EMERGING FRONTIERS IN RESEARCH AND INNOVATION 2011 (EFRI-2011)

1. Engineering New Technologies Based on Multicellular and Inter-kingdom Signaling (MIKS)

2. Mind, Machines, and Motor Control (M3C)

PROGRAM SOLICITATION
NSF 10-596

REPLACES DOCUMENT(S):
NSF 09-606

National Science Foundation

Directorate for Engineering
Emerging Frontiers in Research and Innovation

Directorate for Computer & Information Science & Engineering
Division of Information & Intelligent Systems

Directorate for Biological Sciences
Division of Molecular and Cellular Biosciences

Letter of Intent Due Date(s) *(required)* (due by 5 p.m. proposer's local time):

October 04, 2010

Preliminary Proposal Due Date(s) *(required)* (due by 5 p.m. proposer's local time):

November 08, 2010

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

April 01, 2011

IMPORTANT INFORMATION AND REVISION NOTES

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

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

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

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Emerging Frontiers in Research and Innovation (EFRI)
1. Engineering New Technologies Based on Multicellular and Inter-kingdom Signaling (MIKS)
2. Mind, Machines, and Motor Control (M3C)

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) Engineering New Technologies Based on Multicellular and Inter-kingdom Signaling (MIKS), and (2) Mind, Machines, and Motor Control (M3C). This solicitation will be coordinated with NSF Directorates listed above. 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 16, 2010, 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
- 47.070 --- Computer and Information Science and Engineering
- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 14 (4-year awards)

Anticipated Funding Amount: $31,000,000 in FY 2011, 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 which perform research and with degree-granting education programs in disciplines normally supported by NSF are eligible to be the lead organization. Academic institutions are defined as universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the United States, acting on behalf of their faculty members. Principal investigators are encouraged to form synergistic collaborations with government laboratories, industrial researchers, and scientists and engineers at foreign organizations where appropriate, though no NSF funds will be provided to government labs, industry, or foreign organizations. For interaction with industry, when appropriate for the proposed research, the GOALI mechanism (Grant Opportunities for Academic Liaison with Industry http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf10580) may be used.

PI Limit:

Principal Investigators (PI) must be at the faculty level as determined by the submitting organization. A minimum of one PI and two co-PIs must participate.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

The principal investigator and co-principal investigators may participate in only one proposal submitted to this solicitation. It is the responsibility of the submitting institution to ensure that the PI and all co-PIs are participating in only one proposal submitted 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: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time):

  October 04, 2010

- **Preliminary Proposal Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time):

  November 08, 2010

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

  April 01, 2011

Proposal Review Information Criteria

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

Award Administration Information

Award Conditions: 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 Office of Emerging Frontiers in Research and Innovation (EFRI) provides funding opportunities for interdisciplinary teams of researchers to embark on rapidly advancing frontiers of fundamental engineering research. EFRI seeks proposals with potentially 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. For this solicitation, EFRI will consider proposals that aim to investigate emerging frontiers in the following two specific research areas: (1) Engineering New Technologies Based on Multicellular and Inter-kingdom Signaling (MIKS), and (2) Mind, Machines, and Motor Control (M3C). The proposals must meet the detailed requirements delineated in this solicitation.

1) Engineering New Technologies Based on Multicellular and Inter-kingdom Signaling (MIKS)

The importance and complexity of multicellular signaling, either between populations of the same species of organism or between species or kingdoms in driving the behavior and/or phenotype of these systems is becoming increasingly evident. For example, quorum sensing within bacterial communities can lead to epigenetic changes in the bacteria resulting in changes in growth patterns (from planktonic to biofilm) or virulence of the entire population. Signaling within multicellular organisms is responsible for the coordination of development, maintaining homeostasis, and responding to environmental stimuli. Between species or kingdoms, signaling behavior is often associated with host/pathogen interactions, symbiosis, and community behavior.

Advances in microfabrication technologies, synthetic biology, protein engineering, mass spectrometry-driven omics and optical sensing now provide new opportunities to probe the complexities of molecular interactions associated with multicellular and inter-kingdom signaling in unprecedented ways. Improved understanding of signaling, along with technologies created to detect, drive, or modulate signaling could lead the way to the development of novel engineered systems that address a number of national needs in the areas of human health, the environment, and energy. MIKS provides an opportunity for partnerships among engineers, biologists, mathematical and physical scientists, and computer scientists to address the key elements of the fundamental research needed to understand and control signaling processes in complex multicellular and multi-kingdom systems. It is expected that research proposals submitted to this solicitation will contribute to the understanding of biological signaling systems, development of a rigorous engineering framework for the design and realization of topically-relevant engineered systems, and provide an intellectual framework for education in this emerging area.

2) Mind, Machines, and Motor Control (M3C)

The central theme of M3C is to establish experimentally verified, quantitative, mathematical theories of human sensory-motor control that can serve as predictive models for the design of machines for forceful physical interaction and cooperation with humans, and that consider the coupling with mental (perceptual and cognitive) factors. M3C would contribute to novel tools for the design and control of these machines both at the hardware and software levels. In addition, understanding the role of the mind in forceful physical interaction could translate into novel computer architectures, operating systems, algorithms, and associated hardware and software platforms.

The key barrier is how little is understood about the way humans control their own bodies, and how much less about how they manipulate even the simplest objects or tools. Most studies of human-machine systems have tacitly assumed that the human plays the role of an information processor that relies on an input-output model of the manipulated object in order to control it. This paradigm often neglects the functional requirements of the interplay between physical interactions and mental states that occur between the human and the machine: while some interactions involve signal-based information feedback, others are energy based, requiring significant exchange of power. A fundamental theory of coupled physical/mental sensory motor control will transform the engineering of machines that work in physical contact with people, and help develop new and transformative knowledge in cognition, perception, and neuroscience that may help reverse engineer the brain - a grand challenge. These two developments will catalyze each other: machines that interact intimately with people will provide new context-based knowledge to improve neuroscience; and better predictive mathematical models of human sensory-motor performance will accelerate the development of superior machines.

II. PROGRAM DESCRIPTION

1) Engineering New Technologies Based on Multicellular and Inter-kingdom Signaling (MIKS)

Historically, multicellular signaling has been studied by applying a step change, such as by introducing a signaling molecule, and then measuring the system output. However, multicellular signaling networks are highly non-linear systems, and only by understanding and designing dynamic or orthogonal inputs can the true behavior of the systems be elucidated. The MIKS program seeks multidisciplinary approaches to examine and engineer new systems based on multicellular signaling in which a paradigm shift in the way signaling is studied is employed. For example, using molecular tools such as synthetic biology to manipulate signaling systems represents a transformational change in the way multicellular and inter-kingdom signaling has been studied. Other paradigm changing means of driving or controlling signaling are sought, including novel approaches to examine system output that results in the alteration of the behavior, epigenetic control, and/or phenotype of organisms for the benefit of health, food production, environment, or energy production.

MIKS proposals should stimulate new discoveries concerning the molecular basis of multicellular signaling, both within a single species and across kingdoms. In addition, research in this area should advance the development of novel technologies and multicellular engineered systems.

Advances in the understanding of multicellular and inter-kingdom signaling has the potential to effect numerous fields including developmental biology, ecology, food safety, infectious disease, environmental engineering, biotechnology, and bioengineering. Technologies developed because of advances in these areas could reduce incidence of foodborne illnesses, provide new treatments for antibiotic resistant organisms, or speed advances in tissue engineering. Technologies could also impact the areas of plant health, bioremediation and biorefining. In addition, there is a significant potential benefit from the development of the enabling technologies, particularly in systems and synthetic biology. These tools will then provide the avenues for discovery in bioenergy, biotechnology, bioengineering, and biomedical sciences.

Required Multicellular and Inter-kingdom Signaling Elements:

To advance the frontier within the proposed EFRI topic, MIKS proposals must address the following three elements:

MIKS1) Development of novel technologies or methods to characterize and measure the complex molecular interactions that underlie signaling, and cell response to signaling;

MIKS2) Use of tools/technologies developed in (MIKS1) to advance our understanding and/or manipulation of the mechanisms of multicellular and inter-kingdom signaling; and

MIKS3) Development of novel engineered multicellular and/or multikingdom systems OR other innovations based on the control of signaling that address an important national or societal need.

2) Mind, Machines, and Motor Control (M3C)

The M3C program seeks multidisciplinary teams to conduct transformative research to understand fundamental principles of coupled human motor functions involving forceful physical interactions and their control by managing and influencing the neural activity of the brain. This may include basic tasks such as dexterous manipulations and fine motor control of the hand, walking, and more complex tasks needing specially acquired motor skills - e.g. in specific sports activities. Proposers are encouraged to consider and include sensory-motor functions encountered in the real world, where humans do not act in a vacuum but are physically and mentally coupled to other things (objects, tools, machines, other people) in their environment. On the horizon of M3C-related work will be the creation of systems that seamlessly integrate "human", and "machine". To realize these systems, experimentally-verified, quantitative, mathematical theories of human sensory-motor control that do not treat humans in isolation are urgently needed. Research and education in M3C draw from neuroscience, neuroengineering and neuromechanics, but projects responsive to the needs of the M3C program will place a clear emphasis on human motor behavior that involves physical interaction with application to engineering design. In doing so, these projects will integrate aspects of other fields that may include biomechanics, musculoskeletal dynamics, sensorimotor physiology, dynamics, control, optimization, and systems engineering.

Human-machine interaction, brain-machine interfaces, actuator and sensor design, therapeutic and entertainment robotics, orthotics and exoskeletons, prosthetics, motor neuroscience, and motor learning are some areas of current research activity that could serve as a basis for a well thought out research program. M3C responsive proposals should lead to a **transformative understanding of mind, machine, and motor control** and may include applications that deal with issues related to: (i) *enhancement of human motor capabilities* (assistance, rehabilitation, and augmentation) and the broad area of (ii) *connecting physical human-machine interactions and mental representations.*

Successful proposals will focus on one or more of the following three key themes listed in (A), will leverage one or more of the emerging tools and technologies listed in (B), and will establish clear relevance to one or more of the application areas listed in (C).

A. Key Themes

A.1 Learning and Skill Acquisition: Bicycles and violins are machines that take time to learn how to use properly. Without understanding the dynamics of this learning process, in particular the correlation between initial and ultimate levels of performance, it is difficult to systematically design and evaluate alternative designs. This problem becomes worse for machines that actively co-adapt - for example, a brain-machine interface that learns a map from neural activity to user intent, or a lower-limb prosthesis that learns how to walk over varied terrain in a way that

minimizes the user's metabolic cost - but this type of co-adaption is critical to performance. A key part of any quantitative theory of human sensory-motor control must be a theory of motor learning.

A.2 Power transfer between a Human and a Machine: There is a general lack of theory predicting the physiological response to significant power transfer between a human and a machine. How can we predict the energetic cost of walking with an exoskeleton or a prosthetic before doing pre-clinical tests? How can we derive control and sensing strategies for these devices without trial and error? These questions must be answered in order to make the work generalizable. For example, what is the right balance between providing assistance and causing disuse atrophy with a powered prosthesis or orthosis?

A.3 Pre-clinical Evaluation: Collaboration between engineers, scientists, and clinicians can help improve pre-clinical evaluation. For example, analysis of robotic therapy integrates many different issues including coordination, strength, and stabilization. Furthermore, the process of human walking is a whole-body process, not something that can be confined to an analysis of the lower limbs. What metrics should be used for evaluation? Is it possible to treat coordination, strength, stability, etc. separately? M3C researchers must try to answer some of these basic questions in order to deal with more complex issues.

B. Tools and Technologies

B.1 Robotics: Use of robotic devices that enable functional experiments outside of the laboratory either directly or via telemanipulation (leveraging wireless communication and other technologies).

B.2 Imaging: Use of biophysical sensors that allow detailed assessment of neural and muscular activity during physical human-machine interactions (in particular, neuromuscular activity that relates to hierarchical or higher-level cognitive function).

B.3 Feedback: Use of targeted stimulation or other mechanisms for sensory substitution that explicitly close feedback loops in order to enhance functional performance during human-machine interaction.

C. Application Areas

C.1 Medical/Healthcare Applications: Engineered devices and systems, emphasizing mind, machines, and motor control that are assistive, therapeutic, or compensatory; enable mobility and independence, and facilitate physical interaction with the real world.

C.2 Industrial Applications: Robotic machines with a direct physical coupling to humans that may include areas such as telemanipulation, assembly, exoskeletons, and cargo handling. M3C research should have a transformative impact on designing and engineering these types of robotic machines.

C.3 Consumer Applications: Machines that work side by side with humans in the home, office, and elsewhere that could transition from concept to reality without having to do many years of testing will benefit from M3C research on human motor control.

Required Mind, Machines, and Motor Control (M3C) Elements:

To be considered for the M3C EFRI program, proposals must be primarily centered on human motor functions under forceful physical interaction that are appropriately augmented with ideas and experiments from neuroscience and related disciplines. Proposals must involve three or more investigators, and must include at least one from an engineering discipline and another investigator with neuroscience, behavioral psychology, cognitive science, medicine, or neurobiology expertise. The more competitive proposals will address at least two of the following M3C elements:

M3C1) Experimentally validated theories of human-sensory motor control that will lead to predictive models to enable the design of machines for forceful physical interaction and cooperation with humans.

M3C2) Perceptual and cognitive science based approaches that are primarily concerned with representing mental states that result from forceful physical interactions between human and machine.

M3C3) Model constructs with validation and verification enabling understanding and/or explanation of one or more important human sensory motor control functions.

Proposals that focus exclusively on signal processing and computation (e.g., to study how networks of neurons encode information), on technology development (e.g., for persons with disability) that does not result in new theoretical foundations, or on infrastructure (e.g., sensor networks for data collection) are not expected to be competitive.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 14 (4-year awards)

Anticipated Funding Amount: A total of $31,000,000 in FY 2011 pending the availability of funds.

Anticipated Funding Level: It is anticipated that 14 or more standard grants will be made in FY 2011. Each project team may receive support of up to a total of $500,000 per year for up to four years, pending the availability of funds. 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 which perform research and with degree-granting education programs in disciplines normally supported by NSF are eligible to be the lead organization. Academic institutions are defined as universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the United States, acting on behalf of their faculty members. Principal investigators are encouraged to form synergistic collaborations with government laboratories, industrial researchers, and scientists and engineers at foreign organizations where appropriate, though no NSF funds will be provided to government labs, industry, or foreign organizations. For interaction with industry, when appropriate for the proposed research, the GOALI mechanism (Grant Opportunities for Academic Liaison with Industry http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf10580) may be used.

PI Limit:

Principal Investigators (PI) must be at the faculty level as determined by the submitting organization. A minimum of one PI and two co-PIs must participate.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

The principal investigator and co-principal investigators may participate in only one proposal submitted to this solicitation. It is the responsibility of the submitting institution to ensure that the PI and all co-PIs are participating in only one proposal submitted 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-MIKS” or “EFRI-M3C,” as appropriate.

2. THE TEAM- Names, departmental and university affiliation, and expertise of the Principal Investigator and at least two co-Principal Investigators.

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:

- Sponsored Projects Office (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 is not allowed

Preliminary Proposals *(required):* Preliminary proposals are required and must be submitted via the NSF FastLane system.

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 early February of 2011, successful PIs should expect to receive an invitation from the EFRI Office to submit a full proposal.

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 Proposal Preparation Instructions:

Preliminary proposals must be submitted via FastLane in accordance with the instructions below. Preliminary proposals that are not compliant with this solicitation will be returned without review. It is the submitting organization's responsibility to ensure that the

proposal is compliant with all applicable requirements. If there is more than one university involved in a preliminary proposal, it must be submitted as a single proposal and not as multiple collaborative proposals. 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 all formatting requirements for font size and characters per inch as specified in the NSF Grant Proposal Guide (GPG).

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. A minimum of two co-principal investigators must participate. 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 either "**EFRI-MIKS Preliminary Proposal:"** or "**EFRI-M3C 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: The 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 and the significant leap or 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 the approach and methodology that will be used to achieve the vision and goals in approximately three pages ; and
3. **Impact**- Describe 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 in approximately one page.

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 **Supplementary Docs** 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 efri2011@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 **PowerPoint slide** summarizing the vision of the EFRI proposal. This will be used during review panel discussions.

Remember to email these two documents to efri2011@nsf.gov; do not use FastLane.

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

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

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

Based on the review of preliminary proposals, a limited number of PIs will be invited to submit a full proposal. If there is more than one university involved in an invited full proposal, it must be submitted as a single full proposal, and not as multiple collaborative proposals.

The review of invited full proposals will include both *ad hoc* and panel reviews. The following exceptions and additions to the GPG 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: 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.

Title of Proposed Project: The title for the proposed EFRI project must begin with "**EFRI-MIKS:"** or "**EFRI-M3C:",** 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 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 both intellectual merit and broader impacts in the project summary will be returned without review.

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

1. Results from **Prior Research**: Describe prior research of each PI or co-PIs funded by NSF that is directly relevant to the proposed project; and
2. **Proposed Research**: Describe the vision and goals of the proposed research, approaches and methodologies to attain the goals, and the expected outcomes. The project description should address the "Required M3C Elements" for EFRI-M3C proposals or "Required MIKS Elements" for EFRI-MIKS proposals as applicable as listed in Section II. program description. The project description should end with a subsection labeled **"Impact"** that describes how the proposed project will lead to a 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 three pages of budget justification), and for each subawardee budget (up to three pages of budget justification for each subaward). Proposed budgets must include funds for travel by at least one PI and at least one graduate 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 **Supplementary Docs** 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. For proposals that include support for post-doctoral researchers, provide a **post-doc mentoring plan**;
5. **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; and
6. 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, 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 efri2010@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 **PowerPoint slide** summarizing the vision of the EFRI proposal. This will be used during review panel discussions.

Remember to email these two documents to efri2011@nsf.gov; do not use FastLane. Please submit these documents even if the information has not changed since submission of the preliminary proposal.

Pre-submission Check List

- No principal investigator or co-principal investigator is listed as a principal investigator or co-principal investigator on any other EFRI proposal.
- The Lead PI must be at the faculty level, as determined by the submitting institution.
- If the proposal has multiple organizations, it is not submitted as a collaborative proposal but as a single proposal with subawards.
- Proposal has a minimum number of 3 PI/Co-PIs and a maximum of 5 PI/Co-PIs.
- A Post Doc Mentoring Plan is included, if applicable.
- Annual budget does not exceed $500,000 and duration of proposed research does not exceed 4 years.
- Immediately after submission, an E-mail is sent to efri2010@nsf.gov with (a) the Excel spreadsheet that includes COI information and (b) a one-page project summary as PowerPoint slide. The subject heading of the email should note the proposal number and the lead institution.

This checklist is provided to aid in the preparation of the proposal, the burden to ensure that the proposal is complete and meets all of the solicitation requirements remains with the Principal Investigator.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time):

  October 04, 2010

- **Preliminary Proposal Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time):

  November 08, 2010

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

  April 01, 2011

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

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

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

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

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

A. NSF Merit Review Criteria

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

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

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

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

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

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

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

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

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

Additional Review Criteria:

In addition to the 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?
- Responsiveness to "**Required MIKS Elements"** for EFRI-M3C proposals **or "Required M3C Elements"** for EFRI-MIKS proposals delineated in Section II. Program Description.
- Effectiveness of the proposed plan for management and integration.

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 Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

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

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

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, and a project outcomes report for the general public.

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

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

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) 292-8305, email: srastega@nsf.gov
- TOPIC 1: MULTICELLULAR AND INTER-KINGDOM SIGNAL, telephone: see below, email: tgood@nsf.gov
- Theresa A. Good, Program Director, ENG/CBET, telephone: (703) 292-7029, email: tgood@nsf.gov
- Aleksandr L. Simonian, Program Director, ENG/CBET, telephone: (703) 292-4826, email: asimonia@nsf.gov
- Clark Cooper, Program Director, ENG/CMMI, telephone: (703) 292-7899, email: ccooper@nsf.gov
- Leon Esterowitz, Program Director, ENG/CBET, telephone: (703) 292-7942, email: lesterow@nsf.gov
- Lynn Preston, Program Director, ENG/EEC, telephone: (703) 292-5358, email: lpreston@nsf.gov
- Ruth M. Shuman, Program Director, ENG/IIP, telephone: (703) 292-2160, email: rshuman@nsf.gov
- Gregory Warr, Program Director, BIO/MCB, telephone: (703) 292-8440, email: gwarr@nsf.gov
- TOPIC 2: MIND, MACHINES, AND MOTOR CONTROL, (M3C):, telephone: see below, email: sjayasur@nsf.gov
- Suhada Jayasuriya, Program Director, ENG/CMMI, telephone: (703) 292-7014, email: sjayasur@nsf.gov
- Rajinder Khosla, Program Director, ENG/ECCS, telephone: (703) 292-5376, email: rkhosla@nsf.gov
- Radhakishan Baheti, Program Director, ENG/ECCS, telephone: (703) 292-8339, email: rbaheti@nsf.gov
- Ted A. Conway, Program Director, ENG/CBET, telephone: (703) 292-7091, email: tconway@nsf.gov
- Semahat S. Demir, Program Director, ENG/CBET, telephone: (703) 292-7950, email: sdemir@nsf.gov
- Barbara H. Kenny, Program Director, ENG/EEC, telephone: (703) 292-4667, email: bkenny@nsf.gov
- Eduardo A. Misawa, Program Director, ENG/CMMI, telephone: (703) 292-5353, email: emisawa@nsf.gov
- Kenneth Whang, Program Director, CISE/IIS, telephone: (703) 292-5149, email: kwhang@nsf.gov
- Thomas C. Henderson, Program Director, CISE/IIS/RI, telephone: 703/292-7838, email: thenders@nsf.gov
- Betty K. Tuller, Program Director, SBE/BCS, telephone: (703) 292-7238, email: btuller@nsf.gov
- Diane M. Witt, Program Director, BIO/IOS, telephone: (703) 292-7887, email: dwitt@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the

national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

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

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

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

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

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

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

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

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

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

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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