April 18, 2003

INVITATION TO SUBMIT WHITE PAPERS ON HIGH END COMPUTING

Part 1. Invitation overview

Through this call for white papers, the Federal government is soliciting input from the private sector (academia and industry, including persons at national laboratories and Federally funded research and development centers) and Government personnel that can be used by the High End Computing Revitalization Task Force (HECRTF) in fulfilling its charge. Background, scope, and time frame are in Part 2 below, text from the President's FY 2004 Budget that initiated this activity is in Part 3, the HECRTF charge is in Part 4, the questions to be addressed in the white papers are in Part 5, and how to keep informed or ask questions about this effort is in Part 6.

This solicitation of white papers gives potential respondents an opportunity to provide technical facts and information that can help shape the future development and application of high-end computing technologies in the U.S. This input will augment a large body of materials collected by the HECRTF itself.

Because the HECRTF has an ambitious schedule, white papers are requested by May 16, 2003. Papers submitted earlier than that date are encouraged; papers submitted after that date will be used as much as possible.

In addition to their content, the white papers will be used to guide future interactions with the respondents and their organizations, including use in selecting persons to invite to a workshop tentatively scheduled for June 2003. Such a workshop can give those in attendance the opportunity to provide further input to the HECRTF.

White papers shall be at most five pages in length, printed in a 12-point font on 8-1/2 by 11 inch paper, and include for each author the person's name, title, affiliation, postal service address, e-mail address, and phone number. Please submit white papers to hecrtf-outreach@itrd.gov.

Part 2. Background, scope, and time frame

The U.S. has invested in computing, including high-end or supercomputing, for more than 50 years. One example of the Federal government's investment in and endorsement of high-end computing research and development (R&D) is the High-Performance Computing Act of 1991. What a decade ago was only a vision of how science and engineering applications could benefit from high-end computing has become a reality more successful than most people could have imagined. For example, modeling and simulation on HEC systems have complemented and in some cases replaced the experimentation and theory that for centuries were the only two approaches to advancing

science and engineering knowledge and understanding. Even greater advances in fields such as weapons design, manufacturing design and engineering, environmental modeling, climate modeling and weather forecasting, chemical and pharmaceutical design, astrophysics of stars and galaxies, and aeronautics and aerospace design, are promised by the full three-dimensional, high resolution, comprehensive, multidisciplinary modeling and simulation on future generations of high-end computing systems.

The creation of the HECRTF provides a 21st century opportunity for new investments in: (1) developing core HEC technologies; (2) providing HEC capability, capacity, and accessibility to Federally-funded science and engineering R&D applications; and (3) improving Federal HEC procurement practices. Together, these efforts will help Federal agencies and departments meet their mission goals and help the U.S. remain the world's leader in science and engineering research.

The scope of the HECRTF charge has both topical and temporal dimensions. Illustrative within-scope topics include system architectures, systems software, programming environments, and performance measurement. Temporally, the HECRTF is charged with proposing activities to be accomplished in FY 2005 through FY 2009, although the impact of those activities can extend beyond FY 2009. Topics that provide driving needs for HEC technologies but are in and of themselves out of HECRTF scope include applications *per se* and visualization software. The author of a white paper would need to make a strong case for including a topic such as grid technologies as well as one such as quantum computing that are expected to yield viable HEC technologies after FY 2009.

Part 3. Relevant text from the President's Budget

The *FY 2004 Budget of the U.S. Government: Analytical Perspectives: Research and Development* (page 177) states that:

> Due to its impact on a wide range of federal agency missions ranging from national security and defense to basic science, high-end computing—or supercomputing —capability is becoming increasingly critical. Through the course of 2003, agencies involved in developing or using high-end computing will be engaged in planning activities to guide future investments in this area, coordinated through the NSTC. The activities will include the development of an interagency R&D roadmap for high-end computing core technologies, a federal high-end computing capacity and accessibility improvement plan, and a discussion of issues (along with recommendations where applicable) relating to federal procurement of high-end computing systems. The knowledge gained for this process will be used to guide future investments in this area. Research and software to support high-end computing will provide a foundation for future federal R&D by improving the effectiveness of core technologies on which next-generation high-end computing systems will rely.

Part 4. Charge to the HECRTF

Coordinated through the National Science and Technology Council, the Task Force is charged with developing a plan to guide future Federal investments in High End Computing (HEC). Based on the needs of important Federally-funded applications of HEC, this plan will lay out an overall strategy for these investments and will include the following areas as coordinated subtasks:

(1) High End Computing Core Technologies R&D: This subtask will produce a five-year roadmap, beginning with FY 2005, for core technology development that includes:
   (a) Identification of key technologies that must be advanced to strengthen the foundation for developing new generations of HEC systems
   (b) Coordinated multi-agency R&D plans that lay out a set of alternative programs, as well as identification of those agencies that are best suited to carry out each part of the program based on expertise, facilities, or technical priority
   (c) Discussion of approaches to planning, selecting participants, and carrying out the research, development, and engineering, in order to enable both revolutionary and evolutionary advances of technology, as well as to enable diffusion of advances in core technologies into commercial industry.

(2) Federal High End Computing Capability, Capacity, and Accessibility: This subtask will produce a five-year roadmap, beginning with FY 2005, that includes:
   (a) Sets of alternative plans for HEC resources that would help to reduce capability or capacity gaps in addressing important applications of HEC
   (b) Performance targets for proposed HEC system alternatives that are linked to application domain requirements and user needs
   (c) Discussion of the types of system design specifications needed to effectively meet various application domain requirements
   (d) Discussion of resources, tools, and techniques needed to minimize “time to solution” by users of HEC systems
   (e) Accessibility approaches to make the proposed HEC resources available to Federal and non-Federal user communities, as appropriate, beyond the Federal agency that funds or hosts the resources.

(3) Federal Procurement of HEC Systems: This subtask will produce findings and recommendations that include:
   (a) Identification of a strategy for developing practical performance measures for system procurement that correlate well with realized performance of actual applications
   (b) Recommended methods for deriving system performance targets from actual or projected application requirements or other user needs
   (c) Discussion of total cost of ownership beyond procurement cost, including space, maintenance, utilities, upgradeability, etc.

(d) Recommendations for improving processes for acquiring HEC systems based on the above issues.

(4) Integration of HEC Strategies: This subtask will produce a five-year roadmap, beginning with FY 2005, for the Federal role in HEC R&D, utilization, and procurement. The roadmap will be based on the needs of important Federal applications of HEC and will include an overall strategy that incorporates appropriate roles for government, academia, and the private sector. This subtask will be closely coordinated with, and based on, the other subtasks.

Part 5. Questions to be addressed in the white papers

The authors of the white papers are asked to address one or more of the following questions.

The HECRTF charge (Part 4 above) has been provided in order to put the questions in context. **Please provide only technical facts and information that respond to the questions given below and do not comment on other parts of the charge.** Observing this guidance will help the HECRTF fully comply with Federal law. Failure to observe this guidance may result in your white paper not being used as input to this activity.

(1) As input to HECRTF charge (1a), please provide information about key technologies that must be advanced to strengthen the foundation for developing new generations of HEC systems.

(2) As input to HECRTF charge (1) overall, please provide information about:

(a) Promising hardware and software technologies with potential pay-off for HEC
(b) Technology maturity roadmaps and investments, with discussion of costs
(c) Technology dependencies (for example, does the roadmap depend on technologies yet to be developed?)
(d) Performance metrics that quantify benefits

(3) As input to HECRTF charge (2c), please provide information about the types of system design specifications needed to effectively meet various application domain requirements.

(4) As input to HECRTF charge (2d), please provide information about the resources, tools, and techniques needed to minimize “time to solution” by users of HEC systems.

(5) As input to HECRTF charge (3a), please provide information about the practical performance measures for system procurement that correlate well with realized performance of actual applications.

(6) As input to HECRTF charge (3b), please provide information about methods for deriving system performance targets from actual or projected application requirements or other user needs.

(7) As input to HECRTF charge (3c), please provide information about total cost of ownership beyond procurement cost, including space, maintenance, utilities, upgradeability, etc.

(8) As input to HECRTF charge (3) overall, please provide information about how the Federal government can improve the process of procuring HEC systems and tools

Part 6. For more information or to ask questions

The http://www.itrd.gov/hecrtf-outreach/ Web site provides up-to-date information about the HECRTF.

Please write hecrtf-outreach@itrd.gov with any questions about the white papers or if you wish to be put on the HECRTF outreach mailing list.