

Mathematical Sciences: Innovations at the Interface with the Physical and Computer Sciences and Engineering

Program Solicitation

NSF 05-622

Replaces Document NSF 04-538



National Science Foundation

Directorate for Mathematical and Physical Sciences

Division of Mathematical Sciences

Directorate for Computer and Information Science and Engineering

Directorate for Engineering

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

December 20, 2005

For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Astronomy

December 20, 2005

For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Materials Research

January 13, 2006

For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Chemistry

March 01, 2006

For Interactions between Mathematical Sciences and Computer Science (MSPA-MCS)

Full Proposal Deadline(s):

No fixed deadline

For Interactions between Mathematical Sciences and Engineering (MSPA-ENG). Most due dates fall between October 1, 2005 and March 1, 2006, see full text of the solicitation for specifics.

REVISIONS AND UPDATES

This is a revision of document [NSF 04-538](#) which announced competitions of nine activities of the Mathematical Sciences Priority Area (MSPA) in Fiscal 2004-2005. This revision contains the following specific changes from [NSF 04-538](#):

1. It provides upcoming proposal deadlines and full descriptions for three of the nine MSPA activities that were described by [NSF 04-538](#). The three activities are:

- Interactions between Mathematical Sciences and Computer Science (MSPA-MCS)

- Interactions between Mathematical Sciences and Engineering (MSPA-ENG)
 - Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS)
2. It provides a revised description of areas of interest for Interactions between Mathematical Sciences and Computer Science.
 3. It provides a list of five MSPA activities that were described in [NSF 04-538](#) and that have separate existing solicitations. Links to those separate solicitations are provided. The five activities are:
 - Collaborations in the Mathematical Geosciences (CMG)
 - Joint DMS/BIO/NIGMS Initiative to Support Research in the Area of Mathematical Biology
 - Focused Research Groups in the Mathematical Sciences (FRG)
 - Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21)
 - Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM)
 4. It lists one additional MSPA activity entitled, Mathematical Social and Behavioral Sciences (MSBS) that began after the publication of [NSF 04-538](#). The MSBS has its own solicitation, the link of which is also provided.
 5. [NSF 04-538](#) contained another MSPA activity entitled, New Mathematical and Statistical Tools for Understanding Complex Systems in the Environment. This activity is not continued, hence the revision does not contain this activity.

This revision includes all the interdisciplinary activities under MSPA, three of which are given full descriptions, while others that have separate solicitations are listed with links. The intention is to facilitate researchers who are interested in MSPA to find relevant information. Researchers interested in the three MSPA activities that are described in this solicitation can get the details from this solicitation. Researchers interested in the other MSPA activities with separate solicitations can access them via the links provided in this solicitation.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Mathematical Sciences: Innovations at the Interface with the Physical and Computer Sciences and Engineering

Synopsis of Program:

This solicitation describes the opportunities available for support through the Foundation's Mathematical Sciences Priority Area in the following three categories:

- Interactions between Mathematical Sciences and Computer Science (MSPA-MCS)
- Interactions between Mathematical Sciences and Engineering (MSPA-ENG)
- Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS)

Other Opportunities supported through the Mathematical Sciences Priority Area are described in other existing solicitations. They are listed below for information and completeness of the existing competitions in the Mathematical Sciences Priority Area. Investigators interested in the following competitions should consult with the specific solicitations listed below:

- Collaborations in the Mathematical Geosciences (CMG), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05535
- Joint DMS/BIO/NIGMS Initiative to Support Research in the Area of Mathematical Biology, see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04572
- Focused Research Groups in the Mathematical Sciences, (FRG), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf02129
- Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf03055

[nsf.gov/publications/pub_summ.jsp?ods_key=nsf05595](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05595)

- Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04546
- Mathematical Social and Behavioral Sciences (MSBS), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05542

Investments in the Mathematical Sciences Priority Area will deepen support for fundamental research in mathematics and statistics, and the integration of mathematical and statistical research across the full range of science and engineering disciplines. Investments in interdisciplinary research will focus primarily on mathematical and statistical challenges posed by large data sets, managing and modeling uncertainty, and modeling complex nonlinear systems. Innovative educational activities that foster closer connections between research and education in the mathematical sciences will also be supported.

Cognizant Program Officer(s):

- Please see the full text of this funding opportunity for contact information.

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

- 47.070 --- Computer and Information Science and Engineering
- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences

Eligibility Information

- **Organization Limit:** None Specified.
- **PI Eligibility Limit:**

This solicitation covers three categories of activities. Please see Section II for further information on each of the three categories.

- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 55 to 70
- **Anticipated Funding Amount:** \$15,400,000 This figure is the total amount, subject to availability of funds in FY 2006, for the three categories of activities described in this solicitation, see the full text for more details.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements 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:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m. submitter's local time):
December 20, 2005

For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Astronomy

December 20, 2005

For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Materials Research

January 13, 2006

For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Chemistry

March 01, 2006

For Interactions between Mathematical Sciences and Computer Science (MSPA-MCS)

- **Full Proposal Deadline Date(s):**

No fixed deadline

For Interactions between Mathematical Sciences and Engineering (MSPA-ENG). Most due dates fall between October 1, 2005 and March 1, 2006, see full text of the solicitation for specifics.

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria apply.

Award Administration Information

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

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I. INTRODUCTION

Today's discoveries in science, engineering and technology are intertwined with advances across the mathematical sciences. New mathematical tools disentangle the complex biotic and abiotic processes that drive the climate system; mathematics illuminates the interaction of magnetic fields and fluid flows in the hot plasmas within stars; and mathematical modeling plays a key role in research on micro-, nano-, and optical devices. Innovative optimization methods form the core of computational algorithms that provide decision-making tools for Internet-based business information systems.

The fundamental mathematical sciences - embracing mathematics and statistics - are essential not only for the progress of research across disciplines, they are also critical to training a mathematically literate workforce for the future. Technology-based industries which help fuel the growth of the U.S. economy and increasing dependence on computer control systems, electronic data management, and business forecasting models, demand a workforce with effective mathematical and statistical skills, well-versed in science and engineering.

It is vital for mathematicians and statisticians to collaborate with engineers and scientists to extend the frontiers of discovery where science and mathematics meet, both in research and in educating a new generation for careers in academia, industry, and government. For the United States to remain competitive among other nations with strong traditions in mathematical sciences education, we must attract more young Americans to careers in the mathematical sciences. These efforts are essential for the continued health of the nation's science and engineering enterprise.

The goal of the Mathematical Sciences Priority Area (MSPA) is to advance frontiers in three interlinked areas: (1) fundamental mathematical and statistical sciences, (2) interdisciplinary research involving the mathematical and statistical sciences with science and engineering, and (3) critical investments in mathematical and statistical sciences that embed training in research activities.

Investments in the Mathematical Sciences Priority Area will deepen support for fundamental research in mathematics and statistics and the integration of mathematical and statistical research across the full range of science and engineering disciplines. Investments in interdisciplinary research will focus primarily on three scientific themes:

- Mathematical and statistical challenges posed by large data sets
- Managing and modeling uncertainty, and
- Modeling complex nonlinear systems.

These themes provide the basis for most of the interdisciplinary competitions that are part of the MSPA. Innovative educational activities that foster closer connections between research and education in the mathematical sciences will also be supported.

Existing competitions with separate solicitations as part of the MSPA include the following:

- Collaborations in the Mathematical Geosciences (CMG), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05535
- Joint DMS/BIO/NIGMS Initiative to Support Research in the Area of Mathematical Biology, see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04572
- Focused Research Groups in the Mathematical Sciences, (FRG), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf02129
- Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05595
- Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04546
- Mathematical Social and Behavioral Sciences (MSBS), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05542

These existing competitions are listed here for information only and will not be described hereafter.

This solicitation provides descriptions of the following three broad categories of activities supported through the MSPA:

- Interactions between Mathematical Sciences and Computer Science (MSPA-MCS)
- Interactions between Mathematical Sciences and Engineering (MSPA-ENG)
- Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS)

Investigators wishing to submit proposals to one of these activities are encouraged to read the full text of this solicitation for program descriptions, proposal due dates, eligibility and award information. Proposers are also encouraged to contact one of the cognizant program officers listed in the full text of this solicitation. Proposals in the mathematical sciences may also be submitted to programs in the Division of Mathematical Sciences; further information on these may be found at <http://www.nsf.gov/mps/divisions/dms/>

II. PROGRAM DESCRIPTION

This solicitation describes funding opportunities in the following three broad categories of activities:

- Interactions between the Mathematical Sciences and Computer Science (MSPA-MCS)
- Interactions between the Mathematical Sciences and Engineering (MSPA-ENG)
- Interactions between the Mathematical Sciences and the Physical Sciences (MSPA-MPS)

1. Interactions between the Mathematical Sciences and Computer Science (MSPA-MCS)

1.1 MSPA-MCS Description:

In FY 2006, the Division of Mathematical Sciences (DMS) of the Directorate for Mathematical and Physical Sciences and the Division of Computing and Communication Foundations (CCF) of the Directorate for Computer and Information Science and Engineering of the National Science Foundation (NSF) plan to support projects of mutual interest in specific areas. More precisely, we plan to support research and development teams focusing on mathematical and computational innovations relevant to the following areas of specific interest:

- Mathematical and statistical models, computational theory and algorithms for high-dimensional, under-sampled data sets
- Algorithms for scalable scientific computation
- Models and algorithms for graphics and visualization

As this joint funding will focus on areas of mutual interest, proposals must originate from teams involving collaborators of mathematical scientists and computer scientists. We seek proposals that offer new approaches and promise significant breakthroughs in these areas that aim to develop rigorous mathematical and computational foundations to advance our understanding in both the mathematical sciences and computer science. Thus, proposals for incremental improvements of ongoing efforts are not eligible for this competition. Furthermore, proposals that appear to be requests to augment existing resources for current projects are not eligible for this competition.

1.2 MSPA-MCS Full Proposal Deadline:

March 1, 2006

Proposals submitted to this competition should identify this program solicitation number in the program announcement/solicitation block on the proposal cover sheet. The NSF organizational unit to which proposals should be directed is DMS - Mathematical Sciences Priority Area. Proposal title should begin with the phrase MSPA-MCS: followed by a project title.

1.3 MSPA-MCS Eligibility Information

Organization Limit: None

PI Eligibility Limit: No individual may be PI, or CO-PI, or senior personnel of more than one proposal submitted in response to this category of this solicitation.

1.4 MSPA-MCS Cognizant Program Officers:

Investigators who wish further information should contact one of the following:

Tie Luo, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: (703) 292-8448, email: tluo@nsf.gov

Haesun Park, Program Director, Directorate for Computer and Information Science and Engineering, Division of Computing and Communication Foundations, telephone: (703) 292-8910, email: hpark@nsf.gov

Lawrence Rosenblum, Program Director, Directorate for Computer and Information Science and Engineering, Division of Computing and Communication Foundations, telephone: (703) 292-8910, email: lrosenbl@nsf.gov

Robert Serfling, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: (703) 292-4884, email: rserflin@nsf.gov

Junping Wang, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: (703) 292-4488, email: jwang@nsf.gov

1.5 MSPA-MCS Award Information:

Anticipated Type of Award: Standard grants

Estimated Number of Awards: 5 to 10 Team Grants.

Anticipated Funding Amount: \$4.5 million, subject to availability of funds. Award sizes for each team project are expected to range from \$150,000 - \$200,000 per year for up to three years duration.

2. Interactions between the Mathematical Sciences and Engineering (MSPA-ENG)

2.1 MSPA-ENG Description:

As part of the NSF-wide Mathematical Sciences Priority Area (MSPA), the Division of Mathematical Sciences (DMS) and the Directorate for Engineering (ENG) anticipate funding projects of mutual interest. The research envisioned in this program will seek to build new mathematical and statistical methods and structures within the context of meaningful engineering applications. Appropriate for inclusion under this program are proposals that address the broad topical areas of large data sets (e.g., inference, learning and real-time dynamic optimization), modeling and handling uncertainty (e.g., decision-making under uncertainty) and enhancing the understanding and management of complex systems (e.g., modeling, control and optimization of systems involving multiple scales in time and space). Proposed projects should be innovative and strive for breakthroughs rather than incremental improvement, and should be of compelling independent interest within both the engineering and mathematical and statistical sciences communities. Proposals should focus on developing, extending and analyzing general-purpose mathematical and statistical methods. Efforts at a greater unification of methods, approaches and principles are welcome.

Proposals should be submitted to the relevant organizational units (that is, disciplinary programs) within ENG or DMS in accordance with the deadline or target date or submission window of that program. Proposals should briefly self-identify with clear language in the Project Summary that they are appropriate for cooperative consideration between the pertinent division in ENG and DMS. The program chosen for submission should be the most natural home to the science of the project. Proposals can be submitted to both the ENG and DMS programs, where the first named program will serve as the home division.

Proposals will be reviewed by the normal processes for these units including joint cross-disciplinary reviews whenever possible and as appropriate. Interdisciplinary teams of engineers and mathematical scientists are particularly desirable for this activity. The most competitive proposal will be those that are of interest to both the mathematical sciences and at least one of the engineering programs.

Six divisions within the Directorate for Engineering (<http://www.eng.nsf.gov>), along with DMS, will participate in the MSPA in FY 2006. To locate appropriate disciplinary programs and their due dates, investigators are directed to the following web sites.

<http://www.nsf.gov/div/index.jsp?div=BES> Division of Bioengineering and Environmental Systems (BES)

<http://www.nsf.gov/div/index.jsp?div=CMS> Division of Civil and Mechanical Systems (CMS)

<http://www.nsf.gov/div/index.jsp?div=CTS> Division of Chemical and Transport Systems (CTS)

<http://www.nsf.gov/div/index.jsp?div=DMI> Division of Design and Manufacturing Innovation (DMI)

<http://www.nsf.gov/div/index.jsp?div=ECS> Division of Electrical and Communication Systems (ECS)

<http://www.nsf.gov/div/index.jsp?div=EEC> Division of Engineering Education and Centers (EEC)

<http://www.nsf.gov/div/index.jsp?div=DMS> Division of Mathematical Sciences (DMS)

2.2 MSPA-ENG Proposal Due Dates:

Proposals in response to this solicitation should be submitted in accordance with the due dates of the relevant disciplinary program that is designated as the lead program. However, unsolicited proposals and proposals not in response to this solicitation that are submitted to the disciplinary programs of the pertinent divisions (listed above) and address the research topics of interest to this program (see 2.1 above for description) will be included for funding consideration under this program.

2.3 MSPA-ENG Cognizant Program Officers:

For additional information, individuals are encouraged to contact these resource persons associated with the various divisions.

Radhakishan Baheti, Program Director, Directorate for Engineering, Division of Electrical and Communications Systems, telephone: 703-292-8339, e-mail: rbaheti@nsf.gov

Frederick Heineken, Program Director, Directorate for Engineering, Division of Bioengineering and Environmental Systems, telephone: 703-292-8320, e-mail: fheineke@nsf.gov

Wen Masters, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4871, e-mail: wmasters@nsf.gov

Stephen Nash, Program Director, Directorate for Engineering, Division of Design and Manufacturing Innovation, telephone: 703-292-8330, e-mail: snash@nsf.gov

Robert Norwood, Program Director, Directorate for Engineering, Division of Engineering Education and Centers, telephone: 703-292-7079, e-mail: rnorwood@nsf.gov

Michael Plesniak, Program Director, Directorate for Engineering, Division of Chemical and Transport Systems, telephone: 703-292-4418, e-mail: mplesnia@nsf.gov

Mario Rotea, Program Director, Directorate for Engineering, Division of Civil and Mechanical Systems, telephone: 703-292-7012, e-mail: mrotea@nsf.gov

2.4 MSPA-ENG Award Information

Anticipated Type of Award: Standard or Continuing Grant or Supplement

Estimated Number of Awards: Approximately 25 awards

Anticipated Funding Amount: \$5.8 million subject to availability of funds.

3. Interactions between the Mathematical Sciences and the Physical Sciences (MSPA-MPS)

3.1 MSPA-MPS Description:

As part of the NSF-wide Mathematical Sciences Priority Area, the Directorate for Mathematical and Physical Sciences anticipates funding projects of interest to both the mathematical sciences and the physical sciences divisions (astronomy,

chemistry, materials research, and physics). Proposals appropriate to this program are those that address at least one of the following broad interdisciplinary topic areas: (1) mathematical and statistical challenges posed by large data sets, (2) managing and modeling uncertainty, and (3) modeling complex nonlinear systems. Proposed projects should be innovative and strive for breakthroughs rather than incremental improvement, and should be of compelling independent interest within both the physical sciences and mathematical and statistical sciences communities. Requests for supplementary funding that will significantly enhance existing projects in these areas and for workshops will also be considered.

Proposals should be submitted to the relevant organizational units (that is, disciplinary programs) within one of the five MPS divisions (listed below) and must follow the deadline or target date of that program. Proposals must briefly self-identify with clear language in the Project Summary that they are appropriate for cooperative consideration between DMS and one or more of the other four divisions of MPS. The program chosen for submission should be the most natural home to the science of the project. Proposals can be submitted to both the DMS and other MPS programs, where the first named program will serve as the home division.

Proposals will be reviewed by the normal processes (mail and/or panel review) for these units except that joint cross-disciplinary reviews will be included whenever possible. The most competitive proposals will be those that are of interest to both the mathematical sciences and at least one of the physical sciences. The five divisions within the Directorate for Mathematical and Physical Sciences (<http://www.nsf.gov/dir/index.jsp?org=MPS>) will participate in the MSPA in FY 2006. To locate appropriate disciplinary programs and target date/proposal submission window information, investigators are directed to the following web sites:

<http://www.nsf.gov/div/index.jsp?div=AST> Division of Astronomical Sciences

<http://www.nsf.gov/div/index.jsp?div=CHE> Division of Chemistry

<http://www.nsf.gov/div/index.jsp?div=DMR> Division of Materials Research

<http://www.nsf.gov/div/index.jsp?div=DMS> Division of Mathematical Sciences

<http://www.nsf.gov/div/index.jsp?div=PHY> Division of Physics

3.2 MSPA-MPS Proposal Due Dates:

Proposals in response to this solicitation should be submitted by the deadlines specified in the Due Dates section of this solicitation and designate an appropriate disciplinary program as the lead program. However, unsolicited proposals and proposals not in response to this solicitation that are submitted to the disciplinary programs of the pertinent divisions (listed above) and address the research topics of interest to this program (see 3.1 above for description) will be included for funding consideration under this program.

3.3 MSPA-MPS Cognizant Program Officers:

For additional information, individuals are encouraged to contact these resource persons associated with the various divisions.

Daryl Hess, Program Director, Directorate for Mathematical and Physical Sciences, Division of Materials Research, Room 1065, telephone: 703-292-4942, e-mail: dhess@nsf.gov

Raima Larter, Program Director, Directorate for Mathematical and Physical Sciences, Division of Chemistry, Room 1055, telephone: 703-292-5344, e-mail: rlarter@nsf.gov

Earle Lomon, Program Director, Directorate for Mathematical and Physical Sciences, Division of Physics, Room 1015, telephone: 703-292-7382, e-mail: elomon@nsf.gov

Tie Luo, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-8448, e-mail: tluo@nsf.gov

Wen Masters, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4871, e-mail: wmasters@nsf.gov

3.4 MSPA-MPS Award Information

Anticipated Type of Award: Standard or Continuing Grant or Supplement

Estimated Number of Awards: Approximately 25-35 awards.

Anticipated Funding Amount: \$5.1 million subject to availability of funds.

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the [Grant Proposal Guide](#) are eligible to submit proposals under this program solicitation. In addition, the following apply:

Organization Limit: None specified.

PI Eligibility Limit: This solicitation covers three categories of activities. Please see Section II of this solicitation for further information on each of the three categories.

Limit on Number of Proposals: None specified.

IV. AWARD INFORMATION

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

This solicitation covers three categories of activities. Please see Section II for further award information on each of the three categories.

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.

Proposals being submitted in response to this specific solicitation must follow the GPG Guidelines and the instructions as to proposal format and other requirements stated in the solicitation. In addition, please note and follow any specific instructions with respect to the relevant organizational unit to which a proposal must be submitted and the format for proposal titles, as well as other items described in the full text of this solicitation that supplement the GPG Guidelines.

Proposers are reminded to identify the program announcement/solicitation number (05-622) 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.

C. Due Dates

Proposals submitted in response to this announcement/solicitation will be accepted at any time.

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

December 20, 2005
For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Astronomy

December 20, 2005
For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Materials Research

January 13, 2006
For Interactions between Mathematical Sciences and Physical Sciences (MSPA-MPS), pertaining to interactions with Chemistry

March 01, 2006
For Interactions between Mathematical Sciences and Computer Science (MSPA-MCS)

Full Proposal Deadline(s) :

No fixed deadline
For Interactions between Mathematical Sciences and Engineering (MSPA-ENG). Most due dates fall between October 1, 2005 and March 1, 2006, see full text of the solicitation for specifics.

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.

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.

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>.

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.

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:

This solicitation covers three categories of activities. Please see Section II of this solicitation for contact information on each of the three categories .

For questions related to the use of FastLane, contact:

- Florence Rabanal, Electronic Business Coordinator, Directorate for Mathematical & Physical Sciences, 1005 N, telephone: (703) 292-8808, fax: (703) 292-9151, email: frabanal@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.

Existing competitions with separate solicitations as part of the Mathematical Sciences Priority Area include the following:

- Collaborations in the Mathematical Geosciences (CMG), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05535
- Joint DMS/BIO/NIGMS Initiative to Support Research in the Area of Mathematical Biology, see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04572
- Focused Research Groups in the Mathematical Sciences, (FRG), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf02129
- Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05595
- Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04546
- Mathematical Social and Behavioral Sciences (MSBS), see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05542

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 (FASSED) 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.