

## **Electrotechnology-Related Research in the FY 2007 Budget**

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### **HIGHLIGHTS**

- Reflecting President Bush's call in the State of the Union Address for increased research in the physical sciences, the National Science Foundation (NSF) Research and Related Activities (R&RA) budget would increase by 7.7 percent to \$4.7 billion, but the request again falls far short of the amount authorized in the NSF authorization bill signed into law in 2002 (see Table II-7).
- Despite a record Department of Defense (DOD) budget, Science and Technology (S&T) funding would see another large cut in FY 2007. Basic Research ("6.1"), Applied Research ("6.2"), Advanced Technology Development ("6.3") and Medical Research, known collectively as S&T, would fall 18.6 percent to \$11.2 billion (see Table II-2).
- The National Aeronautics and Space Administration's (NASA) R&D budget would see a significant increase, by 8.0 percent. However, aeronautics R&D would see an 18.1 percent cut, as NASA shifts its focus to implementing the Vision for Space Exploration (see Table II-12).
- Funding for R&D at the Department of Homeland Security would decrease for the first time since it was created in 2002, falling 10.3 percent to \$1.1 billion. Funding of radiological and nuclear countermeasures will be shifted from the S&T Directorate to a new Domestic Nuclear Detection Office (see Table II-6).
- Reflecting the President's goal as stated in his State of the Union address, research and development at the Department of Energy (DOE) Office of Science, the largest federal supporter of electrotechnology basic research in the United States, would increase by 14.4 percent over FY 2006 to a level of \$3.8 billion (see Table II-11).

*Bill Williams*

- The budget for the National Nanotechnology Initiative (NNI) would drop by \$24 million (1.8 percent) to \$1.3 billion (see Table I-9).
- The Advanced Technology Program is once again targeted for elimination in the budget, as it has been every year since FY 2001. The Manufacturing Extension Partnership is again targeted for reductions.

## **INTRODUCTION**

The following chapter is a broad summary of the Bush Administration's proposed FY 2007 funding levels for select electrotechnology R&D programs at the National Science Foundation (NSF), NASA, the Departments of Energy (DOE), Defense (DOD), Homeland Security (DHS), and Commerce and two multi-agency initiatives—the National Nanotechnology Initiative (NNI) and the Networking and Information Technology Research and Development Program (NITRD). The budget figures contained in this analysis are expressed in current dollars and are based on data provided by federal agencies in the FY 2007 budget.

The budget for electrotechnology research and development in FY 2007 is, for the most part, a beneficiary of the increased focus the Bush Administration is placing on bolstering America's innovation and competitiveness. President George W. Bush introduced his American Competitiveness Initiative (ACI) during his recent State of the Union address, and features policies to improve the nation's ability to compete in the global economy. ACI seeks to "double the federal commitment to the most critical basic research programs in the physical sciences over the next 10 years; make permanent the research and development tax credit; and encourage children to take more math and science."

## **NATIONAL SCIENCE FOUNDATION (NSF)**

Total NSF funding would rise to \$6 billion in FY 2007, an increase of \$439 million or 7.9 percent. According to the NSF statement accompanying the budget, the increase "reflects the agency's key role in [the President's] American Competitiveness Initiative." The statement further asserts, "The increase reflects a 10-year doubling effort for NSF and other agencies announced in the State of the Union address."

However, Congress has not followed through on earlier promises to double the NSF budget, as noted by the National Science Board

## ELECTROTECHNOLOGY-RELATED RESEARCH IN THE FY 2007 BUDGET

Chairman, Warren Washington, during a House Appropriations Subcommittee hearing on March 2<sup>nd</sup>. While applauding the increase, Washington pointed out that it would be far below the levels authorized in the Investing in America's Future Act of 2002, which called for doubling the NSF budget over the five years to 2007. "The President's American Competitiveness Initiative again calls for a doubling of the NSF budget over a 10-year period," he said. "However, we would respectfully suggest that the time to implement these admirable authorizations and initiatives has never been more urgent than now."

The Research and Related Activities (R&RA) budget which funds most of NSF's R&D would increase a substantial margin: \$334 million (7.7 percent) to a level of \$4.7 billion (see Table II-7).

According to the budget, NSF's funding priorities will focus on the following four major funding areas that it expects to "strengthen the science and engineering enterprise through investments in frontier research, the workforce, education and cutting-edge research tools." The listed priorities are: Advancing the frontier; Broadening participation in the science and engineering enterprise; Providing world-class facilities and infrastructure; and Bolstering K-12 education.

In addition to these priority areas, the NSF supports seven major research areas, or Directorates, including: Biological Sciences (BIO); Computer and Information Science and Engineering (CISE); Education and Human Resources (EHR); Engineering (ENG); Geosciences (GEO); Mathematical and Physical Sciences (MPS); and Social, Behavioral and Economic Sciences (SBE.) It also has accounts for Polar Programs and Major Research Equipment and Facilities Construction (MREFC).

The CISE Directorate, which supplies 86 percent of the federal funding for university-based basic computer research, would increase by 6.1 percent (\$30 million) to \$527 million. Within CISE, the Information Technology Research (ITR) sub-activity is the only department to be cut, suffering a 16.6 percent or \$24 million reduction from FY 2006 to \$122 million. This is the second year in a row the ITR sub-activity has received major funding cuts. The remaining CISE sub-activities would all increase significantly: the Computing and Communication Foundations (CCF) would increase by 16.5 percent to a level of \$123 million; Computer and Network Systems (CNS) would receive 15

*Bill Williams*

percent raise to \$163 million; and the Information and Intelligent Systems (ITS), likewise would increase by 15 percent to \$119 million.

The Engineering Directorate would increase by 8.2 percent to a level of \$629 million, a \$48 million increase over FY 2006. The Directorate funds 45 percent of all university-based basic engineering research. Under the Engineering Directorate, the Electrical & Communication Systems sub-activity would see a 4.7 percent, \$4 million increase to a level of \$81 million. The Engineering Education and Centers sub-activity budget would increase by \$3 million for the second year in a row. (For more on NSF, see Chapter 7.)

#### **DEPARTMENT OF DEFENSE (DOD)**

The President's budget for FY 2007 for DOD was released simultaneously with the 2006 Quadrennial Defense Review (QDR). The QDR is a congressionally mandated comprehensive review of how the armed forces plan to fund current and future projects specific to each service. "Informed by the 2006 QDR," according to a DOD press release, "the FY 2007 Budget reflects the Department's continued shift in emphasis, away from the static posture and forces of the last century, and toward the highly mobile and expeditionary forces and accompanying war-fighting capabilities, needed in the century ahead." Correspondingly, DOD's budget also shifts research funding from long-term basic and applied research to more immediate, short-term weapons development.

The military's Research, Development, Test and Evaluation (RDT&E) program provides funding for future military hardware and software and their underlying technologies, covering the full spectrum of R&D. From the most basic research to advanced, full-scale, military systems development, RDT&E collectively consists of seven budget activities: Basic Research ("6.1"), Applied Research ("6.2"), Advanced Technology Development ("6.3"), Advanced Component Development ("6.4"), Systems Development and Demonstration ("6.5"), Management Support ("6.6"), and Operational Systems Development ("6.7"). RDT&E is the federal government's single largest R&D account.

Although funding for DOD R&D would increase by 2.2 percent from the 2006 levels to a record level of \$74.1 billion, funding for the DOD Science and Technology (S&T) program (which includes basic and applied research ("6.1" and "6.2"), advanced technology development

#### ELECTROTECHNOLOGY-RELATED RESEARCH IN THE FY 2007 BUDGET

("6.3"), and medical research) would fall by 18.6 percent to \$11.2 billion (see Table II-2). Each of the services' S&T budgets would see double-digit reductions, with the Army seeing the biggest cuts at 42.9 percent.

The Army, Navy and Air Force fund the University Research Initiatives program (URI), which competitively awards basic research grants to university performers. DOD basic research ("6.1") funding for URI would fall 8.4 percent from FY 2006, down to \$249 million.

RDT&E also funds the Defense Advanced Research Projects Agency (DARPA), whose mission is to "develop imaginative, innovative and often high-risk research ideas, offering a significant technological impact that will go beyond the normal evolutionary developmental approaches." DARPA is one of the big gainers in the President's budget with a 10.6 percent increase to \$3.3 billion. (For more on DOD, see Chapter 6.)

#### **NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)**

In remarks accompanying the release of the President's 2007 Budget Request for the National Aeronautics and Space Administration (NASA), NASA's new administrator, Michael Griffin, announced that the FY 2007 NASA budget would continue to emphasize the president's commitment to manned space exploration. "I have no doubt," Griffin said, "that the expansion of human presence into the solar system will be among the greatest of our achievements."

President Bush outlined the space exploration goals in January 2004 in his report, *The Renewed Spirit of Discovery, The President's Vision for U.S. Space Exploration*. The report expressed the president's commitment to "a long-term human and robotic program to explore the solar system, starting with a return to the Moon that will ultimately enable future exploration of Mars and other destinations." Dr. Griffin conceded, however, that NASA's budget increases would be modest in the context of "pressures on the government, in the wake of the greatest natural disaster our nation has faced, and the war on terrorism."

Priorities outlined in the budget request include completing of the International Space Station (ISS); developing a Crew Exploration Vehicle and Crew Launch Vehicle to replace the aging Space Shuttle by 2014; launching a mission to map the moon's surface by 2008; launching

*Bill Williams*

a Mars Science Laboratory in 2009; and robotic missions to other areas of the solar system.

At first glance, NASA's R&D budget fares quite well in the President's budget, with an 8 percent, \$907 million increase (see Table II-12). This increase is due largely to the expected conclusion of the repairs and return to service of the Space Shuttle. However, any unforeseen problems with the Shuttle could jeopardize the expected budgetary windfall, and much of the increase will go toward developing Shuttle replacement vehicles.

Once again, NASA has rearranged its internal account structure. The NASA budget now contains three accounts: Exploration Capabilities (EC); Science, Aeronautics and Exploration (SAE), and the non-research Inspector General. The EC budget contains the ISS and the Space Shuttle, and would see a 9.2 percent decrease over FY 2006, largely due to the aforementioned Space Shuttle completion. SAE is divided into two sub-accounts: Science and Exploration Systems. The Science sub-account, which contains funding for the bulk of NASA's scientific R&D efforts, would rise by \$76 million, a 1.5 percent increase over FY 2006. Several items of note in the Science account are the Hubble Space Telescope (HST), which would see an increase of \$68 million, and the James Webb Space Telescope (the nominal replacement for the HST), which would increase by \$79 million. The Aeronautics R&D budget (also in the Science sub-account), is one of the big losers in the NASA budget: it would fall by \$160 million, an 18.1 percent cut.

Among other things, the Exploration Systems account contains funding for the developing Shuttle replacement vehicles, the Crew Exploration Vehicle and the Crew Launch Vehicle. This account will see a \$928 million (30.4 percent) increase.

#### **DEPARTMENT OF HOMELAND SECURITY (DHS)**

The research and development budget for the Department of Homeland Security (DHS) for FY 2007 would decrease for the first year since the department's inception three years ago, falling 10.3 percent, or \$132 million, to a level of \$1.1 billion (see Table II-6).

The Directorate for Science and Technology (S&T Directorate) is the primary research and development arm of the DHS. The stated mission

#### ELECTROTECHNOLOGY-RELATED RESEARCH IN THE FY 2007 BUDGET

of the S&T Directorate is to “protect the homeland by providing Federal and local officials with state-of-the-art technology and other resources.” It does by “enabling research into technology to provide the capabilities to “anticipate, prevent, respond to and recover from terrorist acts.”

On February 6, 2006, Dr. Charles McQueary, Under Secretary for Science and Technology at the Department of Homeland Security (DHS) announced that he will resign from his post effective March 25. Incidentally, the President’s budget released that week indicated that the S&T Directorate would be cut by \$456 million, a 32 percent cut from FY 2006. Most of the decrease is due to the Department’s shifting \$315 million from S&T to the Domestic Nuclear Detection Office.

Most of the DHS research budget is directed towards Radiological and Nuclear, Explosives, Chemical and Biological Countermeasures. Explosives countermeasures would see the largest gain in the FY 2007 budget, with a near doubling of funding from \$44 million to \$87 million. Chemical Countermeasures would be cut by 11.7 percent, or \$11 million, from FY 2006 to a level of \$83 million. Biological Countermeasures would also receive a cut, 10.4 percent, or \$39 million to a level of \$337 million. Radiological & Nuclear Countermeasures would be zeroed out from the S&T budget and transferred to the Domestic Nuclear Detection Office (DNDO). The DNDO would be funded at \$328 million.

#### **DEPARTMENT OF ENERGY (DOE)**

Proclaiming that America is “addicted to oil, which is often imported from unstable parts of the world,” President George W. Bush announced a broad new proposal designed to break this addiction through technology in his State of the Union Address on 31 January 2006. The President and DOE subsequently introduced the Advanced Energy Initiative, a 22-percent increase in clean-energy research “to push for breakthroughs in two vital areas. To change how we power our homes and offices, we will invest more in zero-emission coal-fired plants, revolutionary solar and wind technologies, and clean, safe nuclear energy.”

The DOE budget reflects the President’s stated commitment, with one of the largest increases in R&D spending for FY 2007. Total R&D at the DOE would increase during FY 2007 by \$326 million, a 3.7 percent increase, to \$9 billion (see Table II-11).

*Bill Williams*

The largest supporter of electrotechnology-related basic research in the United States, DOE's Office of Science lists its mission as "[protecting] our national and economic security by providing a world-class scientific research capacity and advancing scientific knowledge." One of the big winners in the FY 2007 budget, R&D in the Office of Science would increase by 14.4 percent to a level of \$3.8 billion.

The Office of Science contains many budgetary beneficiaries of the new energy initiative including R&D in the Basic Energy Sciences (BES) program, which would see an increase of 25.2 percent or \$286 million to \$1.4 billion. Nuclear Physics Construction would see a 633 percent, \$13 million increase over FY 2006, and Fusion Energy Sciences would increase by 11 percent or \$31 million to \$319 million. This increase is due to the United States' contribution to the International Thermonuclear Experimental Reactor (ITER) program, a proposed joint international fusion reactor project.

On the other hand, Fossil Energy R&D would see dramatic reductions in the FY 2007 budget, with a 31 percent or \$149 million cut from FY 2006 to a level of \$330 million. The only sub-account within Fossil Energy R&D to receive an increase would be the FutureGen project, which would increase by more than 200 percent, from \$18 million to \$54 million. According to the DOE, "FutureGen is an initiative to build the world's first integrated sequestration and hydrogen production research power plant. The project is intended to create the world's first zero-emissions fossil fuel plant." (For more on the DOE, see Chapter 9.)

#### **NATIONAL NANOTECHNOLOGY INITIATIVE (NNI)**

The National Nanotechnology Initiative (NNI) is a multi-agency nanotechnology research initiative conducted at a total of ten federal agencies. NSF, DOD, DOE, NIH, and NASA are the agencies with the most significant investments in nanotechnology research.

After several years of significant increases, NNI funding would fall by \$24 million (1.8 percent) to a level of \$1.3 billion. The organizations taking the most drastic hits are NASA, which would see a 50 percent cut from \$50 million down to \$25 million, and DOD, which would fall from \$436 million in FY 2006 down to \$345 million, a 21 percent reduction (see Table I-9).

## ELECTROTECHNOLOGY-RELATED RESEARCH IN THE FY 2007 BUDGET

NSF's nanotechnology investments would increase by 8.4 percent, from \$344 million in FY 2006 to \$373 million. The Department of Commerce would increase from \$76 million to \$86 million, a 13.2 percent increase.

The Administration reports that the Department of Energy is near completion of 5 Nanoscale Science Research Centers which provide resources and infrastructure for each of the agencies to use for research. The DOE reports that, "The research facilities will focus on synthesis, processing, and fabrication of nanoscale materials. They will be co-located with existing user facilities to provide sophisticated characterization and analysis capabilities."

### **NETWORKING AND INFORMATION TECHNOLOGY R&D (NITRD)**

Another multi-agency research program of considerable importance is the Networking and Information Technology R&D Program (NITRD). Chartered in 1991 as a collaboration of federal agencies involved in fundamental high-end computer research, seven federal agencies participate in NITRD, including the Department of Defense (DOD), the National Science Foundation (NSF), the Department of Energy (DOE), NASA, the Department of Commerce, and the Environmental Protection Agency (EPA). (See Table I-9 for funding details; for more on NITRD, see Chapter 23.)

According to NITRD, the program's activities and plans are coordinated in eight Program Component Areas (PCAs): "high-end computing infrastructure and applications; high-end computing research and development; cyber security and information assurance; human-computer interaction and information management; large-scale networking; high-confidence software and systems; social, economic, and workforce implications of IT and IT workforce development; and software design and productivity." The PCA's are coordinated and planned by an Interagency Working Group (IWG).

For FY 2007, NITRD made several changes including adding High End Computing and the Cyber Security and Information Assurance (CSIA) as an IWG.

On March 1, John Marburger, director of the White House Office of Science & Technology Policy, announced that the President's Council on

*Bill Williams*

Science and Technology (PCAST) would be expanded by 14 new members in order to “comply with its newest task of assessing the federal Networking & Information Technology Research & Development Program.” Said Marburger, “These appointments will enable PCAST to play a key role in helping to implement this initiative.”

Funding for R&D at NITRD would increase by 7.7 percent over FY 2006 to a level of \$3.1 billion. All agencies participating in NITRD would receive an increase except for the Environmental Protection Agency (EPA), which would see flat funding at \$6 million and Health and Human Services, which would see a 2.5 percent cut from FY 2006 to a level of \$548 million. Two agencies would see dramatic increases: the DOE NITRD budget would increase by 32.8 percent over FY 2006 to a level of \$387 million, and the National Science Foundation NITRD Budget would increase 11.5 percent to a level of \$904 million.

#### **NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)**

Research and development at the National Institute of Standards and Technology (NIST) laboratories is one of the bright spots in the FY 2007 budget request. Funding would increase by 21 percent over FY 2007 to \$382 million (see Table II-14).

The National Institute of Standards and Technology (NIST) is a non-regulatory federal agency within the Commerce Department. NIST was founded in 1901 and has a mission to “develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life.”

Within NIST, the Advanced Technology Program (ATP) is once again targeted for elimination in the Bush Administration’s budget request, as it has been every year since FY 2001. ATP’s mission is to “accelerate the development of innovative technologies that promise significant commercial payoffs and widespread benefits for the nation.” Key defenders in Congress have stepped in to rescue the beleaguered program each year. The Hollings Manufacturing Extension Partnership, which is designed to help small and medium-sized manufacturers utilize cutting-edge manufacturing technologies, is targeted for a 56 percent reduction in FY 2007, to a level of \$46 million. (For more on NIST, please see Chapter 13.)