

Opportunities in the US from NSF, DARPA, and NASA

Marianne Winslett
Computer Science Department
University of Illinois
Urbana, IL 61801
winslett@cs.uiuc.edu

Abstract

In this issue, we begin with general information about the High Performance Computing and Communications (HPCC) Program at NSF, followed by a more focused look at HPCC work in the database area, and a close-up of the new scientific databases initiative. A NASA program for intelligent systems, DARPA programs in 3-D visualization and multiple knowledge sources, news of recent events at DARPA, and two new small business solicitations round out the funding news for this issue.

1 The High Performance Computing and Communications Initiative at NSF

The US National Science Foundation (NSF) recently issued an announcement describing this year's activities at NSF for the High Performance Computing and Communications (HPCC) Program. The anticipated funding amount for a successful proposal is \$300,000 to \$800,000 per year for three to five years, with 6 to 8 awards anticipated. Proposals were due¹ April 30. Part of the announcement is reproduced below.

"[Successful proposals] are expected to achieve significant progress on Grand Challenge Applications—fundamental problems in science and engineering, with broad economic and scientific impact, whose solution could be advanced by applying high performance computing techniques and resources. This HPCC activity will provide funding for multidisciplinary groups of scientists, engineers, and mathematicians to apply emerging high performance computing and communications systems to advance the solution of diverse science and engineering problems. The emphasis will be on support for groups requiring HPCC capabilities, where such focused, cross disciplinary support is generally unavailable or difficult to obtain. Any area of science and engineering supported by NSF is eligible for funding under this solicitation.

"Grand Challenge Applications Groups are expected to employ testbed systems exploiting new and emerging

¹Unfortunately, funder announcements and due dates are not synchronized with the *Record* publication schedule!

computer and communications architectures, to prepare the groundwork for the HPCC goal of sustained teraflop computing on important application problems by the mid 1990's. Projects funded through this effort will focus on the fusion of disciplinary research with emerging high performance computing environments and architectures, within the framework of the HPCC program goals. It is anticipated that projects will include aspects of design of models, algorithms and software to fully realize the potential of parallel, distributed and heterogeneous computing systems on Grand Challenge Application problems.

"These opportunities for support have been created through the cooperation of disciplinary sub-activities within NSF and other federal agencies participating in the HPCC program. This Federal inter-agency HPCC program seeks to expand U.S. technological leadership, speed the pace of innovation, and spur gains in U.S. productivity and competitiveness through advances in high performance computing and computation. The program responds to the opportunities for advances inherent in the use of advanced computer models incorporating the basic science of parallel processing and the improved productivity derived by the interaction of people who are spatially separated sharing networked access to information processing and computing resources."

For more information, write to Richard Hirsh, rhirsh@note.nsf.gov, HPCC Coordinator, NSF, Room 306, 1800 G Street, N.W., Washington D.C. 20550.

2 The High Performance Computing and Communications Initiative at IRIS

Larry Rosenberg, the Deputy Director of the Division of Information, Robotics, and Intelligent Systems (IRIS) at NSF, wrote in the April *SIGART Bulletin* that the funding increases for IRIS requested for FY1993 (from US\$24 million in FY1991 to US\$27 million in FY1992 and US\$37 million in FY1993) are largely due to IRIS's role in the High Performance Computing and Communications (HPCC) initiative, as well as IRIS's involvement with the other large initiatives (biotechnology, manufacturing, and advanced materials processing). Dr. Rosenberg's description of IRIS's role in HPCC is reproduced below.

"The IRIS role in the HPCC initiative focuses on the support of:

- Basic research on intelligent systems technology applicable to High Performance Computing Systems, Advanced Software Technology and Algorithms, and Grand Challenge Problems²;
- Development of natural language interfaces, interactive & multimedia environment, intelligent information retrieval, scientific databases, knowledge acquisition systems, and distributed collaboration and coordination environment for High Performance Computing and Communications;
- Basic research on the Grand Challenge Problems—Vision, Speech/Language.

"In the past few years, IRIS has sponsored several HPCC-related efforts: NSF/DARPA Image and Speech Understanding Initiative, Scientific Databases Initiative, Coordination Theory & Technology Initiative, and NSF/Commerce JTECH Study on Machine Translation.

"This year and in the next few years, IRIS plans to launch a major extension of these research efforts to encompass the broader class of R & D issues in high performance computing and communications.

"Each of the following programs in IRIS plays an important role in this Initiative:

"The Information Technology & Organization Program: supports multi-user and group interfaces, computer-supported decision systems, collaboration & coordination theory and technology which provide the software support for Grand Challenge Problems.

"The Knowledge Models & Cognitive Systems Program: supports automated search, inference, and reasoning research which forms the theoretical foundation of high performance fifth-generation computer systems. This program also supports machine learning, knowledge acquisition, and scientific discovery which will enhance the software components and tools as well as computational techniques for Grand Challenge Problems. This program also supports the Natural Language Processing component of the Grand Challenge—Speech/Language.

"The Database and Expert Systems Program: focuses on data/information/ knowledge acquisition, storage, access, retrieval, and understanding/ analysis. This research involves research communities both building or applying information technology or computational tools. This program also seeks software methodologies for design and implementation of database and information systems in the domains of Grand Challenge Problems.

"The Interactive Systems Program concentrates on human-machine interface & adaptation in real & virtual environments, interactive visualization, and multimedia & multisensory systems for High Performance

²Grand Challenges: High Performance Computing and Communications, The FY 1992 U.S. Research and Development Program, A Report by the Committee on Physical, Mathematical, and Engineering Sciences; Federal Coordinating Council for Science, Engineering, and Technology; Office of Science and Technology.

Computing Systems. This program also supports the Speech Processing component of the Grand Challenge - Speech/Language.

"The Robotics and Machine Intelligence Program supports High Performance Computer Architectures and Software Algorithms for machine vision, multisensor fusion, robotic perception/reasoning/action, intelligent control, and mobile robotic navigation which address the Grand Challenge Problem—Vision."

3 Scientific Databases Research at NSF

Larry Rosenberg, the Deputy Director of the Division of Information, Robotics, and Intelligent Systems (IRIS) at NSF, wrote in the April *SIGART Bulletin* that in the Database and Expert Systems Program, "[t]he highest priority for the current year is for research on scientific databases because of the critical role such research plays in the high performance computing, biotechnology, manufacturing and materials initiatives of NSF." IRIS has recently announced an initiative for scientific databases, similar to the one that IRIS sponsored last year. Proposals are due September 15, with awards made in fiscal year 1993. Selected portions of the request for proposals are reproduced below.

"Research on the design, development, management, and use of databases has traditionally focused on concepts and requirements critical to business-like environments. However, current database technology falls short of supporting the diverse needs of scientific and engineering applications. New advances in data storage/access technology, knowledge-based systems, and networked computing have brought about the promise to greatly increase the productivity in science and engineering research in this final decade of the 20th century. Scientific databases can be viewed as critical repositories of knowledge, both existing and yet to be discovered. Global change studies, astronomy, human genome mapping, social and economic studies, and engineering design are a few examples of research areas that generate and require access to extraordinarily large amounts of multi-media data forms: numbers, symbols, texts, images and others. Addressing the special characteristics and requirements of scientific and engineering databases will potentially further database technologies and enable a wide range of scientists and engineers to better utilize their data and other computing resources.

"The research needed to make progress in scientific and engineering databases must be drawn from specialists in many disciplines. Therefore, collaboration of CISE researchers with researchers in other scientific or engineering disciplines is strongly encouraged. [...] Depending on the content of the received proposals, joint evaluation and funding by the relevant scientific and engineering NSF programs outside CISE is planned."

"The objective of this announcement is to foster coupling between database technology and scientific or engineering research for the advancement of both. Specifically, the aim is to promote:

"1. Stimulation of multi-disciplinary research in scientific and engineering databases that addresses significant, real requirements of an application domain. Understanding of the requirements should be derived through collaboration with the domain scientists or engineers.

"2. Expansion of general database technology through addressing the generic requirements of the application domains. Methodologies and tools developed for scientific or engineering databases should be at a high conceptual level with an aim to enhance capabilities of the next generation of general information systems.

"3. Enhancement of scientific infrastructure by making the databases, software, and other sharable resources produced under this initiative available to the research community."

"Research is sought on methodologies and tools for the representation and manipulation of very large volumes of scientific or engineering data in highly distributed heterogeneous environments. In this context, research in three interrelated areas is encouraged:

"1. Scientific Database Models and Systems. Theoretical foundations for the representation and manipulation of new data types (e.g., temporal, spatial and image data, textual data, spectrum data, engineering design data, materials data, chemical compounds, sequences, graphs, user-defined objects with inheritance and encapsulation, or declarative extensions); metadata management; data/knowledge calibration and validation; and uncertainty handling. System issues include system extensibility; rapid prototyping support; development of user-transparent, multi-level storage management (main memory through tertiary storage); multimedia data indexing; partial match retrieval algorithms; long/parallel/concurrent transaction processing; archiving; and version control. Research in this area must consider the special data characteristics associated with a scientific or engineering discipline.

"2. Knowledge Discovery in Scientific Databases. Innovative methods, techniques and tools that provide seamless integration between database management and scientific analytic or engineering design tools. Topics span computing environment transparency; event finding, data examination, selection, analysis and manipulation of temporally or spatially related data (images); data analysis algorithms; scientific visualization; parallel model execution and cross-validation on large volumes of data; automated knowledge acquisition; incorporation of new knowledge into the system; and audit trail provisions.

"3. Resource Sharing Environments. Improvement of data access and resource sharing in distributed, networked environments to support collaboration among scientists or engineers. Research in interoperability is critical to browsing, resource (data, bibliographic references or tools) location, access, and joint processing on systems ranging from personal workstations to supercomputers. Topics include heterogeneous database systems management; effective methods for transport, combination and manipulation of data subsets, images or literature references; development of domain-specific and interdisci-

plinary lexicons and directories for databases and software; assessment of the data relevance and quality; and evolutionary establishment of self-describing, extensible standards for data exchange.

"The topics listed above are not intended to represent the complete set of issues comprising the areas; they are suggestive rather than limiting. Other relevant information may be found in NSF workshop reports, 'Scientific Data Management', 'Database Systems: Achievements and Opportunities', and 'Heterogeneous Database Systems', published in *SIGMOD Record*, Vol. 19, No. 4, Dec. 1990, and in the report 'Grand Challenges 1993: High Performance Computing and Communications' (available by calling NSF, Division of Information, Robotics and Intelligent Systems, 202-357-9572)."

"The awards are anticipated to provide support for inter-disciplinary teams, i.e., researcher(s) in computer and information science and engineering collaborating with domain scientist(s) or engineer(s), of up to \$300,000 per year for 3 years. The fiscal year 1993 plan includes \$2-3 million for awards under this announcement, contingent on the quality of research proposed and the availability of funds."

For more information, contact Dr. Maria Zemankova, mzemanko@note.nsf.gov, (202) 357-9570.

4 Intelligent Systems Technology Research at NASA

The US National Aeronautics and Space Administration (NASA) is soliciting proposals for basic research in data management, AI, software engineering, and computational sciences, relating to intelligent systems technologies for aerospace mission applications at NASA. US\$2,000,000 in funding is available, which will be divided among 1 to 10 successful proposals. Proposals are due by December 31, 1992. For more information, contact Pamela Sue Wellons, (415) 604-3585, NASA-Ames Research Center, ATTN: MS 269-1/NRA2-34953(PSW), Moffett Field, CA 94035-1000.

5 Research Initiation Program at DARPA

The US Defense Advanced Research Projects Agency (DARPA) solicits research proposals for their University Research Initiative Research Initiation Program. The program will be offered through DARPA and also through the three service agencies (ARO, AFOSR, ONR), and is planned to last for three years. Applicants must be from a minority institution, such as a historically Black college, or from an academic institution that receives only small amounts of Department of Defense funding for research and development. Funding available in fiscal year 1992 is estimated to be US\$4,000,000, divided evenly among the four agencies mentioned above. Specific application areas are targeted in the call for proposals; the application area most closely related to

databases is that of computational frameworks for visualization of designs in manufacturing, offered by the Office of Naval Research (ONR). Proposals are solicited that "explore 3-D visualization of large-scale manufactured objects, their interactions and their control in a computational framework enabling effective computer-mediated collaborative design." For more information, contact Dr. R. Wachter, (703) 696-4302, Computer Science Division, Office of Naval Research, Attn: URI RIP 92, 800 North Quincy Street, Arlington, VA 22217-5000.

6 Multiple Data Source Access System Research at DARPA

The US Defense Advanced Research Projects Agency (DARPA) solicits proposals "to design and develop an ADP system which will give intelligence analysts the ability to access multiple heterogeneous data sources. The system must understand the analysts' questions in the context of the analysts' domain; extract information relevant to the questions from data sources ranging from relational databases to partially structured and unstructured free text repositories; and intelligently present the results to the analyst. Information associated with this program will be classified up to, and including, TOPSECRET/SCL. ... There may be opportunities for unclassified scientific work in support of primary contractors." DARPA plans to award one one-year contract with two one-year options for extension. A bidders' meeting took place April 21 in the Washington DC area, for potential contractors and subcontractors. For further information, contact Mrs. Gerry Dillon, 301-981-7308, AFDW Contracting Center/CNA, Bldg 3534, Andrews AFB, Washington DC 20331-5320, re SOL Solicitation Number F49650-92-R0130.

7 Summer Jobs with the US Government

The US Government offers a wide variety of summer job opportunities, including low-level positions in the computer area (e.g., computer operator, engineering technician, computer assistant), intended for high school and college students with technical backgrounds. The government also offers higher-level positions, suitable for those with bachelor's or higher level degrees. Many of the available positions are at locations near Washington, DC. The (extremely lengthy) list of available positions, along with application forms, is available as 1993 Summer Jobs: Opportunities in the Federal Government, published by the US Office of Personnel Management (OPM). In addition, regional supplements that list additional opportunities in locations away from the US capitol are available from OPM Federal Job Information Centers, scattered across the US. For more information, call the OPM in Washington at (202) 606-2700.

8 Recent Events at DARPA

DARPA BAA 92-06, on integration of information from different sources, received 60 proposals. Of these, 6 have been selected for funding this year, with additional proposals possibly being funded next year.

Duane Adams has been appointed the new Acting Director for DARPA SISTO. Adams had previously served as a Special Assistant to the Director of DARPA. Adams replaces Barry Boehm, who has stepped down to devote his attention to the US Department of Defense Software Strategy Plan.

9 New Small Business Solicitation

In the September 1991 issue of the *Record*, we described the various US government programs that give grants to small businesses. As a quick summary, Phase 1 Small Business Innovative Research (SBIR) programs provide \$50,000 in funding to firms that meet eligibility requirements and submit a successful proposal. Both the Department of Defense and NASA have recently issued SBIR solicitations that may be of interest to the database community. The deadlines for submission to both solicitations are in July.

The first solicitation, including forms and submission instructions, is available by writing to US Department of Defense, SBIR Program Office, Washington DC 20301. Potentially relevant topics in the current solicitation include: Integration of Information from Heterogenous Sources, Mapping Object-structured Information Among Applications, Managing and Maintaining Knowledge Bases, Abstracting Information from Spatial Files and Databases, Intelligent Conversion of Scanned Engineering Drawings to Product Data Models, Tools for Rapid Mapping and Analysis of Local Transportation Networks, Multi-mode Transportation and Logistics Management, and Low Cost Electronic Data Interchange.

The second solicitation is available from Mr. John A. Glab, SBIR Program Manager—Code CR, NASA, Washington DC 20546; phone 703-271-5673 for announcement, leave message on 703-271-5672, or fax 703-271-5566. Potentially relevant topics include: Knowledge-based systems, with emphasis on knowledge acquisition, verification and validation, maintenance, and/or real-time; integration of databases and knowledge bases; machine learning for automated data analysis and improvement of problem-solving systems; hierarchical control architectures for distributed knowledge-based systems; task planning and reasoning, including concurrency and subsystem interaction; and human-machine interfaces.