

Electrotechnology-Related Research in the FY 2009 Budget

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HIGHLIGHTS

Electrotechnology-related research spans a very broad array of science and engineering as it includes electrical, electronic, communications, computer and information science and engineering with scales that go from nanotechnology to the interconnected electric grid and multiple federal agencies. While computer science and engineering is often included as an electro technology, computing research is treated in separately in Chapter 22. The passage of the America COMPETES Act will have a significant impact on expenditures in this area.

- The National Science Foundation (NSF) would see significant gains in FY 2009 as one of the beneficiaries of the President's goal of doubling research at key agencies over a 10-year period through the American Competitiveness Initiative (ACI). The NSF budget would increase by \$822 million or 13.6 percent to \$6.9 billion (see Table II-7).

- Bucking recent trends, the basic research ("6.1") budget at the Department of Defense (DOD) would increase by 4 percent or \$65 million to \$1.7 billion. Advances there, however, are offset by dramatic reductions in both applied research ("6.2") and advanced technology development ("6.3") and overall S&T ("6.1"- "6.3" and medical), which would fall 11.7 percent, or \$1.5 billion, to \$11.7 billion (see Table II-2).

- The National Aeronautics and Space Administration (NASA) budget would continue to rise 2.9 percent to \$17.6 billion due to the Administration's emphasis on the development of the next generation Crew Launch Vehicle and Crew Exploration Vehicle. As in recent years, these increases come at the expense of NASA aeronautics, physical sciences and other research (see Table II-12).

- The Department of Homeland Security (DHS) Science & Technology Directorate is currently undergoing a reorganization under new Undersecretary of Science and Technology Jay Cohen in response to congressional criticism. Still, the DHS S&T budget would increase by 4.7 percent or \$39 million, to a level of \$869 million (see Table II-6).
- The Department of Energy (DOE) Office of Science is another agency targeted for doubling over a 10-year period through the ACI. Accordingly, DOE R&D would increase by 8.9 percent or \$858 million to a level of \$10.5 billion (see Table II-11).
- The budget for the National Nanotechnology Initiative (NNI) would increase 2.4 percent to \$1.5 billion (see Table I-9).
- National Institute of Standards and Technology (NIST) R&D would climb by 4.7 percent to \$546 million as part of the ACI; however, the Technology Innovation Program (TIP) and the Manufacturing Extension Partnership (MEP) are again targeted for elimination (see Table II-14).

INTRODUCTION

The following chapter is a broad summary of the Bush Administration's proposed FY 2009 funding levels for select electrotechnology R&D programs at NSF, NASA, DOE, DOD, DHS, and Commerce and two multi-agency initiatives—the 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 agency data from the release of the FY 2009 budget.

The President's Budget Request (PBR) for FY 2009 reflects the President's desire to increase funding at several key agencies through his proposed American Competitiveness Initiative (ACI). Bush outlined his vision for science and technology in his statement accompanying the budget request: "To keep America competitive into the future, we must trust in the skill of our scientists and engineers and empower them to pursue the breakthroughs of tomorrow. Last year, Congress passed legislation supporting the American Competitiveness Initiative, but never followed through with the funding. This funding is essential to keeping our scientific edge. So I ask Congress to double federal support for critical basic research in the physical sciences and ensure America remains the most dynamic nation on Earth."

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With 2008 being a presidential election year and the Bush presidency in its final year, the outlook for the president's budget request as submitted is grim at best. As soon as the budget was released congressional leaders had already declared it "dead in the water." However, many of the science and technology themes and priorities, such as support for the ACI programs, are shared between the White House and Congress.

NATIONAL SCIENCE FOUNDATION (NSF)

National Science Foundation Director Ardent Bement stated that NSF's task is "to keep science and engineering visionaries focused on the furthest frontier. The aim," Bement said, "is to recognize and nurture emerging fields, and to prepare the next generation of scientific and engineering talent and leaders." NSF continues to benefit in the budget request by being targeted for doubling over a ten-year period (2006-2016), as part of the ACI. NSF would enjoy substantial increases in FY 2009. The total NSF budget would increase by \$822 million, a 13.6 percent increase, to a historic high of \$6.9 billion (see Table II-7).

In his remarks about the budget request, Director Bement commented that, "In his recent State of the Union address, the president said he was disappointed that congress had under-funded basic scientific research, and called on congress to put NSF and other research agencies back on track to double their research budgets. I'm also greatly disappointed that we've fallen substantially short for FY 2008. Most emphatically, flat budgets must not be NSF's fate in the future." Bement continued, saying that the NSF budget for 2009 puts the agency "back on the right track."

NSF's overall R&D investment, excluding non-R&D activities, would increase 15.5 percent to \$5.1 billion (see Table II-7). Touting the significant increase in research funding Director Bement remarked that, "Without support for frontier research that covers all disciplines—in all potential interdisciplinary combinations—the transformative discovery that sparks the next technological revolution may not occur in our own backyard." All of the research directorates would receive double-digit percent increases in the budget. The Engineering directorate would increase by \$122 million (19 percent) to \$759 million. The Math and Physical Sciences directorate would receive a \$235 million (20.2 percent) increase to \$1.4 billion. Geosciences would climb by \$96 million (12.8 percent) to \$849 million; Biological Sciences would increase by \$63 million (10.3 percent) to \$675 million; and Computer

and Information Science and Engineering would see an increase of \$104 million (19.5 percent) to \$639 million.

NSF's contribution to the interagency National Nanotechnology Initiative would increase by \$8 million to \$397 million, a 2.1 percent increase. According to Director Bement, the 2009 budget request will emphasize interdisciplinary programs, centers and multi-investigator grants. NSF plans to establish five to seven new Science and Technology Centers (STCs). The STCs will "tackle frontier problems of national and global importance by developing innovative partnerships among disciplines and with business and industry." The Science and Technology Centers program will be increased from \$1 million to \$16 million in FY 2009 to accommodate this expansion.

Major Research Equipment and Facilities Construction would be the big loser in the NSF budget, receiving a 28.2 percent cut to \$148 million, a drop of \$58 million. (For more on NSF, see Chapter 6.)

DEPARTMENT OF DEFENSE (DOD)

DOD accounts for more than one-third of all engineering research performed in U.S. academic institutions through DOD's Research, Development, Test and Evaluation (RDT&E) program. DOD is the third-largest federal sponsor of university research, supporting more than 300 universities and colleges. The DOD S&T Program accounts for 40 percent of the federal investment in math and computer science and 65 percent in electrical and mechanical engineering.

The war in Iraq and the global war on terror continue to be the funding priorities for the Department of Defense. However, Secretary of Defense Robert Gates has indicated that he intends to halt the recent slide in the DOD's investment in basic research. Secretary Gates testified before the House Armed Services Committee on the FY 2009 budget request, "As changes in this century's threat environment create strategic challenges—irregular warfare, weapons of mass destruction, disruptive technologies—this request places greater emphasis on basic research, which in recent years has not kept pace with other parts of the budget."

Accordingly, the Department of Defense has requested a 4 percent, \$65 million increase in basic research ("6.1") to \$1.7 billion. The increase there, however, is offset by dramatic reductions in both applied research

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(“6.2”), a 16.1 percent cut of \$813 million to \$4.2 billion; and to Advanced Technology Development (“6.3”), which would fall by \$455 million or 7.6 percent to \$5.5 billion. Overall S&T (“6.1”-“6.3” and medical) would fall 11.7 percent or \$1.5 billion to \$11.7 billion. But according to AAAS, excluding earmarks DOD S&T would gain 5.6 percent between 2008 and 2009 (see Table II-5).

Within the individual services, overall S&T would drop in each branch. “6.2” and “6.3” accounts would face the largest reductions, while each branch would see modest increases, or flat funding, in their respective basic research (“6.1”) accounts.

The Defense Advanced Research Projects Agency (DARPA) is a DOD agency responsible for “developing imaginative, innovative and often high-risk research ideas, offering a significant technological impact that will go beyond the normal evolutionary developmental approaches.” DARPA’s budget would increase by 11 percent or \$339 million. For more information on the DOD budget, see Chapter 5.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

The FY 2009 budget for NASA would continue to be dominated by the Bush Administration’s vision for manned space exploration. Chief among the Administration’s priorities are completing assembly of the International Space Station, retiring the Space Shuttle by 2010, and completing the development of its replacements, the Orion Crew Exploration Vehicle and the Ares Launch Vehicle. NASA Administrator Michael Griffin called this transition “the greatest management challenge facing NASA since Apollo.” Also mentioned as priorities for NASA are beginning development of an outer planets flagship mission, increasing funding for lunar science missions, and funding research into the Next Generation Air Transportation System (NGATS). The total budget for NASA will again set a record high with a 2.9 percent increase to \$17.6 billion. The NASA R&D budget would likewise see a boost of 4.9 percent to \$12.8 billion (see Table II-12).

The Science budget of \$4.4 billion represents 25 percent of NASA’s FY 2009 budget. This program is directed toward NASA’s Science Mission Directorate (SMD) programs which include Earth science, heliophysics, astrophysics, and planetary science. However, this amount represents a 5.6 percent or \$265 million cut from FY 2008. The Space Operations

program would receive a 4.5 percent increase of \$249 million to \$5.8 billion. Space Operations includes the International Space Station, the Space Shuttle, and Space and Flight Support. The Aeronautics program would continue its budgetary freefall with a 12.7 percent, \$65 million cut to \$447 million. NASA does plan a service mission in the near future to repair and upgrade the Hubble Space Telescope, and also plans to build the Kepler and James Webb Space Telescopes for deep space exploration. (See Chapter 9 for more on the NASA budget.)

DEPARTMENT OF HOMELAND SECURITY (DHS)

After decreases in the past two budgets, DHS R&D would increase in the President's FY 2009 budget by \$41 million to \$1.0 billion, a 4.1 percent increase (see Table II-6). Last year the DHS S&T Directorate underwent a major reorganization under new Undersecretary of Science and Technology Jay Cohen, in response to congressional criticism of how DHS R&D has been conducted and the research funding was handled. In fact, the agency is still currently undergoing restructuring.

The Directorate for Science and Technology (S&T Directorate) is DHS' primary research and development arm. The stated mission 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 so by "enabling research into technology to provide the capabilities to anticipate, prevent, respond to and recover from terrorist acts." Funding for the S&T Directorate would increase by 4.7 percent or \$39 million to \$869 million. Funding for programs within the S&T Directorate is mixed, with changes ranging from a 38.5 percent increase (\$10 million) for Border and Maritime Security to a cut of 41.4 percent (\$27 million) for Infrastructure and Geophysical. The largest component of the DHS R&D budget is the Domestic Nuclear Detection Office (DNDO), which was created out of the S&T Directorate in 2006. It is now a standalone office devoted to providing "resources for the development and evolution of the global nuclear detection architecture." After being created with an initial budget of \$265 million in FY 2007 and seeing an increase of \$9 million for FY 2008, the DNDO R&D portfolio would see a slight increase for FY 2009 of 1.8 percent (\$5 million) to \$279 million.

The extramural aspect of the DHS S&T budget is coordinated through the Homeland Security Advanced Research Project Agency (HSARPA), which is modeled after DOD's DARPA. HSARPA provides grants for

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basic and applied research to assist the agency to “conduct rapid prototyping and commercial adaptation,” and to “research revolutionary options.” HSARPA is funded through the Innovation portfolio, which would see an increase of 36 percent to \$45 million. Funding for University Programs would suffer losses, declining from \$49 million in 2008 to \$44 million in 2009, a drop of \$6 million or 11.2 percent. This program funds university-based centers that consist of multi-year university consortia directed to R&D for homeland security. (For more on DHS, see Chapter 11.)

DEPARTMENT OF ENERGY (DOE)

The Department of Energy is the largest federal sponsor of physical sciences research and one of the largest sponsors of engineering research. Nearly half of all physical sciences research, one fifth of engineering research, and a third of computer science research is DOE-funded. Most of the research is conducted at DOE’s ten national laboratories and at research universities. Along with NSF and the NIST laboratories, DOE benefits significantly as a part of the ACI, which seeks to double funding for these three key agencies over a ten-year period from 2006-2016.

The DOE FY 2009 budget would climb 4.7 percent to \$25.5 billion, with the goal of helping to “address the growing demand for affordable, clean and reliable energy; preserve our national security; and enable scientific breakthroughs that could have significant impacts on our quality of life and the health of the American people.” The DOE R&D budget would increase by an even more dramatic 8.9 percent, fueled by a 19 percent, \$749 million boost in the DOE Office of Science to \$4.7 billion. Within the Office of Science, Fusion Energy Research, which funds the U.S. commitment to the International Thermonuclear Experimental Reactor (ITER), a joint international fusion reactor project, would see a dramatic 72 percent increase to a level of \$493 million. This rise is due to ITER funding being restored after being completely cut in the FY 2008 omnibus appropriations bill. The news for DOE is not all good, however. The large Office of Science increase is partially offset by reductions in R&D at the Offices of Energy Efficiency & Renewables; Electricity Delivery & Reliability; and Nuclear Waste Disposal (see Table II-11).

The DOE R&D budget also benefits as the key agency in the President’s Advanced Energy Initiative (AEI). For FY 2009, the AEI is funded at \$3.2 billion, up \$623 million. The AEI will fund projects seeking to

accelerate the deployment of renewable energy, clean coal and nuclear energy technologies to “reduce U.S. dependence on foreign sources of energy and transform the energy economy by promoting the development of cleaner sources of electricity production.” Included in the FY 2009 budget are such projects as new nuclear technology, clean coal, solar power, lithium-ion battery technology, plug-in hybrid electric vehicles and drive-train electrification.

The Office of Energy Efficiency and Renewable Energy, which conducts R&D to “promote the development and use of clean, reliable, and cost-effective energy efficiency and renewable energy technologies,” would nominally be cut by 17.2 percent, or \$213 million, to a level of \$1.0 billion. However, this reduction includes eliminating \$187 million in “congressionally directed projects,” otherwise known as earmarks. Not all the cuts in this program are earmarks, though. The Hydrogen Technology budget would be cut by 30.7 percent, or \$65 million, to a level of \$146 million, and Hydropower would receive a whopping 70 percent cut, down to \$3 million from \$10 million.

Within Fossil Energy is the FutureGen project, which seeks to “promotes advanced, full-scale integration of integrated gasification combined cycle (IGCC) to produce electric power from coal, while capturing and sequestering carbon dioxide (CO₂) resulting in near-zero atmospheric emissions coal energy systems.” FutureGen funding would more than double to \$156 million, despite DOE’s surprise cancellation of a proposed FutureGen project in Illinois. The DOE cited escalating costs as the reason for killing the project. (For more on DOE, see Chapter 8.)

NATIONAL NANOTECHNOLOGY INITIATIVE (NNI)

The National Nanotechnology Initiative (NNI) is a multi-agency initiative established to coordinate nanoscale science, engineering and technology research. After capping off a tripling of its budget from its inception in FY 2001 to last year, NNI would continue its trend of steady budgetary increases in FY 2009, with a 2.4 percent boost to \$1.5 billion (see Table I-9). The majority of this increase is due to the participation of the three ACI agencies in the NNI.

According to the budget, three key NNI priorities in the FY 2009 budget are support for research on fundamental nanoscale phenomena and processes; instrumentation research; metrology and standards and

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nanomanufacturing research; and Environmental, Health and Safety (EHS) R&D. DOD would be the biggest contributor to NNI's budget, with \$431 million. This contribution nominally represents a \$56 million decrease from the FY 2008 levels; however, the FY 2008 estimate contains \$112 million in earmarks not contained in the NNI plan. NSF would continue to be a major participant in the NNI program, with a \$397 million request, an increase of \$8 million. DOE would likewise see a substantial boost with a \$60 million increase to \$311 million. (For detailed information on the NNI, see Chapter 23.)

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, the stated purpose of NITRD is to provide a "framework and mechanisms for coordination among federal agencies that support R&D in networking and information technology."

NITRD is identified as an "administration interagency R&D budget priority" in the FY 2009 budget. As such, overall funding for NITRD would increase by \$207 million, to a level of \$3.5 billion, a 6 percent increase over the FY 2008 estimate. NSF would be the largest contributor to the NITRD budget, with a \$1.1 billion contribution. The next largest contributors are the Department of Defense and the National Institutes of Health, with \$547 million and \$510 million contributions, respectively. However, both of these agencies' budgets for NITRD represent a decrease from the previous year, \$35 million for DOD, and one million for NIH, as do the budgets for National Security Agency and NASA. These cuts are offset by increases in NSF, the Defense Advanced Research Projects Agency (DARPA), Department of Energy (DOE), National Institute of Standards and Technology (NIST), and the National Oceanic and Atmospheric Association (NOAA). The contribution from the Environmental Protection Agency (EPA) and the National Archives and Records Administration (NARA) would be flat. (See Table I-9 for funding details; for more on NITRD, see Chapter 22.)

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

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.”

The NIST budget includes extramural programs, the Technology Innovation Program (TIP), and the non-R&D Hollings Manufacturing Extension Partnership (MEP). The America COMPETES Act created TIP in 2007, and its mission is “to support, promote and accelerate innovation in the United States through high-risk, high-reward research in areas of critical national need.” TIP replaces the former Advanced Technology Program. The MEP is “a nationwide network of resources transforming manufacturers to compete globally, supporting greater supply chain integration, and providing access to technology for improved productivity.”

Funding for TIP and MEP remain a source of contention between the Bush Administration and Congress. Regardless of the new name, the Administration is targeting TIP again for elimination in FY 2009. TIP has been flagged for removal every year since George W. Bush took office, and funding for the MEP is also drastically reduced to \$4 million for close-out costs.

In contrast, the recently passed America COMPETES Act contains authorization for increased funding for both programs. In his remarks about the President’s budget request House Science and Technology Committee Chair Bart Gordon (D-TN) noted the reason for Congress bucking the president on these programs: “Since taking office, [we have seen] the loss of 3.4 million manufacturing jobs, with 217,000 jobs lost in 2007 alone, and manufacturing employment in the United States now stands at its lowest point since 1950. COMPETES seeks to reverse this trend with robust funding for the Manufacturing Extension Partnership and Technology Innovation programs—both of which have proven track records for return on investment and job creation.”

On the other hand, NIST’s intramural research programs would fare quite well as beneficiaries of the President’s ACI. Along with NSF and DOE’s Office of Science, NIST laboratories are targeted for a doubling of their budget from 2006-2016. As such, the NIST intramural research budget would increase 16.1 percent to \$447 million, while NIST R&D overall would climb by 4.7 percent to \$546 million (see Table II-14). (For more on NIST, please see Chapter 12.)