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Computing Research in the FY 2005 Budget Request

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HIGHLIGHTS

- Networking and Information Technology Research and Development (NITRD) funding would fall 0.7 percent in FY 2005 to $2.00 billion across eleven federal agencies under the President's budget request (see Table I-10).

- The President's request would increase funding for computing research at the National Science Foundation (NSF), the lead agency in the NITRD initiative, to $761 million in FY 2005, an increase of 0.9 percent.

- Concerns about interagency coordination of large-scale "cyberinfrastructure" investments in FY 2005 will likely lead to greater congressional oversight of NITRD programs in 2004.

INTRODUCTION AND BACKGROUND

The importance of computing research in enabling the new economy is well documented. The resulting advances in information technology have led to significant improvements in product design, development and distribution for American industry, provided instant communications for people worldwide, and enabled new scientific disciplines like bioinformatics and nanotechnology that show great promise in improving a whole range of health, security, and communications technologies. Federal Reserve Board Chairman Alan Greenspan has said that the growing use of information technology has been the distinguishing feature of this "pivotal period in American economic history." Recent analysis suggests that the remarkable growth the U.S. experienced between 1995 and 2000 was spurred by an increase in productivity enabled almost completely by factors related to IT. "IT drove the U.S.

productivity revival [from 1995-2000],” according to Harvard economist Dale Jorgenson.

Information technology has also changed the conduct of research. Innovations in computing and networking technologies are enabling scientific discovery across every scientific discipline—from mapping the human brain to modeling climatic change. Researchers, faced with research problems that are ever more complex and interdisciplinary in nature, are using IT to collaborate across the globe, visualize large and complex datasets, and collect and manage massive amounts of data.

A significant reason for this dramatic advance in computing technology and the subsequent increase in innovation and productivity is the “extraordinarily productive interplay of federally funded university research, federally and privately funded industrial research, and entrepreneurial companies founded and staffed by people who moved back and forth between universities and industry,” according a 1995 report by the National Research Council. That report, and a subsequent 1999 report by the President’s Information Technology Advisory Committee (PITAC), emphasized the “spectacular” return on the federal investment in long-term IT research and development.

However, in that 1999 report PITAC—a congressionally-chartered, presidentially-appointed committee charged with assessing the overall federal investment in IT R&D—also determined that federal support for IT R&D was inadequate and too focused on near-term problems; long-term fundamental IT research was not sufficiently supported relative to the importance of IT to the United States’ economic, health, scientific and other aspirations; critical problems in computing were going unsolved; and the rate of introduction of new ideas was dangerously low. The PITAC report included a series of recommendations, including a set of research priorities and an affirmation of the committee’s unanimous opinion that the federal government has an “essential” role in supporting long-term, high-risk IT R&D. This opinion was buttressed by the inclusion of a recommendation for specific increases in funding levels for federal IT R&D programs beginning in FY 2000 and continuing through FY 2004—an increase of $1.3 billion in additional funding over those five years.

The PITAC report has done much to shape the current federal IT R&D effort—a $2.0 billion, multi-agency enterprise called the Networking and

Information Technology Research and Development (NITRD) program and coordinated by the Interagency Working Group (IWG) on Information Technology Research and Development of the National Science and Technology Council (NSTC). NITRD is the successor of the High Performance Computing and Communications Program established by Congress in 1991. NITRD agencies coordinate research in seven Program Component Areas (PCAs): High End Computing Infrastructure and Applications; High End Computing Research and Development; Human Computer Interaction and Information Management; Large Scale Networking; Software Design and Productivity; High Confidence Software and Systems; and Social, Economic, and Workforce Implications of IT and IT Workforce Development. The National Science Foundation (NSF) is the lead agency in NITRD; other participating agencies include the Agency for Healthcare Research and Quality (AHRQ), the Defense Advanced Research Projects Agency (DARPA), the Department of Energy (DOE) National Nuclear Security Administration (NNSA), the DOE Office of Science, the Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), the National Institutes of Health (NIH), the National Institute of Standards and Technology (NIST), the National Oceanographic and Atmospheric Administration (NOAA), the National Security Agency (NSA), and the Defense Information Systems Agency (DISA).

CURRENT POLICY ENVIRONMENT

Despite the impact of the 1999 PITAC report on the current structure of the NITRD program, the funding levels recommended by the committee have never been realized. The FY 2004 enacted level of $2.02 billion fell $683 million below the recommended level (see Figure 1), continuing a trend of shortfalls established within the first year of the recommendations. At a congressional hearing shortly after the President's FY 2005 budget release, John H. Marburger, the Director of the White House Office of Science and Technology Policy, defended the slight decrease in NITRD funding in the request by describing the initiative as "highly successful" and "mature," justifying limited reprioritization within some agencies and allowing for program cuts, an announcement met with some concern in the computing research community.

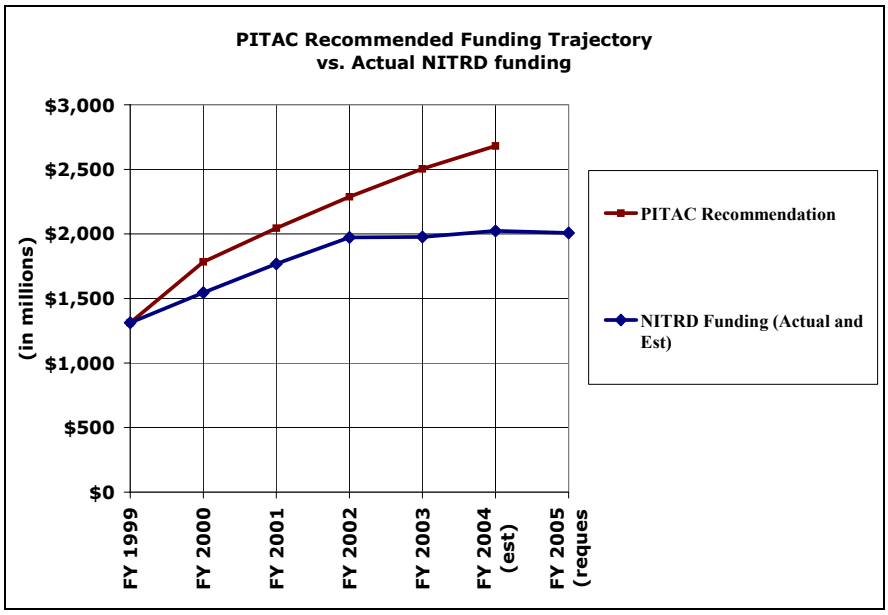

Figure 1.

The issue of NITRD prioritization will likely receive increased congressional attention in 2004, partly in response to developments overseas in 2002. An April 2002 announcement that the Japanese "Earth System Simulator" supercomputer, designed to perform simulations of the global environment, had surpassed the fastest U.S.-designed supercomputer—the ASCI White system at Lawrence Livermore National Laboratory—in computational speed by nearly a factor of five, garnered much attention in Congress and the Administration. The House Science Committee began focusing on the issue in earnest with the start of the 108th Congress in 2003, examining the U.S. effort in "high-end computing"—a catch-all phrase intended to encompass not only supercomputing, but high-speed networks, large-scale databases, data storage, software and hardware design. In this way, high end computing is infrastructure that supports advancements in practically every field of scientific endeavor—sometimes called "cyberinfrastructure." In July, 2003, the committee held its first hearing to explore whether the Japanese advance indicated that the U.S. had lost its leadership role in high-end computing.

The Administration was asking the same questions. The President's FY 2003 budget request directed the NITRD Interagency Working Group (IWG) to establish a "High End Computing Revitalization Task Force"

(HECRTF) to examine the current state of federal high-end computing efforts, with the goal of having all the participating agencies submit a coordinated budget request for high-end computing for FY 2005. The Task Force convened a public workshop on the issue in June 2003 that resulted in a report, *The Roadmap for the Revitalization of High End Computing*, which mapped out the short and long term technical challenges required to revitalize the area. However, the Task Force had not, at the time of the President's FY 2005 request, been able to take that input and develop a coordinated interagency budget plan.

In the absence of a coordinated plan, many of the NITRD agencies have begun to move forward with their own versions of a cyberinfrastructure plan, raising concerns for the House Science Committee that important, time-sensitive opportunities for coordination and long-term collaboration are being lost. The Committee will likely act on these concerns in 2004 by introducing NITRD "reauthorization" legislation aimed at encouraging that coordination and collaboration.

Recent efforts at reauthorizing NITRD programs have not met with much success. A bill introduced by former House Science Committee Chair F. James Sensenbrenner (R-WI) in the 106th Congress (H.R. 2086) passed the House but fell victim to a dispute with the Senate Commerce, Science and Technology Committee over an unrelated matter. House Science Subcommittee on Research Chair Nick Smith (R-MI) and Ranking Member Eddie Bernice Johnson (D-TX) also introduced similar legislation in the 107th Congress (H.R. 3400) that garnered committee approval. However, H.R. 3400 failed to receive the consideration of the full House. It is not clear how easy a path a NITRD authorization in the second session of the 108th Congress will face.

One other area of computing likely to see a considerable amount of congressional attention continue is research into data-mining techniques that might prove valuable in the war on terror. Concerns in 2003 about the privacy risks to innocent U.S. citizens due to data-mining research—specifically about Defense-sponsored research into "a prototype network that integrates innovative information technologies for detecting and preempting foreign terrorist activities against Americans," a project known as Terrorism Information Awareness (TIA)—resulted in Congress taking the unusual step of not only singling the program out for elimination in the FY 2004 Defense Appropriations bill, but eliminating the entire program office in which the program was housed. Sen. Ron

Wyden (D-OR) led the charge against TIA-related research at DARPA, ultimately pressing for elimination of DARPA's Information Assurance Office (IAO), run (until his resignation under pressure in August 2003) by former Admiral John Poindexter.

Though the congressional action prevented DARPA from pursuing any research that might someday result in a TIA-like system, congressional appropriators did insert language that appeared to allow that work to continue in unspecified intelligence agencies, as long as the work did not focus on U.S. citizens. The result of the language, however, is that the bulk of the research in this area is now classified, raising concerns from some in the academic community that outside oversight of the work is no longer possible.

One final area likely to see some action in 2004 is computing research and standards setting at NIST. Congress cut $21 million from NIST FY 2004 funding as part of the FY 2004 Omnibus Appropriations bill, a move that NIST warns will cause them to cut back "significantly" on the agency's cybersecurity projects, as well as stop all of its activities in e-voting standards development called for in the 2002 Help America Vote Act (HAVA). As Table II-14 shows, much of that funding would be restored under the President's budget plan. However, it is not clear how much unaccounted-for spending requirements incurred in canceling NIST's Advanced Technology Program (ATP), as called for in the budget, would affect NIST's computing-related activities in FY 2005.

BUDGET REQUEST

Seven agencies included requests for FY 2005 funding as part of the NITRD activity. Under the President's plan, NSF, as the recipient of the largest amount of NITRD funds, would once again be designated as the lead agency for the initiative, with NSF Computing and Information Science and Engineering (CISE) directorate head Dr. Peter Freeman serving as the head of the NITRD Interagency Working Group. For FY 2005, the President has requested $2.0 billion for the NITRD initiative, a decrease of 0.7 percent over the FY 2004 enacted level (see table I-10). Under the President's plan, NSF, HHS, Energy and Commerce would see small to moderate increases in FY 2005, while NASA and DOD would see cuts of 5.8 and 10.3 percent, respectively.

National Science Foundation (NSF): NSF has requested $761 million in NITRD-related funding, an increase of $7.0 million over FY 2004, or 0.9 percent. The bulk of IT-related funding in the NSF request is contained within the request for the CISE directorate, which would grow 2.2 percent over FY 2004 to $618 million. CISE itself has undergone reorganization into a new set of sub-activities, as shown in Table II-7. Four of the new activities—Computer and Networked Systems, Computing and Communication Foundations, Information and Intelligent Systems, and Shared Cyberinfrastructure—would see increases in FY 2005 under the President's plan. The increases are largely offset by decreasing the request for the Information Technology Research activity, which had been an NSF-wide priority area until FY 2004, by $40 million for FY 2005.

NSF remains active in every aspect of the NITRD program component areas and continues in its role as the principal source of federal funding for university-based basic research in computer science, computer engineering, information science, networking and the computational science disciplines. NSF's request of $761 million is more than double the size of the next largest NITRD participant (HHS, $371 million).

Two areas of significant focus for NSF in FY 2005 will be "Cyber Trust," research aimed at addressing concerns about the vulnerability and trustworthiness of computers, networks and information systems, and "Cyberinfrastructure," managing and supporting the creation of a widely shared high-end computing infrastructure aimed at revolutionizing the conduct of research and education across the sciences.

Department of Defense (DOD): The DOD request of $226 million for NITRD-related activities department-wide represents a decrease of $26 million from the FY 2004 level. DARPA constitutes the largest share of NITRD-related defense funding, with the bulk of that effort taking place within the Information Processing Technology Office (IPTO). Program cuts at DARPA called for in the FY 2004 Defense Appropriations bill (P.L.108-87) account for the majority of the planned decrease in funding. Appropriators, concerned that DARPA's TIA program (described above) posed serious threats to American civil liberties, cut all funding for the program and eliminated DARPA's Information Assurance Office, where it (and related research efforts) were housed.

Additionally, much of DARPA's formerly unclassified work in cybersecurity research and development has been classified in FY 2005. DARPA Director Anthony Tether explained the move to a February 2004 gathering of computer society and association leaders as necessary because so much of the Defense Department's warfighting capability now depends upon using the computer networks as both offensive and defensive weapons. Exposing potential methods of attack or defense would therefore put national security in jeopardy, he explained. This has raised some concerns within the computing community, especially because research that formerly might have been available to help secure public networks now cannot be disseminated.

Agency-wide, DARPA is focused on future-generations computing, communications and networking as well as embedded software and control technologies. Within IPTO, the focus is on "cognitive computing"—described as "systems that know what they are doing" and have the ability to reason about their environment. Meeting this focus means concentrating on six core research areas: computational perception; representation and reasoning; learning; communications and interaction; dynamic coordinated teams of cognitive systems; and robust software and hardware infrastructure for cognitive systems.

Health and Human Services (HHS): NIH constitutes the bulk of funding in IT R&D at HHS. For FY 2005, the President's plan includes $371 million in IT R&D funding at HHS, an increase of 0.8 percent, or $3 million over the FY 2004 level. Within HHS, NIH participates in NITRD by supporting research that advances its mission of developing the basic knowledge for the understanding, diagnosis, treatment, and prevention of human disease. IT research in this area includes applying the power of computing to manage and analyze biomedical data and to model biological processes. AHRQ focuses on research into state-of-the-art IT for use in health care applications such as computer-based patient records, clinical decision support systems, and standards for patient care data.

Department of Energy (DOE): IT R&D activities in DOE's Office of Science and NNSA constitute DOE's participation in NITRD. The Office of Science focuses on computational and networking tools that enable researchers to model, simulate, analyze, and predict complex physical, chemical and biological phenomena important to the department's overall mission. NNSA supports research developing new means of

assessing the performance, safety, and reliability of nuclear weapons systems through high-fidelity computer models and simulations. Under the President's plan DOE NITRD funding would be $354 million for FY 2004, an increase of 2.9 percent, or $10 million, over the FY 2004 level.

National Aeronautics and Space Administration (NASA): Under the President's plan, NASA would see a decrease in IT funding for FY 2005, in part related to the elimination of a number of congressional earmarks enacted as part of the FY 2004 Omnibus Appropriations bill (P.L. 108-199). NASA NITRD funding would shrink 5.8 percent for FY 2005, down $16 million from the FY 2004 enacted level to $259 million. NASA IT funding is focused on advancing the agency's mission to extend U.S. technological leadership to benefit the U.S. aeronautics, Earth and space science, and spaceborne research communities. NASA, NIH, and NSF are alone among NITRD agencies in their support of research efforts in all seven NITRD program component areas.

Department of Commerce (DOC): The DOC request for FY 2005 contains NITRD-related funding requests from two agencies: NOAA and NIST. NIST IT R&D efforts include working with industry, educational, and government organizations to make IT systems more useable, secure, scalable, and interoperable. In addition, NIST works to apply IT to specialized areas like biotechnology and manufacturing, and to encourage industry to accelerate development of IT innovations.

NOAA supports IT research in emerging computer technologies for improved climate modeling and weather forecasting, and for improved communications technologies to disseminate weather products and warnings to emergency responders, policymakers, and the general public.

Environmental Protection Agency (EPA): The EPA would receive $4 million in FY 2005 under the President's plan, the same amount it received in FY 2004. EPA intends to use that funding to support IT technologies that facilitate ecosystem modeling, risk assessment, and environmental decision making at the federal, state, and local levels.

Department of Homeland Security (DHS): Because the Department of Homeland Security, established in 2003, was created well after the original passage of the legislation creating the current NITRD structure (the High Performance Computing and Communications Act of 1991), the agency is not officially a member of the NITRD Interagency

Working Group. However, the agency has requested $18 million in FY 2005 for cyber security research and development, out of a total Science and Technology directorate budget request of $987 million (see Table II-20).