

Engineering Sciences for Modeling, Simulation, Decision-Making and Emerging Technologies

Program Solicitation

NSF 03-505

Replaces Document NSF 00-31



National Science Foundation

Directorate for Engineering

Division of Design, Manufacture, and Industrial Innovation

Division of Electrical and Communications Systems

Division of Civil and Mechanical Systems

Division of Chemical and Transport Systems



Sandia National Laboratories

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

January 06, 2003

100-Word Abstract Required

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

March 14, 2003

By invitation only

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Engineering Sciences for Modeling, Simulation, Decision-Making and Emerging Technologies

Synopsis of Program:

This is a continuation of a collaborative research program between the National Science Foundation (NSF) and Sandia National Laboratories (Sandia) that was started in 1997. The objective of this collaborative program is to fund

research projects that are focused on advancing the fundamental knowledge base needed to support advanced computer simulations. Advances are needed in the following broad classes of technical development: the fidelity of the simulation models, experimental discovery necessary for the determination of the models and their validations, uncertainty quantification of the resulting computations, and computational techniques for the solution of the simulation models on high performance computing platforms.

Cognizant Program Officer(s):

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

- 47.041 --- Engineering

Eligibility Information

- **Organization Limit:** Proposals must be submitted by individual investigators or small groups (3 to 4 investigators) from colleges, universities, and non-profit organizations in the United States.
- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant (NSF) or Contract (Sandia)
- **Estimated Number of Awards:** 8 to 12 - pending the availability of funds and the quality of proposals.
- **Anticipated Funding Amount:** \$2,000,000 total, \$1,000,000 in FY 03 and \$1,000,000 in FY 04 pending the availability of funds and quality of proposals.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full funding opportunity document for further information.
- **Full Proposal Preparation Instructions:** The program announcement/solicitation contains deviations from the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full program announcement/solicitation for further information.

B. Budgetary Information

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

C. Due Dates

- **Letters of Intent (*required*)** (due by 5 p.m proposer's local time):
January 06, 2003
100-Word Abstract Required
- **Full Proposal Deadline Date(s)** (due by 5 p.m proposer's local time):
March 14, 2003
By invitation only

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria. Additional merit review considerations apply. Please see the full funding opportunity document for further information.

Award Administration Information

- **Award Conditions:** Additional award conditions apply. Please see the full funding opportunity document for further information.
- **Reporting Requirements:** Additional reporting requirements apply. Please see the full funding opportunity document for further information.

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I. INTRODUCTION

This is a solicitation for the continuation of a collaborative research program between the National Science Foundation (NSF) and Sandia National Laboratories (Sandia). Sandia has the responsibility for engineering systems and developing technologies that have profound impact on national security. The engineering systems responsibility includes defining the requirements for a variety of engineered systems, establishing the concepts to meet the requirements, evaluating design options, verifying that a design satisfies the requirements, manufacturing the system, operating and maintaining the system, and finally dismantling and disposing of the system. In addition, Sandia is responsible for developing, evaluating, and applying emerging technologies, such as microsystems, to larger engineered systems. With the advent of teraflop-level, massively parallel computers Sandia is moving toward an engineering process in which decisions are increasingly based on computational simulations with experiments used more for understanding the underlying physical phenomena and validating computational models than for certifying designs.

The NSF mission is to advance the fundamental science and engineering base of the United States, including a commitment to the further development of engineering processes using computer modeling and simulation. The two organizations have entered into a collaborative program to fund research projects that are focused on advancing the fundamental knowledge base needed to support advanced computer applications in the engineering sciences and design.

Although significant progress has been made in establishing a leading role for computational simulations in the engineering of systems, additional physical discovery involving better experimental diagnostics, better models of physical phenomena, improved validation of models, improved computational algorithms, and increased emphasis on the treatment of uncertainty are all needed to reach the necessary level of confidence in the approach. This is especially true for emerging technologies such as micro and nano systems. Therefore significant advances are required in the fundamental sciences and engineering that form the foundation of all computational analyses. Sandia and NSF are seeking proposals that address these modeling and simulation advances in the following focus areas: Thermal Transport and Fluid Mechanics, Solid Mechanics and Structural Dynamics, Engineering Design, Electrical and Electromagnetic Modeling, and Emerging Technologies. Detailed information of the scope of each of the focus areas is given below.

II. PROGRAM DESCRIPTION

FOCUS AREAS

A. Thermal Transport and Fluid Mechanics

This discipline area has as its focus the development of advanced constitutive models and computational tools with the objective of enabling validated, predictive scientific simulations for fluid and thermally-dominated processes. Clearly, fluid and thermal processes play a central role in many engineering applications of importance to Sandia such as in manufacturing and materials processing, power conversion and storage, biological and microelectronic micro-/nano-scale device design and application. This research area extends beyond traditional uncoupled continuum thermal and fluids phenomenology quantification. It also supports improved understanding of non-continuum and reactive processes and is closely tied to the geo-technology (especially single and multiphase reactive transport), and aero-technology (subsonic through hypersonic compressible flows and thermo-physics) focus areas critical to Sandia's mission.

This focus area is particularly interested in proposals that emphasize the development of analytical and computational methods to represent critical fluid/thermal transport phenomena and processes with appropriate resolution, dimensionality, and coupling with other physical processes. Topics suitable for consideration include, but are not limited to research in the areas of:

- transition and turbulence,
-

convective heat transfer coupled with moving boundaries,

- participating media radiative heat transfer,
- interfacial phenomena,
- phase change systems,
- material processing,
- microscale processes of importance to the fabrication and performance of microelectronics,
- micro-electro-mechanical-systems (MEMS),
- microfluidic devices.

The development and application of advanced diagnostics and experimental methods, to better characterize critical transport phenomena and to support the development of analytical and computational methods, are also appropriate.

B. Solid Mechanics and Structural Dynamics

This focus area seeks to improve and expand fundamental computational and material mechanics knowledge in the areas of solid mechanics and structural dynamics. In the area of structural dynamics, methods of treating the nonlinearities associated with energy dissipation in joints and interfaces are needed for systems whose vibrational response is otherwise linear. Advances in nonlinear, large deformation quasistatics and transient dynamics (both explicit and implicit) are also needed. A major area of emphasis is in models for material response and failure. The shift from a test-based to a simulation-based design environment requires accurate, robust and efficient computer codes which model large ranges of loadings, deformation amplitudes and rates, length- (including nano-, micro-, meso- and macro-scales) and time-scale mechanics, and damping of mechanical interfaces and joints. It seeks to develop a basic engineering understanding of numerical solution methods including finite elements, boundary elements, gridless Lagrangian and other methods for challenging simulation problems such as in impact and penetration, thermomechanical aspects of material processing and manufacturing, crack initiation, propagation and arrest, design optimization and uncertainty analysis, including accurate constitutive and/or molecular description of materials. Advanced solution algorithms based upon easy-to-implement meshes, e.g., mesh free or advanced tetrahedral elements, are particularly attractive. Adaptive techniques that automatically improve accuracy are desired. The solution algorithms must be robust, reliable, efficient, and scalable on parallel computing platforms. Carefully designed experimental investigations to validate and otherwise support the above technology areas are also needed.

Another very important issue in the use of computational models to impact design and design qualification is the time it takes to create computational models. It can often take so long to create a computational model for a complex system that the computations are not timely enough to impact design. Therefore, proposals addressing computational model creation issues for complex systems are solicited that cover issues such as improvements in solid geometry technology to defeat geometric models for analysis, methods for detecting and correcting nonphysical attributes in solid models, and improvements in automatic mesh generation, such as hexahedral finite element meshes.

C. Engineering Design

This focus area seeks to improve the fundamental theory of design and the computational tools needed to implement the theory. Design is recognized as involving decision making under uncertainty and risk. In this area, research is sought that will apply the rigorous mathematics of decision theory, game theory and probability theory, together with the engineering sciences, to enhance decision making in engineering design. This includes research on the fundamental theory of predictive modeling and the validation of predictive models, on the quantification of uncertainty and risk, the explication of decision maker preferences, and the application of decision theory to the analysis of engineering design decisions. Emphasis will be placed on research efforts that seek to make use of large-scale computational capabilities to enable the creation of tools that will enhance the application of the fundamental theories in real engineering design situations.

Engineering design is a very complex human activity in which designers gather and use information from a wide variety of sources to accomplish their goal. Much of the information designers draw on is subjective and uncertain. The purpose of design theory is to provide a mathematical framework within which designers can be assured that their decisions are consistent with their information and goals. Typically, such a framework provides conceptually simple principles that are enormously complex to implement. Software tools

are needed to help in implementing this theory. This research is particularly amenable to small groups including expertise in engineering design, mathematics and computation.

D. Electrical and Electromagnetic Modeling

Emerging electrical modeling and simulation technologies are spanning a wide range of capabilities, from digital representations that model highly integrated circuitry on a single chip to large electrical circuit systems to detailed calculations of features on the micron scale. Many opportunities for meaningful research are in this range of calculation capabilities. However, the area of interest for Sandia is the modeling of electrical systems and the interactions with the surrounding environment. Circuit simulations require that the devices comprising the circuits be well characterized in order to have confidence in calculation results. We are soliciting activities in the areas of improved device characterizations (construction analysis, destructive physical analysis and nondestructive techniques that would provide data for construction of improved electrical models), improved uncertainty quantification techniques that relate to electrical circuit simulations, and improved device models that interact with the environment. In addition, to leverage existing modeling and simulation technologies in the digital realm, technologies are required to link digital and analog circuit simulation. These technologies need to be extended to model hardware/software (co-simulation) and include actual electrical hardware in the simulations.

Electromagnetics (EM) modeling and simulation is also applied to a wide range of areas, including: response to high power/frequency EM environments, response to lightning insult, and high voltage (HV) breakdown due to both pulsed and DC environments. Our focus areas for proposals are those that will significantly advance our engineering science capabilities for:

1. response of components and systems in EM environments up to 100 GHz, including both narrow and wide band;
2. response of materials to lightning strikes, such as burning through conductive layers and rupturing/spalling due to localized heating;
3. the physics of HV arc formation in components/devices at atmospheric pressure (which include metal and dielectric objects, coatings, and wires).

We seek tools and technologies such as advanced computational methods, new analytical treatments, novel experimental series and new diagnostic techniques.

E. Emerging Technologies

Microscale and nanoscale systems and processes are becoming more viable for use in engineering applications. However, our knowledge of their behavior and our ability to model their performance remains limited. In particular, existing continuum-based computational capabilities are not applicable over the full range of operational conditions. We observe non-continuum behavior in gas dynamic transport, thermal transport and material mechanics as characteristic scales drop towards the micron scale. To support the design and qualification of microscale and future nanoscale systems and processes, we must develop validated analytical, computational and experimental capabilities that can span the continuum to non-continuum regimes. In the near continuum regimes we anticipate that we can extend our continuum capabilities through subgrid constitutive models that can capture non-continuum phenomena and that can be integrated into continuum mechanics capabilities. In the non-continuum regimes we anticipate that new formulations of the conservation laws and new constitutive relationships will be required for these capabilities. In this area we solicit proposals that seek to expand our understanding of microscale and nanoscale phenomena and to develop models of micro- and nanoscale engineered systems and processes.

A growing level of effort at Sandia National Laboratories is being devoted to creating a science-based understanding of micro and nano scale phenomenology as it relates to MEMS and microsystems. To encourage university interactions in this area, Sandia has created the MESA Institute. It can help to support the labor costs of university faculty and students who come to work on-site with Sandia staff. By working through the MESA Institute with Sandia line organizations, researchers can obtain both supplemental support for project labor costs and access to Sandia's world-class facilities and capabilities in the MEMS area. Projects for which on-site work at Sandia would be beneficial should consider this MESA Institute option as part of their proposal. More information on the MESA Institute can be found at <http://www.sandia.gov/mesa/institute/institute.htm>.

III. ELIGIBILITY INFORMATION

Limitation on eligible topics: The proposed effort should address only one of the focus areas and be related to either validation of models intrinsic to high performance computing or to the development of modeling protocols and computational procedures which materially accelerate and improve such computations relative to their specific focus area.

IV. AWARD INFORMATION

Awards may be funded by Sandia or NSF. The NSF awards will be made as standard or continuing grants, funded at a typical annual range of \$80,000/year for an individual investigator or small groups (three to four investigators) award for a duration of three years pending the availability of funds. The Sandia awards will be contracts for three years. NSF and Sandia will determine which organization will fund individual projects. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (*required*):

A 100-word abstract must be submitted by the PI in response to this solicitation. It is requested that such submission be done at the earliest possible convenience. The abstract should be submitted to both the contact person for general information at NSF ghazelri@nsf.gov and at Sandia hsmorga@sandia.gov no later than January 6, 2003. The abstract should contain the following:

- a title with a maximum of 12 words;
- names of all investigators and their institutions;
- a concise statement of research goals; and
- a concise description of relevance.

The descriptions of Goals and Relevance are limited to a total of 100 words. No fax or mail copies of the abstracts will be accepted. Abstracts that do not specifically address the overall aims of this solicitation will be judged to be nonresponsive.

Abstracts that address the overall aims of this solicitation, such as directing the effort to only one of the focus areas and proposing research related to either validation of models intrinsic to high performance computing or to the development of modeling protocols and computational procedures which materially accelerate and improve such computations relative to their specific focus area, will be accepted. PIs of such abstracts will be notified by e-mail no later than January 21, 2003, and will be invited to submit a full proposal.

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/cgi-bin/getpub?gpg>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

A. General Information

NSF and Sandia will use a two-step process for proposal submission and evaluation under this solicitation. As the first step, proposers must submit an abstract. If the abstract is judged to address the overall aims of this solicitation, the PI will be invited to submit a full proposal (second step).

B. Proposal Preparation Instructions.

Only invited proposals, selected on the basis of review of abstracts, will be considered by NSF and Sandia in this competition.

Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the Grant Proposal Guide (GPG), NSF 03-2. The complete text of the GPG (including electronic forms) is available electronically on the NSF Web site at: <http://www.nsf.gov>.

THE PROPOSAL MUST INCLUDE A SEPARATE DISCLOSURE AUTHORIZATION PAGE. THIS PAGE MUST STATE THE FOLLOWING:

AUTHORIZATION TO DISCLOSE PROPOSAL AND REVIEW MATERIALS TO SANDIA NATIONAL LABORATORIES

We acknowledge by submission of this proposal that we understand that the program announcement "Engineering Sciences for Modeling, Simulation, Decision-Making and Emerging Technologies" is a joint initiative of the National Science Foundation and the Sandia National Laboratories, and the submitted proposals and review materials will be shared with the Sandia National Laboratories for the purposes of proposal evaluation. We authorize the National Science Foundation to disclose this proposal and all associated materials and review documents to the Sandia National Laboratories and its representatives for the purpose of evaluation and selection of proposals.

NOTE THAT SUBMISSION OF A PROPOSAL AND CONSENT TO DISCLOSE ARE VOLUNTARY. HOWEVER, FAILURE TO AUTHORIZE DISCLOSURE WILL PRECLUDE REVIEW OF YOUR PROPOSAL UNDER THIS JOINT INITIATIVE AND WILL RESULT IN INELIGIBILITY FOR AN AWARD UNDER THIS ANNOUNCEMENT.

Proposers are reminded to identify the program announcement/solicitation number (03-505) 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 in proposals submitted under this Program Solicitation.

C. Due Dates

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

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

January 06, 2003
100-Word Abstract Required

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

March 14, 2003
By invitation only

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: <http://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 judgements.

What is the intellectual merit of the proposed activity?

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

concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

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

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

Integration of Research and Education

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

Integrating Diversity into NSF Programs, Projects, and Activities

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

Additional Review Criteria

In addition to the above criteria, proposals in the focus area of Engineering Design (see Section II.c) will be judged in terms of their ability/potential to provide sweeping theories that will cover and regularize wide ranges of engineering design. Proposals that address modeling and simulation uncertainty will be judged in terms of their ability/potential to provide general approaches to, and new theories for, uncertainty estimation in modeling and simulation-based design.

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 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.

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.

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 also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). 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/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 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/cgi-bin/getpub?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:

Notification of the Award

The final award recommendations will be a joint decision of a working group comprised of program officers from NSF and Sandia. Grants from NSF or contracts from Sandia will be funded totally by either agency. Notification of Program Officers' recommendation will be made to the Principal Investigator by June 28, 2003.

Notification of an award from NSF is made to the submitting organization by a Grants Officer in the Division of Grants and Agreements (DGA). 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 to the Principal Investigator. Sandia contracts will be administered in accordance with their policies and procedures.

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.

In addition to standard NSF reporting requirements, principal investigators funded under this program will be required to attend an annual progress review meeting each year while funding for the project is in force. Travel expenses for this meeting will come from the award.

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 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. 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:

- George A. Hazelrigg, Group Leader, Directorate for Engineering, Division of Design, Manufacture, & Industrial Innovation, 550 S, telephone: (703) 292-7068, fax: (703) 292-9056, email: ghazelri@nsf.gov
- Richard N. Smith, Program Director, Directorate for Engineering, Division of Chemical & Transport Systems, 525 N, telephone: (703) 292-8371, fax: (703) 292-9054, email: rsmith@nsf.gov
- Ken P. Chong, Program Director, Directorate for Engineering, Division of Civil & Mechanical Systems, 545 S, telephone: (703) 292-8360, fax: (703) 292-9053, email: kchong@nsf.gov
- James W. Mink, Program Director, Directorate for Engineering, Division of Electrical & Communications Systems, 675 S, telephone: (703) 292-8339, fax: (703) 292-9147, email: jmink@nsf.gov
- Charalabos Doumanidis, Program Director, Directorate for Engineering, Division of Design, Manufacture, & Industrial Innovation, 531 S, telephone: (703) 292-7088, fax: (703) 292-9056, email: cdoumani@nsf.gov
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- Dr.Art C Ratzel, Sandia National Laboratories, telephone: (505) 844-4759, email: acratze@sandia.gov
- Dr.Martin Philch, Sandia National Laboratories, telephone: (505) 845-3047, email: mpilch@sandia.gov
- Dr.Mark L Kiefer, Sandia National Laboratories, telephone: (505) 845-7271, email: mlkiefe@sandia.gov
- DrJill M Hruby, Sandia National Laboratories, telephone: (925) 294-2596, email: jmhruby@sandia.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, National Science Foundation, telephone: (800) 675-6188, email: fastlane@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 *Custom News Service* (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become available.

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

- **To Order Publications or Forms:**

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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.

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