DDDAS: Dynamic Data Driven Applications Systems

Program Solicitation
NSF 05-570

National Science Foundation
Directorate for Computer and Information Science and Engineering
Directorate for Engineering
Directorate for Education and Human Resources
Directorate for Mathematical and Physical Sciences
Office of International Science and Engineering
Directorate for Social, Behavioral, and Economic Sciences

National Institutes of Health
National Institute of General Medical Sciences
National Library of Medicine

National Oceanic and Atmospheric Administration

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

June 13, 2005

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

DDDAS: Dynamic Data Driven Applications Systems

Synopsis of Program:

Information technology-enabled applications/simulations of systems in science and engineering have become as essential to advances in these fields as theory and measurement. This triad of approaches is used by scientists and engineers to analyze the characteristics and predict the behavior of complex systems and the applications that represent them. However, accurate and comprehensive analysis and prediction of the behavior of complex systems over time is difficult. With traditional simulation and measurement approaches, even elaborate computational models of such systems produce applications and simulations that diverge from or fail to predict real system behaviors.

This solicitation focuses explicitly on Dynamic Data Driven Applications Systems (DDDAS), a promising concept in which the computational and experimental measurement aspects of a computing application are dynamically integrated, creating new capabilities in a wide range of science and engineering application areas. Computational aspects of DDDAS may be realized on a diverse set of computer platforms including computational grids, leadership-class supercomputers, mid-range clusters, distributed, high-throughput computing environments, high-end workstations, and sensor networks. Consequently, DDDAS-funded projects are expected to make significant contributions to research advances in computational science and engineering, high-end computing, measurement methods, and cyberinfrastructure.

DDDAS is a paradigm whereby application/simulations and measurements become a symbiotic feedback

control system. **DDDAS entails the ability to dynamically incorporate additional data into an executing application, and in reverse, the ability of an application to dynamically steer the measurement process.** Such capabilities promise more accurate analysis and prediction, more precise controls, and more reliable outcomes. The ability of an application/simulation to control and guide the measurement process, and determine when, where and how it is best to gather additional data, has itself the potential of enabling more effective measurement methodologies. Furthermore, the incorporation of dynamic inputs into an executing application invokes new system modalities and helps create application software systems that can more accurately describe real-world complex systems. This enables the development of applications that adapt intelligently to evolving conditions, and that infer new knowledge in ways that are not predetermined by startup parameters. The need for such dynamic applications is already emerging in business, engineering and scientific processes, analysis, and design. Manufacturing process controls, resource management, weather and climate prediction, traffic management, systems engineering, civil engineering, geo-exploration, social and behavioral modeling, cognitive measurement and bio-sensing are examples of areas likely to benefit from DDDAS.

DDDAS creates a rich set of new challenges for applications, algorithms, systems' software and measurement methods. The research scope described here requires strong, systematic collaborations between applications domain researchers and mathematics, statistics and computer sciences researchers, as well as researchers involved in the design and implementation of measurement methods and instruments. Consequently, most projects proposed in response to this solicitation are expected to involve teams of researchers. Following merit review of the proposals received, projects will be selected for support by NSF, the National Institutes of Health (NIH) and the National Oceanic and Atmospheric Administration (NOAA).

Cognizant Program Officer(s):

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

- 47.070 --- Computer and Information Science and Engineering
- 47.076 --- Education and Human Resources
- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.075 --- Social, Behavioral and Economic Sciences

Eligibility Information

- **Organization Limit:**

  The categories of proposers identified in the Grant Proposal Guide (GPG) are eligible to submit proposals under this solicitation.

- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** An individual can be a PI, Co-PI or Senior Personnel in only one proposal in this competition.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 25 to 30
- **Anticipated Funding Amount:** $15,000,000 approximately from NSF and other sponsor agencies, subject to availability of funds.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.
- **Indirect Cost (F&A) Limitations:** None
- **Other Budgetary Limitations:** Not Applicable.

C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m. submitter's local time):
  June 13, 2005

Proposal Review Information

- **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

Information technology-enabled applications/simulations of systems in science and engineering have become as essential to advances in these fields as theory and measurement. This triad of approaches is used by scientists and engineers to analyze the characteristics and predict the behavior of complex systems and the computing applications that represent them. However accurate and comprehensive analysis and prediction of the behavior of complex systems over time is difficult. With traditional simulation and measurement approaches, even elaborate computational models of such systems produce applications and simulations that diverge from or fail to predict real system behaviors.

This solicitation focuses explicitly on Dynamic Data Driven Applications Systems (DDDAS), a promising concept in which the computational and experimental measurement aspects of an application are dynamically integrated, creating new capabilities in many application areas of science and engineering. Computational aspects of DDDAS may be realized on a diverse set of computer platforms including computational grids encompassing leadership-class supercomputers, mid-range clusters, distributed, high-throughput computing environments, and sensor networks. Enabling DDDAS requires multidisciplinary research that focused on generating advances in applications, application algorithms, systems software, and measurement approaches. As such, DDDAS-funded projects are expected to make significant contributions to research advances in computational science, high-end computing and cyberinfrastructure.

DDDAS is a paradigm where application/simulations and measurements become a symbiotic feedback control system. **DDDAS entails the ability to dynamically incorporate additional data into an executing application, and in reverse, the ability of an application to dynamically steer the measurement process.** It promises more accurate analysis and prediction, more precise controls, and more reliable outcomes. The ability of an application/simulation to control and guide the measurement process, and determine when, where and how it is best to gather additional data, has itself the potential of enabling more effective measurement methodologies. The ability to incorporate dynamic inputs into an executing application and invoke new modalities of the system creates application software systems that can more accurately describe real world complex systems. It enables applications to adapt intelligently to evolving conditions, and infer new knowledge in ways that are not predetermined by startup parameters. The DDDAS concept dynamically integrates computational and measurement modalities, and creates new frontiers advancing present methodologies and capabilities. The ability of application/simulations to accept and respond to dynamic inputs from on-line or archival measurement data or users, and/or control such measurements in a dynamic manner, adds new dimensions to the capabilities of applications and measurement systems.

The need for such dynamic applications is already emerging in business, engineering and scientific processes, analysis, and design. Manufacturing process controls, resource management, weather and climate prediction, traffic management, systems engineering, civil engineering, geo-exploration, social and behavioral modeling, cognitive measurement and bio-sensing are examples of areas likely to benefit from the DDDAS paradigm. DDDAS has the potential to transform the way science and engineering is done, and impact many aspects of our society, including manufacturing, commerce, transportation, hazard

prediction/management, ecology and environmental biology, medicine, security and emergency response, to name a few.

DDDAS creates a rich set of new challenges for applications, algorithms, systems' software and measurements methods. These include: advances at the applications level for enabling dynamic feedback and coupling with measurements; application interfaces with measuring devices and instrumentation methods; advances in applications algorithms to be amenable to perturbations by dynamic data inputs; enhanced capabilities for handling uncertainties in input data; and new technology in computer system software to support such environments. With the DDDAS concept the measurement system becomes part of the "platform" supporting the application. Thus, DDDAS requirements extend the current notion of "grid" infrastructure to include measurement systems in a dynamically integrated way.

DDDAS challenges clearly present the need for a synergistic multidisciplinary research among researchers in applications, algorithms, measurements, and software systems. This solicitation seeks to catalyze multidisciplinary research enabling DDDAS. The research scope laid-out here seeks to establish stronger and more systematic collaborations among applications domain researchers and mathematics, statistics and computer sciences researchers, as well as researchers involved in measurement methods and design of measurement instruments. This program will support multidisciplinary, synergistic research encompassing specific application domains, mathematical and statistical algorithms, and aspects of computer science relevant to enabling DDDAS. Individual single-investigator research projects may be appropriate in some cases, but they must clearly express the advances to be made in the context of enabling DDDAS capabilities for a specified driving application. DDDAS activities are expected to have a very positive impact on graduate and undergraduate student education, by providing opportunities for students to contribute to novel, exciting, and multidisciplinary projects.

II. PROGRAM DESCRIPTION

Research and Education Themes

While the sponsors of this DDDAS program already support research in four component areas critical to DDDAS advances - ***applications, mathematical and statistical algorithms, systems software, and measurement methods*** - this solicitation is intended to stimulate and support multidisciplinary research and education projects that span and advance these components in an integrative way to enable Dynamic Data Driven Applications Systems. Investigators must clearly describe how, by employing the DDDAS concept, their proposed efforts will lead to new and/or improved applications and measurements. The research scope in every proposed project must be driven by a specific application domain(s) and must indicate how the DDDAS concept advances the specific application or applications. In the case where a proposal emphasizes the development of application algorithms, or measurements, or systems software to support DDDAS environments, these advances must be made in the context of a specific application (or applications) which require these technologies.

Below are listed some of the technical challenges covered in the four DDDAS research component areas; this list is illustrative rather than exhaustive. In addition, a list of illustrative examples of applications and application areas is provided at the end of this section and in the "examples of applications" web link on the DDDAS webpage (www.cise.nsf.gov/dddas).

- **Applications Advances:** In implementing DDDAS, an application/simulation must be able to accept data at execution time and be dynamically steered by such dynamic data inputs. This requires research advances in application models that: describe the application system at different levels of detail and modalities; are able to dynamically invoke appropriate models as needed by the dynamically injected data into the application; and include interfaces of applications to measurements and other data systems. Construction of such application models, and methods to interpolate between such models, requires research advances, including but not limited to:

    - Application Models: multi-modal and hybrid methods of describing the system at hand; multi-scale application models for modeling multiple levels of system detail; inverse problems and modeling; chaotic and fractal modeling methods; model enhancements for dynamic resolution; methods for incorporating in the models asynchronously collected data; methods to incorporate data of variable quality. Combining data (measured, computed or archived) taken at different spatial or temporal scales is a significant problem; mathematical and computational models of multi-scale systems often involve a hierarchy of models and transfer information between the levels of this hierarchy.

    - Application Composition: dynamic selection of models, based on data dynamically streamed into the executing application; application model interfaces and application knowledge based systems to create the ability to invoke such multiple scales at runtime; stochastic application models.

    - Application-Data Interfaces: application-measurement interfaces and data models (dynamic data streaming into the application / controlling measurement processes); application-measurement time-scale correlation; asynchronous data collection; dynamic data-assimilation; continuous data streams in addition to discrete data sets.

- **Application Measurement Systems and Methods**: DDDAS enables improvements in measurement, observation, and instrumentation methods and systems, and interfaces such systems with application execution environments such that data may be dynamically injected into executing applications which in turn enhance control of the measurement/observation process. Efforts encouraged include improvements and innovations in instrumentation and sensor designs (including existing experimental infrastructure). Improvements in the means and methods for collecting data, such as: focusing in a region of relevant measurements, controlling sampling rates, multiplexing, and determining the architecture of networked sensor assemblies and other measurement systems are also of interest. *Innovations and improvements in major experimental systems will be supported in coordination with programs focused on developing such experimental measurement, observations, and instrumentation infrastructures. Investigators interested in this area must discuss their ideas with cognizant program officials prior to submission - see the Related Programs and Participating Agencies Specifics sections of this solicitation for more information.*

- **Mathematical and Statistical Algorithms:** DDDAS requires advances in existing mathematical, statistical, and other application algorithms, as well as the creation of new mathematical algorithms with stable and robust convergence properties under perturbations induced by dynamic data inputs: algorithmic stability under dynamic data injection/streaming; algorithmic tolerance to data perturbations; multiple scales and model reduction; enhanced asynchronous algorithms with stable convergence properties; stochastic algorithms with provable convergence properties under dynamic data inputs; handling data uncertainty in decision-making/optimization algorithms, especially in cases where decisions can adapt to unfolding scenarios (data paths). Algorithms are needed for verification, validation, and quantification of uncertainty in large-scale simulations, such as in cases where the underlying physical system itself, or the computational model of it, may combine stochastic and deterministic elements. These include (but are not limited to) the following broad mathematical and statistical issues:

    - methods to assess the quality and propagation of measurement errors and of uncertainty, in both stochastic and deterministic systems; external data are likely to be scattered in space and time; addressing the challenge of small sample sizes, incomplete data, and extreme events; differences between computational results and external data can be viewed as a measure for controlling the course of the simulation; here all the issues of uncertainty, sensitivity, combination, scatter, quality, propagation, and hierarchy arise again in attempting a systematic control of the simulation.

    - research to address issues of varying discretization schemes, depending on the streamed data, and develop the underlying algorithms that need to have the ability to interpolate or extrapolate between grids of different granularity. Handling uncertainties of dynamically streamed data creates new and additional challenges for deriving the ensuing errors and fidelity levels of the simulations.

    - continual optimization, and stochastic programming methods in which sampled-data may be adaptively incorporated within an algorithm. For such algorithms, issues such as the choice of re-optimization epochs, adaptive choice of sample size, and warm-starting using previously obtained approximations and solutions, become important for algorithmic efficiency.

  It is important to note that the mathematical and statistical advances sought here must be made in the context of being driven and validated by specific DDDAS application cases.

- **Systems Software Infrastructure:** Advances are also necessary in systems software supporting the execution of applications whose systems requirements are dynamically dependent on dynamic data inputs. In addition, new systems software approaches are required that support integrated computational and measurement system software architecture, interfaces and best practices of applications software with measurement systems, including sensor systems, and systems software to manage underlying computational grid resources and measurement systems.

    - Dynamic Application Execution Support Environments: Support for dynamic selection at runtime of Application Components. Multi-resolution capabilities (that is scaling for multiple levels of resolution) are essential in DDDAS systems. That will require systems software to dynamically select application components, embodying algorithms suitable for the kinds of solution approaches depending on the streamed data, and depending on the underlying resources.

    - Dynamic Computing Requirements and Matching Dynamic Resource Requirements: DDDAS will employ heterogeneous platform environments such as high end and grid computational platforms, embedded sensors for data-collection, distributed high-performance simulations environments, and special-purpose platforms for pre- and post processing of data, for example dynamic data assimilation and visualization. Such environments require systems software supporting dynamic discovery of computational resources to match the changing requirements of the applications, dynamic and adaptive application execution, resource management taking into account the unified computational and instruments platforms, and supporting the runtime of such systems with fault tolerance and Quality of Service (QoS).

    - Interfaces to Physical Devices (including sensor systems, detectors for spectrometers of all kinds, such *as*

synchrotron and neutrons sources) and Dynamic Data Management Requirements: Software supporting Application/Measurement Interfaces together with new capabilities for managing measurement systems, sensors and actuators is required, which are additional "resources" in the computational grid. Accordingly, resource discovery and allocation of sensors, and ways to architect the set of sensors to behave as a "system" become important issues. Computer and network modeling and simulation methods that extend beyond current approaches by dynamically incorporating on-line and archived measurements from real networks are of interest. These will provide a better understanding and more accurate prediction of network behavior for a wide range of time-scales, a broad spectrum of spatial network topology structures, and multiple protocols interacting with one another and across the different networking layers, especially as one goes from wired to wireless and streaming data from networked sensor systems. Integrating application and measurement data also requires new approaches for data management systems supporting different naming schemas or ontologies, information services, or information views. Feedback systems must return data in a timely fashion and useable form to computational resources and instruments, as well as to individuals who might act on it.

The scale and scope of DDDAS provide excellent education opportunities for students and faculty, and is expected to contribute to broadening participation and may lead to the development of innovative courses and curricula. Exploration of the DDDAS concept will enable students to work on state-of-the-art, multidisciplinary projects.

Where appropriate, interface, collaboration and partnerships with industry in developing some of these technologies and best practices are encouraged, as it is also important that prototype technology developed in DDDAS projects lead to technological innovation in industry.

Background Information

NSF organized a workshop on DDDAS in March 2000, convening members from the academic community, industry, and other funding agencies. Workshop participants examined the technical challenges and research areas associated with DDDAS. Representative applications illustrating the potential impact of DDDAS research were also identified. The workshop report and other related workshops and reports are listed in this solicitation in the section entitled: Related Workshops and Reports.

DDDAS can have an impact in the biological sciences, engineering, geosciences, materials, physical sciences, space and social sciences, and in enabling infrastructure technologies. The following is an illustrative but non-exhaustive list of possible applications/areas that may benefit from the DDDAS paradigm (additional examples are given in the "examples of applications" web link on the DDDAS webpage: www.cise.nsf.gov/dddas):

In engineering and physical systems, applications involving real-time and virtual operations re-planning, process control and optimization situations such as those occurring in manufacturing and service systems; in earthquake tolerant structures, in crisis management, like fire propagation prediction and containment; in complex structural and fluidic processes encountered in chemical, mechanical and biomechanical systems; in new methodologies, like in computing and measurements infrastructure systems, such as the design and configuration methodologies for sensor networks and traditional networked computer systems, in enhancing methods for improved engineering and for enabling analysis and prediction in decision support systems ranging from advanced driving assistance systems for automobiles to systems proposed for air-traffic management, analysis on structural integrity of mechanical systems, like analysis of systems of sensors, such predicting crack development in aircraft fuselage, to neurobiological and bio-molecular systems, to enhancing oil exploration methods, to improved analysis of environmental systems observations; in chemical imaging; X-ray and neutron scattering and spectroscopy.

In biological sciences, DDDAS can increase the accuracy of image-guided interventions, improve the performance and utility of multi-scale models, enhance methods to analyze and gain insights of the biodiversity and bio-complexity of the world's terrestrial and aquatic communities and ecosystems; complex models are needed integrating data from several scales of observation, including real time measurements from remote sensing and geographic information systems.

In geosciences, DDDAS methods can be used to address the non-linearities and diverse spatial and time scales in the highly interactive system for example of the hydro-complexity of weather, water and pollution processes

In the social and behavioral sciences, DDDAS can enable real time adaptive approaches to interviewing, cognitive measurement and experimentation. It can enable ways to better understand and to increase the efficiency of business production, customer service, policing, crowd control, crisis decision making, learning processes, language comprehension, and perception.

Recent advances in grid computing and sensor systems, high-end computing, as well as cyberinfrastructure projects such as the Network for Earthquake Engineering Simulation (NEES), the international Virtual Data Grid Laboratory (iVDGL), the Large Hadron Collider (LHC), Chemistry and Materials Consortium for Advanced Radiation Sources (ChemMatCARS), Energy Recovery Linac (ERL), Vibrational Spectrometer for SNS (VISION) , Data Acquisition For Neutron Scattering

Experiments (DANSE), and Center for High Resolution Neutron Scattering (CHRNS), the National Ecological Observatory Network (NEON), and the Geosciences Network (GEON), are all excellent examples of applications where DDDAS can be used to enhance research productivity and the impact of simulation and measurements enabled by these infrastructure projects.

Participating Agencies Specifics

Sponsors of this solicitation include NSF, the National Institutes of Health, and the National Oceanic and Atmospheric Administration. Where sponsors have specific emphasis or applications interests, they are described below. Investigators targeting projects to also meet such interests, must indicate the proposed areas of emphasis and requirements. Proposals that are expected to be co-funded or fully funded by such sponsors must reflect those sponsors' areas of emphasis and requirements. In general, this competition will support projects that include research in all four DDDAS area components. However, some sponsors place emphasis on measurement and instruments development applications (these cases are listed below) or place emphasis on projects relating to the infrastructure that supports such instruments. For projects involving the development of a major measurement system (other than those listed here), proposers must contact the cognizant program officials of the respective programs.

NSF/MPS: The NSF Directorate for Mathematical and Physical Sciences (MPS) encourages DDDAS proposals whose scope intersects the interests of the Physics, Chemistry, Materials Research, Astronomical Sciences, and Mathematical Sciences Divisions. Examples include proposals related to incorporating DDDAS principles into existing MPS-supported infrastructure such as ChemMatCARS, the Large Hadron Collider, detectors (e.g., spectrometers) at x-ray or neutron sources, CHRNS experimental infrastructure efforts, and telescopes. Other examples include bringing DDDAS principles into the early stages of developing infrastructure such as next generation light sources or adaptive optics for telescopes. Proposers should contact and discuss their intended submission with the cognizant program officials from these divisions listed in the solicitation.

NIH/NLM: The interests of the National Library of Medicine (NLM) focus on important problem areas in biomedical domains that have proved difficult to address efficiently and with validity using conventional methods, and thus require the computational approach of DDDAS. These problems--relating to health care, biomedical research, or the education of health professionals--must either be problems of intense current interest or problems expected to emerge in coming years. Such areas include: Modeling of medical care delivery systems and processes within complex health care delivery environments, for purposes of making these processes safer and more efficient; Intelligent educational systems based on complex simulation models that adapt to learner actions and decisions; Dynamic assembly of multimedia, multimodality patient data from disparate sources will be required to create a virtual electronic record for a single patient delivered to the point of care; Modeling of physiological processes; Complex systems of importance to disaster management.

NIH/NIGMS: Potential projects of interest to the NIH National Institute of General Medical Sciences (NIGMS) are in the areas of : dynamical models of patient response to drug regimens, or other sustained intervention; dynamical models of metabolic and signaling pathways and network; models of infectious diseases; and data driven computational algorithms for sequence analysis such as hidden Markov models.

NOAA: Potential applications for DDDAS technology within NOAA might include real-time monitoring, prediction, and warning of hazardous weather (e.g., tornadoes, hurricanes), tsunamis, and chemical, biological and radiological contamination. In the area of weather forecasting, the ability to incorporate real-time data from satellites, radar and other sensor systems would greatly impact the overall reliability and timeliness of forecasts, nowcasts, and warnings. Incorporating data directly from a variety of radar systems such as hurricane hunters (i.e. P-3 aircraft) and UAV's could substantially assist in tornado and hurricane warnings. Specifically, upon detection of a tornado, a radar or cluster of radars could adapt to the situation by changing their scanning strategy, depending upon the location of the tornado or tornadoes. In the event of a tsunami, earthquake sensors could activate other sensors, like DART and ship-borne sensors, that would provide critical information into a warning system. In the areas of air and water quality stewardship and homeland security, the ability to incorporate real time measurements of the location and concentration of the contaminants (e.g. oil spills in environmentally sensitive areas), along with real time data regarding tides and currents could provide decision makers vital information needed for containment and warnings and derived wind fields into models would have the strongest likelihood for overall prediction. For airborne contamination, accidental or intentional, air quality sensors in the affected areas, combined with real time numerical model data (providing forecasted wind fields) produced specifically for the area affected and triggered by the real time sensor event identification, could not only provide details emergency managers need to warn the public and evacuate downstream areas, but also stimulate the deployment of other sensors upon detection, e.g. UAV's. DDDAS technology could be a crucial component of NOAA's assessment, monitoring, and warning mission, providing officials information needed to warn the public with sufficient lead-time to save lives and property.

Project Categories

This DDDAS solicitation seeks to catalyze stronger and more systematic collaborations between applications' research communities and mathematical modeling, computer sciences, and measurement systems researchers. Three types of DDDAS projects will be supported: **Team Multidisciplinary Research Projects (TMRPs) of 3-5 year durations, each** involving 2-5 investigators working collaboratively on application, application measurement and algorithms, and systems software aspects of the projects. **Small Multidisciplinary Research Projects (SMRPs**) **of 3 year durations**, each involving

1-2 investigators, may place emphasis in one or two of the four area components described in this solicitation and must clearly describe advances to be made in the context of enabling DDDAS capability for (a) specified driving application(s). Finally, the program will support **Small Exploratory Projects (SEPs) of 1 year durations**, to either explore some unusually high-risk ideas or establish partnerships with researchers in one or two of the other component areas, or conduct workshops bringing the broader community to articulate specific opportunities.

DDDAS provides tremendous new opportunities of interest to industry. For DDDAS, NSF and the other sponsor agencies welcome proposals for collaborative projects involving both universities and the private commercial sector, where:

- US commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education, participate as subawardees. Proposals like these should be submitted by the due date described in this solicitation; or
- Small businesses submit projects or lead collaborative projects involving academic partner organizations. The participation of NSF's STTR and SBIR programs in this solicitation provides an alternate venue for funding of such activities. Small business-led projects are encouraged to apply to the NSF Small Business Innovation Research and Small Business Technology Transfer Programs, SBIR and STTR (http://www.nsf.gov/eng/sbir), referencing the relation of their project to DDDAS. Investigators should contact officials of the SBIR/STTR programs to discuss specifics.

In collaborative projects involving commercial sector partners, proposals should include roadmaps and milestones that demonstrate how effective collaboration and technology transfer will occur.

International collaborations are also encouraged. Given the worldwide expansion of research and education, international collaborations that advance DDDAS goals and strengthen proposed project activities are encouraged. There is opportunity for coordinated funding with colleagues from foreign institutions who will add value to the project. The DDDAS program will support US-based scientists. Collaborators in institutions outside the US must seek funding from their respective funding organizations. NSF requires that proposals with international collaborations include the foreign collaborators' biographical sketches (CVs) and documentation of their agreement to collaborate in the proposed project, as well as the means by which they will support their part of the work. International funding organizations that are co-operating in this solicitation include: the EU e-Infrastructure (www.cordis.lu/ist/rn), Dr. Kyriakos Baxevanidis, Kyriakos.Baxevanidis@cec.eu.int, the EU Information Society Technologies (IST) Programme (www.cordis.lu/ist) and the Grid Research under the IST Programme (www.cordis.lu/ist/grids), Dr. Max Lemke (max.lemke@cec.eu.int), and the UK e-Sciences Program, specifically the RCUK e-Science Program, (www.rcuk.ac.uk/escience, and www.rcuk.ac.uk/escience/links), Dr. James Fleming, james.fleming@epsrc.ac.uk.

III. ELIGIBILITY INFORMATION

Organization Limit: The categories of proposers identified in the Grant Proposal Guide are eligible to submit proposals under this program solicitation.

PI Eligibility Limit: None specified.

Limit on Number of Proposals: An individual can be a PI, co-PI or Senior Personnel in only one proposal in this competition.

IV. AWARD INFORMATION

Proposals in the TMRP (Team Multidisciplinary Research Projects) category are expected to request budgets in the range of $600,000-$2,000,000 ***total*** with 3-5 year durations.

Proposals in the SMRP (Small Multidisciplinary Research Projects) category are expected to request budgets in the range of $300,000-$600,000 ***total*** with 3 year durations.

Proposals in the SEP (Small Exploratory Projects) category are expected to request budgets of up to $50,000, and up to 1 year durations.

Approximately $15,000,000 of NSF and other agency funds are allocated to this competition. This is estimated to allow about 15-20 awards in the TMRP and SMRP categories, and up to 10 SEP awards.

The estimated program budget, number of awards, and average award size/duration are subject to the identification of suitable and meritorious proposals and to the availability of funds.

In each case, the requested budget must be justifiably commensurate to the proposed effort.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions:

Proposals submitted in response to this program announcement/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.

The following information deviates from the GPG guidelines.

Proposers should clearly articulate the proposed project's responsiveness to the scope of this solicitation. Each proposal must describe the intellectual merit and broader impacts of the proposed project. For TMRP and SMRP proposals, a management and collaboration plan should be included within the project description section. Each management and collaboration plan should include a set of interim and final milestones, and should describe how project team members will co-coordinate their activities to meet the interim and final milestones.

The project description should make clear why a budget of the requested size is required to carry out the proposed activities.

Proposers are encouraged to indicate in the Project Summary which of the sponsoring organizations (Directorates, Agencies, Divisions, Programs) are likely to have interest in their proposals. This is particularly important in the case where the proposal is focused on the specific requirements expressed in the Participating Agencies Specifics Section in this solicitation.

All proposals must be submitted to NSF by FastLane, specifying their project category: TMRP, SMRP and SEP. Proposal titles should begin with the project types, "DDDAS-TMRP:" or "DDDAS-SMRP:" or "DDDAS-SEP:".

Proposers are encouraged to contact cognizant program officials from the organizations sponsoring this solicitation to discuss their proposal.

Proposers are also encouraged to monitor the webpage of the DDDAS program solicitation and the www.cise.nsf.gov/dddas site for related information.

Proposers are reminded to identify the program announcement/solicitation number (05-570) in the program announcement/ solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required by NSF in proposals submitted under this Program Solicitation.

Indirect Cost (F&A) Limitations:

None

C. Due Dates

Proposals must be submitted by the following date(s):

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

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal 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 announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

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. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: http://www.fastlane.nsf.gov

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 (NSB 97-72). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued Important Notice 127, Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the Grant Proposal Guide Chapter III.A for further information). 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 he/she is qualified to make judgments.

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

Relevance to Sponsor Interests: Reviewers will consider the relevance of the proposed project to those interests of the participating sponsor agencies as stated in the Participating Agencies Specifics section.

For TMRP and SMRP proposals only: Reviewers will consider the likely effectiveness of the collaboration and management plan, including the interim and final milestones described.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Ad Hoc 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.

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 Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In most cases, proposers will be contacted by the Program Officer after his or her recommendation to award or decline funding has been approved by the Division Director. This informal notification is not a guarantee of an eventual award.

NSF is striving to be able to tell proposers whether their proposals have been declined or recommended for funding within six months. The time interval begins on the closing date of an announcement/solicitation, or the date of proposal receipt, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

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 Division 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.A. 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 (NSF-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 agreement awards are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/. Paper copies of these documents 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 is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpm. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at http://www.gpo.gov.

Special Award Conditions:

Periodic review and/or site visits may be conducted at NSF's discretion.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Projects funded by sponsoring agencies other than NSF will be subject to the conditions of those agencies' reporting requirements. Site visits and other reviews, as the case might require for specific projects or as required by the co-sponsors of a given project, may be conducted. Additionally participation in periodic PI meetings may be required to discuss scientific and policy issues of interest and to facilitate communication and collaboration across the DDDAS community.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. 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. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, 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.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- Frederica Darema, Senior Science and Technology Advisor, Directorate for Computer & Information Science & Engineering, Division of Computer and Network Systems, 1175 N, telephone: (703) 292-8950, fax: (703) 292-9010, email: fdarema@nsf.gov

- Mario Rotea, Program Director, Directorate for Engineering, Division of Civil & Mechanical Systems, 545 N, telephone: (703) 292-8360, fax: (703) 292-9053, email: mrotea@nsf.gov

- Marvin Goldberg, Program Director, Directorate for Mathematical & Physical Sciences, Division of Physics, 1015 N, telephone: (703) 292-7374, email: mgoldber@nsf.gov

- Daniel H. Newlon, Program Director/Cluster Coordinator, Directorate for Social, Behavioral & Economic Sciences, Division of Social and Economic Sciences, 995 N, telephone: (703) 292-7276, fax: (703) 292-9068, email: dnewlon@nsf.gov

- John C. Cherniavsky, Senior EHR Advisor for Research, Directorate for Education & Human Resources, Division of Research, Evaluation & Communication, 855 S, telephone: (703) 292-5136, fax: (703) 292-9046, email: jchernia@nsf.gov

- Juan E. Figueroa, Program Manager, Directorate for Engineering, Division of Design, Manufacture, & Industrial Innovation, 550 S, telephone: (703) 292-7054, fax: (703) 292-9057, email: jfiguero@nsf.gov

- Jeanne E. Hudson, Program Coordinator, Office of the Director, Office of International Science and Engineering, 935 N, telephone: (703) 292-8702, fax: (703) 292-9067, email: jhudson@nsf.gov

- Charles Friedman, Senior Scholar and Program Officer, National Library of Medicine, Office of Extramural Programs, telephone: (301) 594-4882, email: friedmc1@mail.nih.gov

- Peter Lyster, Program Director, National Institute of General Medical Sciences, telephone: 301-451-6446, email: lysterp@mail.nih.gov

- Robert Bohn, Project Manager, NOAA, telephone: (301)-713-3573, fax: (301)-713-4040, email: robert.b.bohn@noaa.gov

For questions related to the use of FastLane, contact:

- Gwen Hardenbergh, Integrative Activities Specialist, Directorate for Computer & Information Science & Engineering, Division of Computer and Network Systems, 1175 N, telephone: (703) 292-4538, fax: (703) 292-9010, email: ghardenb@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at http://www.nsf.gov/cgi-bin/getpub?gp. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF Website at http://www.nsf.gov/home/ebulletin, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's MyNSF News Service (http://www.nsf.gov/mynsf/) to be notified of new funding opportunities that become available.

- Multi-Scale Modeling in Biomedical, Biological, and Behavioral Systems (NSF 04-607)
- Human and Social Dynamics Competition FY 2005 (NSF 05- 532)
- Science and Engineering Information Integration and Informatics (NSF 04-528)
- Computer Systems Research (NSF 04-609)
- CLEANER: Project Office to Coordinate Network Activities (NSF 05-549)
- Nanoscale Science and Engineering (NSF 04-043)
- Sensors and Sensor Networks (NSF 05-526)

- Biocomplexity in the Environment - MUSES (NSF 03-597)
- Manufacturing Enterprise Systems (Dr. Abhijit Deshmukh - DMI/ENG)
- Service Enterprise Systems (Dr. Survajeet Sen - DMI/ENG)
- Operations Research (Dr. Survajeet Sen - DMI/ENG)
- Engineering Design (Dr. Delcie Durham, DMII/ENG)
- Process and Reaction Engineering (Dr. Maria Burka - CTS/ENG)
- Engineered Materials and Mechanics Cluster (Dr. Ken Chong - ENG/CMS)
- Intelligent Civil and Mechanical Systems Cluster (Dr. Mario Rotea - ENG/CMS)
- Infrastructure Systems and Hazard Mitigation Cluster (Dr. Dennis Wenger - ENG/CMS)
- Elementary Particle Physics (MPS/PHY: Marvin Goldberg, Jim Whitmore)
- Nuclear Physics (MPS/PHY: Brad Keister)
- National Facilities (MPS/DMR: Guebre Tessema)
- Special Projects (MPS/CHE: Art Ellis)
- Statistics (MPS/DMS: Robert Serfling)
- Advanced Technologies and Instrumentation (MPS/AST: Nigel Sharp)

RELATED WORKSHOPS AND REPORTS

- NSF Workshop on Dynamic Data Drive Application Systems. In March 2000, NSF organized a workshop convening members from the academic community, industry, national laboratories, and including representatives from many government agencies. The workshop examined the technical challenges and research areas that need to be stimulated to enable the capabilities envisioned with the DDDAS concept, and addressed applications and application areas illustrating the potential impact this kind of research can have. The proceedings of this workshop are posted in www.cise.nsf.gov/dddas
- Dynamic Data Driven Applications Systems Workshop at the 2003 International Conference of Computational Science (ICCS'03), Melbourne, Australia, June 2003
- Dynamic Data Driven Applications Systems Workshop at the 2004 International Conference of Computational Science (ICCS'04), Krakow, Poland, June 2004
- The High-End Computing Revitalization Task Force (HECRTF) Report http://www.itrd.gov/hecrtf-outreach/index.html.
- Workshop on Control and System Integration of Micro- and Nano-Scale Systems; the report can be found at http://www.isr.umd.edu/CMN-NSFwkshp
- Control in an Information Rich World, Report of the Panel on Future Directions in Control, Dynamics, and Systems Workshop, July 16-17, 2000; published by SIAM 2003; http://www.cdfn.caltech.edu/cdspanel.pdf
- The Neutron Science Software Initiative (NeSSI) NeSSI workshop held in Oak Ridge, Tennessee, on October 13-15, 2003; http://www.sns.gov/workshops/nessi/nessi.htm
- High-Performance Networks for High-Impact Science, Report of the August 13-15, 2002, Workshop, Conducted by the Office of Science, DOE
- Cyberinfrastructure Report http://www.communitytechnology.org/nsf_ci_report
- NSF Workshop on "Cyberinfrastructure-Operations Research-Enterprise Applications" August 30 - September 1, 2004.
- The MIT Engineering Systems Symposium, March 29-31, 2004
- NSF Workshop on Simulation Based Engineering Science, April 15-16, 2004
- Closed-Loop Supply Chains 4 Workshop, INSEAD, Fontainebleau, France, 17-19 October, 2004
- Global Conference on Sustainable Product Development and Life Cycle Engineering, Berlin, Germany, 29 September - 1 October, 2004
- OSG Technical Meeting December 15-17, 2004, University of California at San Diego, La Jolla,CA (http://www.opensciencegrid.org/events/meetings/technical/ucsd1204/index.html)
- The Confluence of three frontiers: Physical Science Research, Computer Science Research and Technology, and research on the Science of Teaching and Learning (http://www-ed.fnal.gov/uueo/)
- Developers Workshop for Grid Techniques in Introductory Physics Classroom Projects, January 28-30, 2004 at Florida International University (http://www.eurekalert.org/pub_releases/2004-02/dnal-fea020604.php)

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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; 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 applicant 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 needing information as part of the review process or in order to coordinate programs; 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," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). 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 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 this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.