

**Office of Science
Notice 02-16**

***Early Career Principal Investigator Program
in Applied Mathematics, Computer Science and High-
Performance Networks***

**Department of Energy
Office of Science**

Office of Science Financial Assistance Program Notice 02-16: Early Career Principal Investigator Program in Applied Mathematics, Computer Science and High-Performance Networks

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant applications.

SUMMARY: The Office of Advanced Scientific Computing Research (ASCR) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications for grants in support of its Early Career Principal Investigator Program. The purpose of this program is to support research in applied mathematics, computer science and networks performed by exceptionally talented scientists and engineers early in their careers. The full text of Program Notice 02-16 is available via the Internet using the following web site address: <http://www.science.doe.gov/production/grants/grants.html>.

DATES: To permit timely consideration for award in Fiscal Year 2002, completed applications in response to this notice should be received by April 17, 2002, to be accepted for merit review and funding in Fiscal Year 2002.

ADDRESS: Completed applications referencing Program Notice 02-16, should be forwarded to: U.S. Department of Energy, Office of Science, Grants and Contracts Division, SC-64, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Notice 02-16. This address must be used when submitting applications by U.S. Postal Service Express Mail or any commercial mail delivery service, or when hand-carried by the applicant. An original and seven copies of the application must be submitted.

FOR FURTHER INFORMATION CONTACT: Dr. Walter M. Polansky, Office of Advanced Scientific Computing Research, SC-31, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone: (301) 903-5800, e-mail: walt.polansky@science.doe.gov

SUPPLEMENTARY INFORMATION:

Program Mission. The primary mission of the Office of Advanced Scientific Computing Research, which is carried out by the Mathematical, Information and Computational Sciences (MICS) Division, is to discover, develop and deploy the computational and networking tools that enable researchers in the scientific disciplines to analyze, model, simulate and predict complex physical, chemical, and biological phenomena important to DOE. To accomplish this mission, the MICS Division fosters and supports fundamental research in advanced scientific computing – applied mathematics, computer science and networking – and operates supercomputers, a high performance network and related facilities. Further descriptions of the base research portion of the MICS portfolio, which is the scope of this Notice is provided below:

Applied Mathematical Sciences Research. The objective of the applied mathematics component of the MICS research portfolio is to support research on the underlying mathematical understanding as well as the numerical algorithms needed to enable effective description and prediction of physical, chemical and biological systems such as fluids, materials, magnetized plasmas, or protein molecules. This includes, but is not limited to, methods for solving large systems of partial differential equations on parallel computers, techniques for choosing optimal values for parameters in large systems with hundreds to hundreds of thousands of parameters, improving our understanding of fluid turbulence, and developing techniques for reliably estimating the errors in simulations of complex physical phenomena.

In addition to the existing research topics described, MICS plans to invest in new areas of applied mathematics research to support DOE's mission. Such investments may include research in multiscale algorithms, the mathematics of feature identification in large datasets, asymptotically optimal algorithms for solving PDEs, fast multipole and related hybrid methods, and algorithms for handling complex systems with constraints. The MICS research portfolio in Applied Mathematics emphasizes investment in long-term research that will result in the next generation of computational tools for scientific discovery.

Computer Science Research. The objective of the computer science component of the MICS research portfolio is to support research that results in a comprehensive, scalable, and robust high performance software infrastructure that translates the promise and potential of high peak performance to real performance improvements in DOE scientific applications. This software infrastructure must address needs for: portability and interoperability of complex high performance scientific software packages; operating systems tools and support for the effective management of terascale and beyond systems; and effective tools for feature identification, data management and visualization of petabyte-scale scientific data sets. The Computer Science component encompasses a multi-discipline approach with activities in:

- Program development environments and tools -- Component-based, fully integrated, terascale program development and runtime tools, which scale effectively and provide maximum performance, functionality and ease-of-use to developers and scientific end users.
- Operating system software and tools -- Systems software that scales to tens of thousands of processors, supports high performance application-level communication and provides the highest levels of performance, fault tolerance, reliability, manageability, and ease of use for system administrators, tool developers and end users.

- Visualization and data management systems -- Scalable, intuitive systems fully supportive of DOE application requirements for moving, storing, analyzing, querying, manipulating and visualizing multi-petabytes of scientific data and objects.
- Problem Solving Environments – Unified systems focused on the needs of specific scientific applications, which enable radically improved ease-of-use of complex systems software and tools by domain application scientists.

The MICS research portfolio in Computer Science emphasizes investment in long-term research that will result in the next generation of high performance tools for scientific discovery.

High-Performance Networks Research

Scientists working in teams on emerging complex energy problems involving the fundamental building blocks of life and matter are increasingly dependent on advanced networking to harness the capabilities of geographically distributed science facilities and data resources. Networks enable access to distributed terascale computing facilities and remote instrumentation, provide a medium for large-scale scientific collaboration between distributed teams, and make remote visualization possible. Unlike today's commodity Internet, optimized for low-speed commercial applications, networks used to support science infrastructures are high-speed and high-performance networks capable of delivering and sustaining multi- Gigabits/sec to high-end data intensive applications and of providing transparent security to end users. These networks should be amenable to dynamically controllable end-to-end performance and differentiated services. Designers developing networks with these capabilities are faced with the challenge of:

- Developing high-performance transport protocols that deliver and sustain multi-gigabits/sec to scientific applications.
- Understanding and characterizing large traffic flows generated by single sources and their impact on aggregate traffic in the core networks.
- Developing innovative formal techniques for estimating the robustness of proactive secure systems.
- Developing network-aware middleware services and toolkits that couple scientific applications to networks.

This announcement calls for proposals to address the fundamental issues of high-performance networks that support DOE's science mission. It focuses on four major topics: 1) high-throughput transport protocols, 2) traffic engineering and characterization, 3) cyber-security science and engineering, and 4) modeling of network-aware middleware and middleboxes (firewalls, NAT, proxies, etc.) deployed in networks to perform functions other than the standard routing functions. Responses to this announcement must go beyond the development of tools and software to an emphasis on rigorous techniques and proofs for analyzing and validating the performance of the proposed approaches.

The focus of this announcement is on the fundamental issues of networking technologies that address these challenges.

Background: Early Career Principal Investigator Program

This is the first year of the Early Career Principal Investigator Program. A principal goal of this program is to identify exceptionally talented applied mathematicians, computer scientists and high-performance networks researchers early in their careers and assist and facilitate the development of their research programs. Eligibility for awards under this notice is restricted to tenure-track regular academic faculty investigators, who are no more than five years beyond completing either a Ph.D., or equivalent, or a postdoctoral position, and are conducting research in applied mathematics, computer science, or high- performance networks. Applications should be submitted through a U.S. academic institution. Applicants should request support under this notice for normal research project costs as required to conduct their proposed research activities. However, no salary support will be provided for other faculty members or senior personnel.

It is anticipated that up to \$4 million will be available for grant awards during Fiscal Year 2002, contingent upon the availability of appropriated funds. DOE expects to make up to forty (40) awards for exceptional applications in Fiscal Year 2002, to meet the needs of the program. Multiple-year funding of grant awards is expected, with funding provided on an annual basis subject to the availability of funds. The typical duration of these grants is three years, and they will not normally be renewed after the project period has been completed. It is anticipated that at the end of the grant period, grantees will submit new grant applications to continue their research to DOE or other Federal funding agencies.

Merit Review

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria, which are listed in descending order of importance as codified at 10 CFR 605.10(d):

- 1) Scientific and/or Technical Merit of the Project;
- 2) Appropriateness of the Proposed Method or Approach;
- 3) Competency of Applicant's Personnel and Adequacy of Proposed Resources;
- 4) Reasonableness and Appropriateness of the Proposed Budget.

The evaluation of applications under item 1, Scientific and Technical Merit, will pay attention to the responsiveness of the proposed research to the research challenges of the MICS base research programs in Applied Mathematics, Computer Science, and Network Research.

It is expected that the application will include involvement of graduate and/or undergraduate students in the proposed work.

Applicants are encouraged to collaborate with DOE National Laboratory researchers. The collaborations may include one, or more, extended visits to the laboratory by the applicant each year. Such an arrangement, if proposed, must be clearly explained in the grant application. Furthermore, a letter of support from the DOE National Laboratory collaborator(s) should be included with the application. A list of the DOE National Laboratories can be found at: http://www.sc.doe.gov/sub/lab_map/index.htm.

Grantees under the Early Career Principal Investigator Program may apply for access to high-performance computing and network resources at several National Laboratories. Such resources include, but are not limited to, the National Energy Research Scientific Computing (NERSC) Center: <http://www.sc.doe.gov/production/octr/mics/nersc/index.html>; the Advanced Computing Research Testbeds <http://www.sc.doe.gov/production/octr/mics/acrt/index.html>; the Energy Sciences Network <http://www.sc.doe.gov/production/octr/mics/esnet/index.html>; and the High-Performance Networking Research effort at the Oak Ridge National Laboratory; <http://www.csm.ornl.gov/net>.

The evaluation under item 2, Appropriateness of the Proposed Method or Approach, will consider the quality of the proposed plan, if any, for interacting with a DOE National Laboratory.

Please note that external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers will often be used, and submission of an application constitutes agreement that this is acceptable to the investigator and the submitting institution.

Submission Information

The Project Description should be 20 pages or less, exclusive of attachments. It must contain an abstract or project summary on a separate page with the name of the applicant, mailing address, phone, FAX and E-mail listed, and a short curriculum vita for the applicant.

To provide a consistent format for the submission, review, and solicitation of grant applications under this notice, the preparation and submission of grant applications must follow the guidelines given in the Application Guide for the Office of Science Financial Assistance Program, 10 CFR Part 605. Access to SC's Financial Assistance Application Guide is possible via the World Wide Web at: <http://www.science.doe.gov/production/grants/grants.html>. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications if an award is not made.

The Catalog of Federal Domestic Assistance number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

John Rodney Clark
Associate Director of Science
for Resource Management

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