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

Program Solicitation
NSF 04-538

National Science Foundation
Directorate for Mathematical and Physical Sciences
    Division of Mathematical Sciences
Directorate for Biological Sciences
Directorate for Computer and Information Science and Engineering
Directorate for Education and Human Resources
Directorate for Engineering
Directorate for Geosciences
Office of Polar Programs
Directorate for Social, Behavioral, and Economic Sciences

Due Dates:

October 01, 2003 - April 07, 2004
    Deadlines, target dates and submission windows in FY 2004 vary by competition category. See full text of this solicitation for detailed information.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

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

Synopsis of Program:

This solicitation describes many of the opportunities available for support through the Foundation's Mathematical Sciences Priority Area (MSPA). Investments in the Mathematical Sciences 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. Initial 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. In FY2004, a set of focused competitions will be supported; these are described or referenced in this solicitation.

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):

- 47.074 --- Biological Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.076 --- Education and Human Resources
- 47.041 --- Engineering
- 47.050 --- Geosciences
- 47.049 --- Mathematical and Physical Sciences
- 47.078 --- Office of Polar Programs
- 47.075 --- Social, Behavioral and Economic Sciences

Eligibility Information

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

  Please see the full text of this solicitation for further information.

- **Limit on Number of Proposals:** Please see the full text of this solicitation for further information.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 70 to 80
- **Anticipated Funding Amount:** $18,660,000 This figure is the total amount, subject to availability of funds in FY 2004, for categories 1 and 2 in this solicitation; it does not include funding for categories 3 and 4 - see 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.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Due Dates

- **Due Dates:**

  October 01, 2003 - April 07, 2004
  Deadlines, target dates and submission windows in FY 2004 vary by competition category. See full

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 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. Initial 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.

This solicitation describes many of the opportunities available as part of the MSPA for addressing some of the issues listed above. In FY2004, a set of focused competitions will be held; these are described or referenced in this solicitation. In future years, it is expected that some of these competitions will be broadened in scope.

Investigators wishing to submit proposals to one of these activities are encouraged to contact one of the cognizant program officers listed. 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 both new and existing competitions that are part of the Mathematical Sciences Priority Area.

1. New activities with specific deadline dates include:

(a) New Mathematical and Statistical Tools for Understanding Complex Systems in the Environment

(b) Interactions Between the Mathematical Sciences and Computer Science

2. Activities covered by existing target dates or deadlines previously announced for FY 2004 include the following. Proposals already submitted that meet the guidelines for these activities may be considered for funding (see the descriptions below and Section IV for further details):

(a) Interactions Between the Mathematical Sciences and Engineering

(b) Interactions Between the Mathematical Sciences and the Physical Sciences

3. Existing activities, covered by separate solicitations and summarized in this document for information purposes, include the following:

(a) Collaborations in the Mathematical Geosciences (CMG)

(b) Joint DMS/BIO/NIGMS Initiative to Support Research in the Area of Mathematical Biology

(c) Focused Research Groups in the Mathematical Sciences (FRG)

(d) Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21)

The existing activities are fully described in separate solicitations. URLs for these solicitations are provided at the end of each summary description of the activity (see below).

4. Over the next few months, it is expected that competitions involving (a) undergraduate research activities on the interface between the mathematical sciences and biology and (b) interactions between the mathematical sciences and the social, behavioral, and economic sciences will be announced. Preliminary information about (a) is provided later in this document.

1.(a) NEW MATHEMATICAL AND STATISTICAL TOOLS FOR UNDERSTANDING COMPLEX SYSTEMS IN THE ENVIRONMENT

The National Science Foundation announces a competition focusing on new mathematical and statistical ideas and tools for understanding and modeling complex systems in the environment. New instrumentation, data handling, and methodological capabilities have expanded the horizons of what scientists can study and understand about the biotic and abiotic components of the environment. These advances create the demand for collaborative teams that go beyond current disciplinary research and educational frameworks. This new competition is aimed at developing the mathematical and statistical tools and approaches essential for the creative advancement of research in the science of complex systems. Research into complex systems is needed to understand how to integrate spatial and temporal scales of organization, drawing from different disciplines and facilitating the synergy that results from partnerships between mathematical scientists and other scientists. The synthesis of knowledge about the environment depends on the development of robust theoretical and empirical understanding of complex systems, including the capacity for self-organization, resilience, and adaptation. Integrated models of complex systems in the environment require the integration of measurements, initial assumptions, uncertainty of events, and model performance. Understanding complex human and natural systems requires the development of sophisticated interdisciplinary models - conceptual, mathematical, statistical, and computational - that can represent the nonlinearities encountered in these systems and provide a deeper understanding of the resulting behavior.

Proposals should address questions involving the fundamentals of complex systems at the interface between the mathematical sciences and the sciences related to the biotic and abiotic environment. We seek proposals that offer *new* mathematical and statistical approaches to the study of complex systems that are characteristic of those encountered in environmental science areas. Of particular interest are proposals that offer the possibility of new insights into the dynamical consequences of nonlinearity and high dimensionality. The most competitive proposals are likely to involve an investigator or teams of investigators with strengths in both the mathematical sciences and the applications areas. Proposals for incremental improvements of ongoing efforts will not be competitive in this competition. Proposals submitted to this competition must include an explanation, not to exceed one page, of how the project will lead to new mathematical or statistical approaches to, or insights about, the fundamentals of complex systems that exhibit some of the challenging aspects of complexity relevant to systems in the environment. It should also explain how the project shows promise of significant breakthroughs and represents substantial intellectual differences from ongoing work. This should be included within the Project Description. The Project Description should not exceed fifteen pages in length.

Some of the scientific issues in these applications that may be addressed by new mathematical or statistical tools are discussed in a recent report that provides an overview of complex systems in the environment. It may be accessed at:

http://www.nsf.gov/geo/ere/ereweb/acere_synthesis_rpt.cfm

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 must be either DMS-Applied Mathematics or DMS-Statistics and the title of the project should have the form: MSPA-CSE: proposal title**

1(a).1 ELIGIBILITY INFORMATION:

* Organizational Limit: None

* PI Eligibility Limit: No individual above the rank of post-doctoral researcher, or equivalent, may be part of more than one proposal submitted in response to this category of this solicitation.

* Limit on Number of Proposals: No individual above the rank of post-doctoral researcher, or equivalent, may be part of more than one proposal submitted in response to this category of this solicitation.

* Scientific Eligibility: Proposals submitted to this competition must include an explanation, not to exceed one page, in the 15 page project description, stating why the submission meets these eligibility standards for new approaches, promise of significant breakthroughs, and substantial intellectual differences from ongoing work.

1.(a).2 COGNIZANT PROGRAM OFFICERS:

For additional information, individuals are encouraged to contact these resource persons associated with the participating NSF units:

* Xuming He, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4876, e-mail: xhe@nsf.gov

* Stephen Meacham, Program Director, Directorate for Geosciences, telephone: 703-292-8527, e-mail: smeacham@nsf.gov

* James Morris, Program Director, Directorate for Biological Sciences, telephone: 703-292-8481, e-mail: jmorris@nsf.gov

* Carolyn Ruppel, Program Director, Directorate for Geosciences, telephone: 703-292-8581, e-mail: cruppel@nsf.gov

* Thomas Russell, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4863, e-mail: trussell@nsf.gov

* Samuel Scheiner, Program Director, Directorate for Biological Sciences, telephone: 703-292-8481, e-mail: sscheine@nsf.gov

* Nicholas Clesceri, Program Director, Directorate for Engineering, telephone: 703-292-7940, e-mail: nclescer@nsf.gov

* Cheryl Eavey, Program Director, Directorate for Social, Behavioral, and Economic Sciences, telephone: 703-292-7269, e-mail: ceavey@nsf.gov

* William Wiseman, Program Director, Office of Polar Programs, telephone: 703-292-4750, e-mail: wwiseman@nsf.gov

1.(a).3 FULL PROPOSAL DEADLINE: April 7, 2004 for FY 2004; November 15, 2004 for FY 2005

1.(a).4 AWARD INFORMATION

* Anticipated Type of Award: Standard or Continuing Grant

* Estimated Number of Awards: Approximately 10 awards, of up to 4 years duration and up to $800,000 per award.

* Anticipated Funding Amount: Approximately $3.78 million in FY 2004, subject to availability of funds.

1.(b) INTERACTIONS BETWEEN THE MATHEMATICAL SCIENCES AND COMPUTER SCIENCE

In FY 2004, 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:

*   Algebraic and Geometric Algorithms

*   Algorithms for Scalable Scientific Computation

*   Algorithms for Visualization

*   Statistical Learning Algorithms

As this joint funding will focus on areas of mutual interest, proposals must originate from teams involving collaborations of mathematical scientists and computer scientists. We seek proposals that offer new approaches and promise significant breakthroughs in these areas. 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. Proposals submitted to this competition must include an explanation, not to exceed one page, in the 15 page project description, stating why the submission meets these eligibility standards of new approaches, promise of

significant breakthroughs, and substantial intellectual differences from on-going work.

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-Infrastructure and the title of the project should have the form: MSPA-MCS: proposal title.**

1.(b).1 ELIGIBILITY INFORMATION

* Organization Limit: None

* PI Eligibility Limit: No individual may be part of more than one proposal submitted in response to this category of this solicitation.

* Limit on Number of Proposals: No individual may be part of more than one proposal submitted in response to this category of this solicitation.

Scientific Eligibility: Proposals submitted to this competition must include an explanation, not to exceed one page, in the 15 page project description, stating why the submission meets these eligibility standards of new approaches, promise of significant breakthroughs, and substantial intellectual differences from on-going work.

Prospective PIs who wish further information should contact one of the following:

1.(b).2 COGNIZANT PROGRAM OFFICERS:

* S. Kamal Abdali, Directorate for Computer and Information Science and Engineering, Division Director, Division of Computing and Communication Foundations, telephone: (703) 292-8910, email: kabdali@nsf.gov

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

* Roger Berger, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: (703) 292-4884, email: rberger@nsf.gov

* Benjamin Mann, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: (703) 292-4867, email: bmann@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

* Michael H. Steuerwalt, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: (703) 292-4860, email: msteuerw@nsf.gov

1.(b).3 FULL PROPOSAL DEADLINE: April 7, 2004 for FY 2004; March 1, 2005 for FY 2005

1.(b).4 AWARD INFORMATION:

* Anticipated Type of Award: Standard or Continuing Grant

* Estimated Number of Awards: 6 to 10 Team Grants.

* Anticipated Funding Amount: $3.46 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.(a) INTERACTIONS BETWEEN THE MATHEMATICAL SCIENCES AND ENGINEERING

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 in stochastic environments) 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 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.

In FY 2004, proposals that were submitted to the relevant organizational units (that is, disciplinary programs) within ENG or DMS will be reviewed by the normal processes for these units including joint cross-disciplinary reviews whenever possible and as appropriate. For future reference, most of the deadlines and target dates within ENG and DMS fall between October 1 and March 1 annually. 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.

For information purposes, in FY 2004, for unsolicited proposals mentioned above, NSF plans to recommend up to 25 awards, for a total of $5.82 million, subject to availability of funds.

Five divisions within the Directorate for Engineering (http://nsf.gov/home/eng/), along with DMS, will participate in the MSPA in FY 2004. To locate appropriate disciplinary programs, investigators are directed to the following web sites.

http://www.eng.nsf.gov/bes/   Division of Bioengineering and Environmental Systems (BES)

http://www.eng.nsf.gov/cms/   Division of Civil and Mechanical Systems (CMS)

http://www.eng.nsf.gov/cts/   Division of Chemical and Transport Systems (CTS)

http://www.eng.nsf.gov/dmii/   Division of Design, Manufacturing and Industrial Innovation (DMII)

http://www.eng.nsf.gov/ecs/   Division of Electrical and Communication Systems (ECS)

http://nsf.gov/mps/divisions/dms/ Division of Mathematical Sciences (DMS)

COGNIZANT PROGRAM OFFICERS:

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

divisions.

Contacts in the Directorate for Engineering:

* 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

* T.J. (Lakis) Mountziaris, Program Director, Directorate for Engineering, Division of Chemical and Transport Systems, telephone: 703-292-8371, e-mail: tmountzi@nsf.gov

* Suvrajeet Sen, Program Director, Directorate for Engineering, Division of Design, Manufacture, and Industrial Innovation, telephone: 703-292-7081, e-mail: ssen@nsf.gov

* Masayoshi Tomizuka, Program Director, Directorate for Engineering, Division of Civil and Mechanical Systems, telephone: 703-292-7012, e-mail: mtomizuk@nsf.gov

Contacts in the Division of Mathematical Sciences:

* Leland Jameson, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4883, e-mail: ljameson@nsf.gov

* J. Kenneth Shaw, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4859, e-mail: kshaw@nsf.gov

* Michael Steuerwalt (BES proposals only), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4860, e-mail: msteuerw@nsf.gov

2.(b) INTERACTIONS BETWEEN THE MATHEMATICAL SCIENCES AND THE PHYSICAL SCIENCES

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. 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 (see below) and 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/mps/) will participate in the MSPA in FY 2004. To locate appropriate disciplinary programs and target date/proposal submission window information, investigators are directed to the following web sites:

http://www.nsf.gov/mps/divisions/ast/   Division of Astronomical Sciences

http://www.nsf.gov/mps/divisions/che/   Division of Chemistry

http://www.nsf.gov/mps/divisions/dmr/   Division of Materials Research

http://www.nsf.gov/mps/divisions/dms/   Division of Mathematical Sciences

http://www.nsf.gov/mps/divisions/phy/   Division of Physics

2.(b).1 ELIGIBILITY INFORMATION:

The proposals being considered in FY 2004 for these funds will be those unsolicited proposals that were submitted in accordance with the programmatic target dates or proposal submission windows with the following exception(s). Proposals addressing this activity submitted to the Division of Astronomical Sciences for FY 2004 are due no later than April 7, 2004; in future years the regular AST deadline of November 15th will apply. This also applies to proposals submitted to the Division of Mathematical Sciences that address applications in astronomy.

2.(b).2 COGNIZANT PROGRAM OFFICERS:

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

Contacts in the Divisions of Astronomical Sciences, Chemistry, Materials Research, and Physics:

* 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

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

* Nigel Sharp, Program Director, Directorate for Mathematical and Physical Sciences, Division of Astronomical Sciences, Room 1030, telephone: 703-292-4905, e-mail: nsharp@nsf.gov

* Alfons Weber, Program Director, Directorate for Mathematical and Physical Sciences, Division of Chemistry, Room 1055, telephone: 703-292-4930, e-mail: aweber@nsf.gov

Contacts in the Division of Mathematical Sciences:

* Roger Berger (interactions with astronomy), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4884, e-mail: rberger@nsf.gov

* Alexandre Freire (interactions with chemistry and physics), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-8104, e-mail: afreire@nsf.gov

* Shulamith Gross (interactions with chemistry), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4868, e-mail: sgross@nsf.gov

* Hans Kaper (interactions with materials research), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4879, e-mail: hkaper@nsf.gov

* J. Kenneth Shaw (interactions with materials research), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4859, e-mail: kshaw@nsf.gov

* Henry Warchall (interactions with astronomy and physics), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, telephone: 703-292-4861, e-mail: hwarchal@nsf.gov

2.(b).3 AWARD INFORMATION

* Anticipated Type of Award: Standard or Continuing Grant or Supplement

* Estimated Number of Awards: Approximately 25-35 awards

* Anticipated Funding Amount: $5.6 million subject to availability of funds. This will be distributed for projects and supplements meeting the above eligibility information that are of interest to the mathematical sciences and (1) astronomy ($3.0 million), (2) chemistry ($0.3 million), (3) materials research ($2.0 million) and (4) physics ($0.3 million).

3.(a) COLLABORATIONS IN THE MATHEMATICAL GEOSCIENCES (CMG)

(OPPORTUNITIES FOR RESEARCH COLLABORATIONS BETWEEN THE MATHEMATICAL SCIENCES AND THE GEOSCIENCES)

The purposes of the CMG activity are: (A) to enable collaborative research at the intersection of mathematical sciences and geosciences, and (B) to encourage cross-disciplinary education through summer graduate training activities. Research topics under (A) should fall within one of three broad themes: (1) mathematical and statistical modeling of large, complex geosystems, or (2) representing uncertainty in geosystems, or (3) analyzing large geoscience data sets. Research projects supported under this activity should be essentially collaborative in nature. Research groups should include at least one mathematical scientist and at least one geoscientist. Projects under category (A) should be of three to four years in duration. It is not the intent of this activity to provide general support for infrastructure. Projects under category (B) are not restricted to topics (1) - (3). The award duration for category (B) will be two years.

COGNIZANT PROGRAM OFFICERS:

* Xuming He, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4876, fax: (703) 292-9032, email: xhe@nsf.gov

* Stephen Meacham, Directorate for Geosciences, Division of Atmospheric Sciences, 775 S, telephone: (703) 292-8527, fax: (703) 292-9022, email: smeacham@nsf.gov

* Elise Ralph, Directorate for Geosciences, Division of Ocean Sciences, 725 N, telephone: (703) 292-8580, fax: (703) 292-9085, email: eralph@nsf.gov

* Robin Reichlin, Directorate for Geosciences, Division of Earth Sciences, 785 S, telephone: (703) 292-8556, fax: (703) 292-9025, email: rreichli@nsf.gov

* Thomas Russell, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4863, fax: (703) 292-9032, email: trussell@nsf.gov

* Junping Wang, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4488, fax: (703) 292-9032, email: jwang@nsf.gov

Proposals must be submitted in accordance with the solicitation for this activity, which may be found at:

http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf04508

3.(b) JOINT DMS/BIO/NIGMS INITIATIVE TO SUPPORT RESEARCH IN THE AREA OF MATHEMATICAL BIOLOGY

The Division of Mathematical Sciences in the Directorate for Mathematical and Physical Sciences and the Directorate for Biological Sciences at the National Science Foundation and the National Institute of General Medical Sciences at the National Institutes of Health plan to support research in mathematics and statistics related to mathematical biology research. Both agencies recognize the need for additional research at the boundary between the mathematical sciences and the life sciences. This competition is designed to encourage new collaborations at this interface, as well as to support existing ones. Awards made through this competition are dependent upon responsiveness of the proposals to the announcement, the quality of the proposed research, and the availability of funds. DMS and NIGMS anticipate making 20 -25 awards totaling about $6 million, in each of fiscal years 2003-2005. The projected range is from $100,000 to $400,000 per award per year (total costs), with durations of 4-5 years. Awards made from this competition may be made by either DMS or NIGMS, at the option of the agencies, not the grantee.

COGNIZANT PROGRAM OFFICERS:

* Keith N. Crank (General Questions), Mathematical Sciences, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, Room 1025, telephone: (703) 292-4880, email: kcrank@nsf.gov

* Michael H. Steuerwalt (Mathematical Questions), Applied and Computational Mathematics, Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, Room 1025, telephone: (703) 292-4860, email: msteuerw@nsf.gov

* Roger Berger (Statistical Questions), Program Director, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, Room 1025, telephone: (703) 292-4884, email: rberger@nsf.gov

* John Whitmarsh (Biological Questions), Program Director, Division of Cell Biology and Biophysics, NIGMS, Building 45, NIGMS, NIH, telephone: 301-594-0828, email: whitmarj@nigms.nih.gov

* James Anderson (Biological Questions), Program Director, Division of Genetic and Developmental Biology, NIGMS, Room 2AS.25A, Building 45, NIGMS, NIH, telephone: 301-594-0943, email: andersoj@nigms.nih.gov

* Samuel M. Scheiner (Biological Questions), Program Director, Directorate for Biological Sciences, Division of Environmental Biology, telephone: 703-292-8481, e-mail: sscheine@nsf.gov

Proposals must be submitted in accordance with the solicitation for this activity, which may be found at: http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf02125 .

3.(c) FOCUSED RESEARCH GROUPS IN THE MATHEMATICAL SCIENCES (FRG)

The purpose of the FRG activity is to allow groups of researchers to respond to recognized scientific needs of pressing importance, to take advantage of current scientific opportunities, or to prepare the ground for anticipated significant scientific developments in the mathematical sciences. Groups may include, in addition to mathematical scientists, researchers from other science and engineering disciplines appropriate to the proposed research. The activity supports projects for which the collective effort by a group of researchers is necessary to reach the scientific goals. Projects should be scientifically focused and well-delineated. It is not the intent of this activity to provide general support for infrastructure. Projects should also be timely, limited in duration to up to three years, and substantial in their scope and impact.

COGNIZANT PROGRAM OFFICERS:

* Henry A. Warchall, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4861, fax: (703) 292-9032, email: hwarchal@nsf.gov

* John B. Conway, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4872, fax: (703) 292-9032, email: jconway@nsf.gov

* Xuming He, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4876, fax: (703) 292-9032, email: xhe@nsf.gov

* Joanna Kania-Bartoszynska, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4881, fax: (703) 292-9032, email: jkaniaba@nsf.gov

* Andrew D. Pollington, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4877, email: adpollin@nsf.gov

Proposals must be submitted in accordance with the solicitation for this activity, which may be found at: http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf02129 .

3.(d) ENHANCING THE MATHEMATICAL SCIENCES WORKFORCE IN THE 21ST CENTURY (EMSW21)

The long-range goal of the EMSW21 program is to increase the number of U.S. citizens, nationals, and permanent residents who are well-prepared in the mathematical sciences and who pursue careers in the mathematical sciences and in other NSF-supported disciplines. EMSW21 builds on the VIGRE program and now includes a broadened VIGRE activity, an additional component for Research Training Groups (RTG) in the Mathematical Sciences and an additional component for Mentoring through Critical Transition Points (MCTP) in the Mathematical Sciences.

COGNIZANT PROGRAM OFFICERS:

* John B. Conway, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4872, fax: (703) 292-9032, email: jconway@nsf.gov

* Lloyd E. Douglas, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4862, fax: (703) 292-9032, email: ldouglas@nsf.gov

* Richard Millman, Program Director (VIGRE), Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4878, email: rmillman@nsf.gov

Proposals must be submitted in accordance with the solicitation for this activity, which may be found at: http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf03575 .

4.(a) INTERDISCIPLINARY TRAINING FOR UNDERGADUATES IN BIOLOGICAL AND MATHEMATICAL SCIENCES (UBM)

The National Science Foundation plans to announce an activity for Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM); its purpose will be to enhance undergraduate education and training at the intersection of the biological and mathematical sciences and to better prepare undergraduate biology or mathematics students to pursue graduate study and careers in fields that integrate the mathematical and biological sciences. It is a joint effort of the Education and Human Resources (EHR), Biological Sciences (BIO), and Mathematical and Physical Sciences (MPS) directorates at the National Science Foundation (NSF). Projects should focus on research at the intersection of the mathematical and biological sciences, involve students from both areas in collaborative research experiences,include joint mentorship by senior faculty in both fields, and influence the direction of academic programs for a broad range of students.

COGNIZANT PROGRAM OFFICERS:

For additional information, individuals are encouraged to contact one of the following:

* Samuel Scheiner, Directorate for Biological Sciences, telephone: 703-292-8481, e-mail: sscheine@nsf.gov

* Michael H. Steuerwalt, Directorate for Mathematical and Physical Sciences, telephone: (703) 292-4860, email: msteuerw@nsf.gov

* Elizabeth Teles, Directorate for Education and Human Resources, telephone: (703) 292-8670, email: eteles@nsf.gov

* Calvin Williams, Directorate for Education and Human Resources, telephone: (703) 292-8670, email: cwilliams@nsf.gov

For further details about proposal submission requirements and guidelines and due dates, please consult the forthcoming program solicitation.

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: Please see the full text of this solicitation for further information.

Limit on Number of Proposals: Please see the full text of this solicitation for further information.

IV. AWARD INFORMATION

Anticipated Type of Award: Standard or Continuing Grant. Supplements to existing awards may be considered in certain activities; see text for details.

Estimated Number of Awards: 70 to 80

Anticipated Funding Amount: $18,660,000. This figure is the total amount, subject to availability of funds in FY 2004, for the activities described in Section II, categories 1 and 2 in this solicitation. It does not include existing (category 3) or forthcoming (category 4) activities that are or will be covered by separate solicitations and that are referenced in this solicitation.

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

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 (703) 292-7827 or by e-mail from pubs@nsf.gov.

Proposals being submitted in response to this specific solicitation and those referenced in Section II of this solicitation must follow the instructions as to proposal format and other requirements in the relevant solicitation. In addition, please note 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 detailed in Section II that supplement the GPG Guidelines. Otherwise, proposals should be prepared in accordance with the NSF Grant Proposal Guide.

Proposers are reminded to identify the program announcement/solicitation number (04-538) 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.

Budget Preparation Instructions:

Other budgetary limitations may apply. Please see the full text of this solicitation, and of the solicitations referenced, for further information.

C. Due Dates

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

Due Date(s):

October 01, 2003 - April 07, 2004
> Deadlines, target dates and submission windows in FY 2004 vary by competition category. See full text of this solicitation for detailed information.

Deadlines, Target Dates, and Proposal Submission Windows vary by competition. Please see the full text of this solicitation, and of the solicitations referenced, for this information.

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 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 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 (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/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.

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:

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

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 Custom News Service (http://www.nsf.gov/home/cns/start.htm) to be notified of new funding opportunities that become available.

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**   (703) 292-5111
  (NSF Information Center)**:**

- **TDD (for the hearing-impaired):**   (703) 292-5090 or (800) 281-8749

- **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 National Science Foundation
4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: 703-292-5111, FIRS: 800-877-8339 | TDD: 703-292-5090 or (800) 281-8749

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