with the requirement for cross-disciplinary teams, the requirement for addressing a challenging engineering testbed and other necessary requirements in the project description.
- Effectiveness of the proposed plan for management and integration.

- **The following additional criteria will be used in the review of RESIN proposals:**

  - Responsiveness of the proposal to address the Required RESIN Proposal Elements listed in the program description.
  - Degree to which the vision for interdependent resilient and sustainable infrastructures is compelling, cohesive, and important for the nation.
  - Relevance of the engineering disciplines to the advances and interdependencies of the infrastructures selected for study.
  - Potential of the research and its outcomes to contribute to a new multidisciplinary engineering field (incorporating aspects of social, behavioral, and economic sciences) for interdependent resilient and sustainable infrastructures.
  - Effectiveness of the team s management plan.

B. Review and Selection Process

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

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

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

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

In developing its recommendations for awards, review panels as well as NSF staff will consider: the relative merit of the EFRI proposals using the criteria listed above, the potential national impact of the proposed activity, the balance of awards among scientific fields, geographical distribution, and the combined ability of the proposals to meet the objectives of the EFRI Office. The EFRI Office will not normally award more than one proposal from any one lead institution in this competition.

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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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, Director, Office of Emerging Frontiers in Research and Innovation (EFRI), 505, telephone: (703) 292-5379, email: srastega@nsf.gov
- TOPIC 1, COGNITIVE OPTIMIZATION & PREDICTION, telephone: (703) 292-8339, email: pwerbos@nsf.gov
- Paul Werbos, Program Director, Power, Controls and Adaptive Networks (PCAN), Division of Electrical, Communications and Cyber Systems, 675S, telephone: (703)292-8339, fax: (703) 292-9146, email: pwerbos@nsf.gov

- Semahat Demir, Program Director, Biomedical Engineering, Division of Chemical, Bioengineering, Environmental & Transport Systems, telephone: (703) 292-7950, email: sdemir@nsf.gov
- Eduardo Misawa, Program Director, Dynamical Systems, Division of Civil, Mechanical & Manufacturing Innovation, 545S, telephone: (703) 292-5353, fax: (703) 292-9053, email: emisawa@nsf.gov
- Frederick Heineken, Program Director, Biotechnology, Division of Chemical, Bioengineering, Environmental, and Transport Systems, 565S, telephone: (703) 292-7944, fax: (703)292-9098, email: fheineke@nsf.gov
- Kenneth Whang, Program Director, Collaborative Research in Computational Neuroscience, Division of Information and Intelligent Systems, 1125S, telephone: (703) 292-5149, email: kwhang@nsf.gov
- Scott Midkiff, Program Director, Integrative, Hybrid and Complex Systems, Division of Electrical, Communications, and Cyber Systems, 675S, telephone: (703) 292-8339, fax: (703) 292-9146, email: smidkiff@nsf.gov
- Stephen Nash, Program Director, Operations Research, Division of Civil, Mechanical, Manufacturing and Innovation, 545S, telephone: (703) 292-7902, fax: (703) 292-9056, email: snash@nsf.gov
- TOPIC 2, RESILIENT & SUSTAINABLE INFRASTRUCT., telephone: (703)292-7024, email: jpauschk@nsf.gov
- Joy Pauschke, Program Director, George E. Brown, Jr. Network for Earthquake Engineering Simulation, Division of Civil, Mechanical & Manufacturing Innovation, telephone: (703) 292-7024, email: jpauschk@nsf.gov
- Richard Fragaszy, Program Director, GeoEnvironmental Engineering and GeoHazards Mitigation Program, Division of Civil, Mechanical & Manufacturing Innovation, telephone: (703) 292-7011, email: rfragasz@nsf.gov
- Bruce Hamilton, Program Director, Environmental Sustainability, Division of Chemical, Bioengineering, Environmental, & Transport Systems, telephone: (703) 292-8320, email: bhamilto@nsf.gov
- Barbara Kenny, Program Director, Engineering Research Centers, Division of Engineering Education and Centers, 585N, telephone: (703) 292-4667, fax: (703) 292-9051, email: bkenny@nsf.gov
- Dagmar Niebur, Program Director, Power, Controls and Adaptive Networks (PCAN), Division of Electrical, Communications and Cyber Systems, telephone: (703) 292-8339, email: dniebur@nsf.gov
- William Schultz, Program Director, Fluid Dynamics, Division of Chemical, Bioengineering, Environmental & Transport Systems, telephone: (703) 292-8371, email: wschultz@nsf.gov
- Dennis Wenger, Program Director, Infrastructure Management and Hazard Response, Division of Civil, Mechanical & Manufacturing Innovation, telephone: 703-292-8360, email: dwenger@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.
- Johnetta Lee, Program Specialist, telephone: (703) 292-8300, email: jlee@nsf.gov
- Shirah Pope, Executive Assistant, telephone: (703) 292-8300, email: spope@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