

Computing Research in the FY 2003 Budget Request

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HIGHLIGHTS

- Networking and Information Technology Research and Development (NITRD) activities for FY 2003 would increase 2.5 percent to \$1.9 billion, spread across eleven federal agencies, under the President's budget request (see Table I-10).
- House-sponsored legislation would authorize several NITRD agencies at the levels recommended by the President's Information Technology Advisory Committee (PITAC).
- Cyber Security legislation in the House and Senate would authorize new grant and fellowship programs in information security research at the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST), and the National Security Agency (NSA).

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." The President's FY 2003 budget request notes that "about two-

Peter Harsha

thirds of the 80 percent gain in economic productivity since 1995 can be attributed to information technology.”

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 climate 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 private-sector, 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 \$1.8 billion, multi-agency enterprise called the Networking

COMPUTING RESEARCH IN THE FY 2003 BUDGET REQUEST

and Information Technology Research and Development (NITRD) program and coordinated by the Interagency Working Group 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 six Program Component Areas (PCAs): High End Computing; 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's (DOE) National Nuclear Security Administration (NNSA), DOE's 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 Oceanic and Atmospheric Administration (NOAA), the National Security Agency (NSA), and the Office of the Deputy Under Secretary of Defense for Science and Technology (ODUSD [S&T]).

CURRENT POLICY ENVIRONMENT

The PITAC report generated some movement in Congress towards authorizing significant increases for IT R&D and NITRD agencies. In 2000, H.R. 2086, the "Networking and Information Technology Research and Development Act," introduced by Rep. F. James Sensenbrenner, Jr. (R-WI), who was then Chair of the House Science Committee, would have authorized funding levels at NITRD agencies under the Science Committee's jurisdiction at the PITAC-recommended levels. But the bill, which passed the House on voice vote, did not receive consideration in the Senate.

In the current Congress, Rep. Nick Smith (R-MI), Chair of the House Science Subcommittee on Research, has introduced H.R. 3400, the Networking and Information Technology Research Advancement Act (NITRA). NITRA, like Sensenbrenner's H.R. 2086, would authorize IT R&D funding at PITAC-recommended levels at NITRD agencies under the Science Committee's jurisdiction (see Table 1, below). The measure

Peter Harsha

was approved unanimously by the House Science Committee earlier this year but has not yet received consideration by the full House. The bill is not expected to face the same opposition Sensenbrenner's H.R. 2086 faced in the Senate.

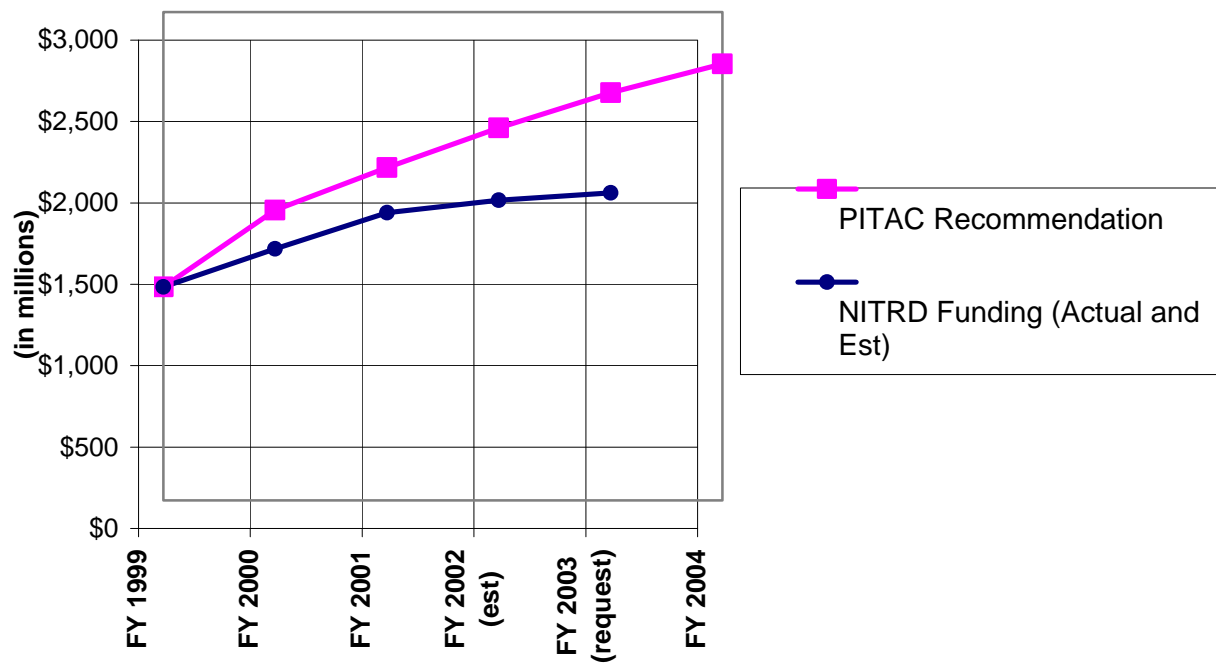
Table 1. H.R. 3400 –
Networking and Information Research and Development Act (as introduced)
(authorized funding levels in millions of dollars)

| Agency | FY 03 | FY 04 | FY 05 | FY 06 | FY 07 | Total |
|-------------------------|-------|-------|-------|-------|-------|-------|
| NSF | 704 | 774 | 851 | 937 | 1,030 | 4,296 |
| NASA | 199 | 219 | 240 | 265 | 292 | 1,215 |
| Dept. of Energy | 193 | 212 | 234 | 258 | 283 | 1,180 |
| NIST | 24 | 27 | 29 | 32 | 35 | 147 |
| NOAA | 22 | 24 | 26 | 29 | 32 | 133 |
| EPA | 4 | 4.4 | 4.8 | 5.3 | 5.8 | 24.3 |
| NAS Benchmarking Survey | 1 | | | | | 1 |
| TOTAL | 1,147 | 1,260 | 1,385 | 1,526 | 1,678 | 6,996 |

Despite the general tenor of support IT R&D has received from the Administration and the Congress, agency appropriations have fallen well short of the PITAC-recommended funding levels (see Figure 1). Though the President's budget request of \$1.9 billion for NITRD activities in FY 2003 represents a 2.5 percent increase over FY 2002 (see Table I-10), it would still fall \$614 million beneath the PITAC funding recommendation for FY 2003.

In another development, PITAC's charter, which would have expired June 1, 2001, was renewed through June 1, 2003 by executive order in May 2001. However, all previous presidential PITAC appointments expired December 1, 2001, and no new appointments have yet been made. As a result, PITAC is currently a committee without members, a situation the Administration has indicated it intends to fix "as soon as possible."

**Figure 1. PITAC Recommended Funding Trajectory
vs. Actual NITRD funding**



Peter Harsha

In addition to the traditional debate over general IT R&D funding, there is increasing attention being paid to information assurance and information security research. The terrorist attacks of September 11, 2001, have highlighted the need to secure the nation against future attacks, and there has been a growing understanding within the federal government that elements of a future attack could include an effort to disrupt the nation's information infrastructure, and also that vulnerable information technology systems are critical to the control and monitoring of all other elements of the nation's critical infrastructure (*e.g.*, the electric power grid, the air traffic control system, the telecommunications grid). On October 9, 2001, the President appointed Richard Clarke to the Office of Homeland Defense as Special Advisor to the President for Cyberspace Security with the task of minimizing this threat. In announcing the appointment, Office of Homeland Defense Director Tom Ridge noted, "disrupt [the information infrastructure], destroy it or shut it down... and you shut down America as we know it and as we live it and as we experience it every day."

Congress has responded quickly to the threat. The House has passed legislation introduced by Rep. Sherwood Boehlert (R-NY), Chair of the House Science Committee, which would authorize additional research opportunities in information security at NSF and NIST. The bill, H.R. 3394, the "Cyber Security Research and Development Act," would authorize \$880 million over five years at NSF and NIST to create new cybersecurity research centers, undergraduate program grants, community college grants and fellowships, in addition to new program grants at NIST for partnerships between academia and industry, new post-docs, and a new program to encourage senior researchers in other fields to work on computer security. Sen. John Edwards (D-NC) has introduced similar legislation in the Senate. Edwards' "Cybersecurity Research and Education Act of 2002" (S. 1901) would authorize new "Information Assurance Fellowships" at NSF and a new cybersecurity awareness, training, and education grant program at NSA. Neither H.R. 3394 nor S. 1901 has yet received consideration by the Senate.

BUDGET REQUEST

For FY 2003, seven federal agencies included requests for funding as part of the NITRD budget activity. NSF, which would receive the most NITRD-related funding this year, is again designated as the lead agency, with the head of the Computing and Information Science and

COMPUTING RESEARCH IN THE FY 2003 BUDGET REQUEST

Engineering (CISE) directorate serving as the head of the Interagency Working Group. The President has requested \$1.9 billion for NITRD activities in FY 2003, an increase of \$46 million, or 2.5 percent, over FY 2002 (see Table I-10). NASA would receive the largest increase under the President's plan, both in terms of percentage (17.7 percent over FY 2002) and in dollars (\$32 million). The Department of Defense (DOD), NOAA, AHRQ (in HHS), and NNSA (in DOE) would all see decreases in funding compared to FY 2002.

National Science Foundation (NSF): NSF has requested \$678 million in NITRD-related funding, an increase of \$2 million over FY 2002, or 0.3 percent. The bulk of IT-related funding in the NSF request is contained within the request for the CISE directorate, which would grow 2.3 percent over FY 2002 to \$527 million (see Table II-7). As Table II-7 indicates, the largest programmatic increase within the CISE directorate is the \$17.2 million increase over FY 2002 in the directorate's share of the NSF-wide Information Technology Research (ITR) initiative. The remaining programs all see funding decreases over FY 2002 levels, with the exception of the Computer-Communications Research activity, which would see a slight bump up of 0.5 percent.

Within CISE, NSF intends to focus on broad thematic, large-scale, long-term, basic computer science research challenges for FY 2003. Examples include research addressing the theory and technology for building safe and secure, complex, embedded, networked and autonomous systems; new interfaces, such as speech, touch/tactile sensing, and telepresence; research at the interface of biology and IT, including bioinformatics, biomolecular computation, and biologically inspired computing; and a research focus on Cyberinfrastructure, with attention to data gathering, data storage and transformation, and visualization of massive data sources. CISE will also contribute research and education efforts to the other Foundation-wide priority areas in Biocomplexity in the Environment, Nanoscale Science and Engineering, Learning for the 21st Century Workforce, and the new Mathematical Sciences initiative.

Also new at CISE for FY 2003 is Dr. Peter Freeman, who was named Assistant Director of the NSF in charge of CISE by NSF Director Rita Colwell in February 2002, and who will assume that post beginning May 2002. As head of CISE, Freeman will also chair the NITRD Interagency Working Group.

Peter Harsha

Department of Defense (DOD): The DOD request of \$306 million for NITRD-related activities represents a decrease of \$14 million over the FY 2002 level. However, funding at DARPA would see an overall increase of \$60.9 million for IT-related activities compared with FY 2002 levels, though not all of that increase is slated for NITRD activities. DARPA's participation in NITRD includes research in "future-generations" computing, communications, and networking as well as embedded information technologies in national defense applications such as battlefield awareness.

DARPA's Computing Systems and Communications Technologies would grow to \$424.9 million under the President's plan, an increase of \$66.4 million over FY 2002. Included in this activity is NITRD-related research in intelligent systems and software, high-performance and global scale systems, software engineering technology, information assurance and survivability, and systems for countering asymmetric threats. DARPA's Embedded Software and Pervasive Computing program would see a decrease of \$5.5 million compared to FY 2002 levels, to \$60 million for FY 2003.

Health and Human Services (HHS): The HHS request includes funding for two NITRD agencies: NIH and AHRQ. NIH, which would receive the largest percentage R&D increase of any federal agency (see Table I-1), also would receive a large increase in NITRD-related funding for FY 2003. The President's plan includes \$327 million in IT R&D funding at NIH, an increase of 10.5 percent or \$31 million over FY 2002. 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 would see its NITRD funding decrease to \$9.0 million for FY 2003, from \$14.0 million in FY 2002—a drop of 35.7 percent, or \$5.0 million. 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

COMPUTING RESEARCH IN THE FY 2003 BUDGET REQUEST

enable researchers to model, simulate, analyze, and predict complex physical, chemical and biological phenomena important to the department's overall mission. Under the President's request, the Office of Science would see IT R&D funding increase to \$186 million for FY 2003, an increase of \$12 million or 6.9 percent over FY 2002.

However, the NNSA, which supports research developing new means of assessing the performance, safety, and reliability of nuclear weapons systems through high-fidelity computer models and simulations, would see IT funding decrease to \$127 million for FY 2003, \$11 million less than FY 2002.

National Aeronautics and Space Administration (NASA): Under the President's request, NASA would see both the largest dollar increase and largest percentage increase in IT funding for FY 2003 of any NITRD agency. NASA NITRD funding would grow 17.7 percent for FY 2003, up \$32 million over FY 2002 to \$213 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 space-borne 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 2003 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. For FY 2003, the President's request includes \$22 million for NITRD activities, the same amount NIST received in FY 2002.

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. NOAA would receive \$20 million for FY 2003 under the President's plan, \$1.0 million less than FY 2002.

Peter Harsha

Environmental Protection Agency (EPA): EPA would receive \$2 million in FY 2003 under the President's plan, the same amount it received in FY 2002. 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.