

Electrotechnology-Related Research in the FY 2014 Budget

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HIGHLIGHTS

- The FY 2014 budget request targets funding increases to civilian basic and applied R&D, with support for electrotechnology-related research in areas such as smart grid, the electrification of transportation, robotics, cyber-physical systems, and advanced sensors.
- The \$4.0 billion request for the multi-agency Networking and Information Technology Research and Development (NITRD) Program includes support for advanced networking, health IT, wireless spectrum sharing, cloud computing and other information technologies.
- The \$1.7 billion request for support of the National Nanotechnology Initiative includes a research emphasis on nanoscale sensors and nanoelectronics.

INTRODUCTION

Electrotechnology encompasses a wide array of basic and applied research into the applications of electricity, and finds expression in all technology sectors from aerospace and transportation to communications, defense, healthcare and manufacturing. The breadth of the discipline and the multi-disciplinary nature of many federal R&D programs make it impractical to provide a “cross-cut” of the FY 2014 request for electrotechnology. Instead, this chapter highlights areas of enhanced funding or strategic emphasis involving electrotechnology in the key federal department and agency budget proposals. Computing research is highlighted separately in Chapter 22. Requested increases or decreases are referenced against FY

2012 funding levels, and are not adjusted for inflation.

DEPARTMENT OF DEFENSE

Despite the proposed 6.7 percent cut in its FY 2014 R&D budget request, the Department of Defense (DOD) remains a primary source of federal funding for electrotechnology-related research, which is supported through each of the military services and by the Defense-wide mission agencies such as the Defense Advanced Research Projects Agency (DARPA). Electrotechnology R&D support spans the DOD R&D funding categories from Basic Research to Operational Systems Development.

Key DOD electrotechnology priorities include cyberspace operations (\$4.7 billion requested), space capabilities (\$10.1 billion requested), and new intelligence, surveillance, and reconnaissance technology (\$2.5 billion requested).

Army priorities include sensors and electronic survivability, electronic warfare, missile technology, electronic devices, night vision optics, command control and communications, anti-terrorism technology, missile defense, electronic surveillance and avionics. Navy priorities include basic and applied research on electromagnetic systems, command and control, precision approach and landing systems, space and electronic warfare, acoustic sensors, next generation jammers, fleet telecommunications and information technology development, Marine Corps data systems, satellite communications, ocean and space sensors, and unmanned aerial vehicles. The Air Force is supporting work on high energy lasers, directed energy weapons, aerospace propulsion and sensor technology, electronic combat and airborne electronic attack technology, space situational awareness, and an expendable launch vehicle for space operations.

Electrotechnology-related R&D priorities in the Defense-wide agencies include cognitive computing, information and communications technology, cybersecurity, electronics technology, advanced aerospace systems, networked communications, robotics and autonomous systems, high-performance computing, network-centric warfare technology, advanced sensors, directed energy, and wide area surveillance.

DEPARTMENT OF ENERGY

The Department of Energy (DOE) is targeted for an 8.0 percent budget

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increase over FY 2012, which would provide significant support for electrotechnology R&D in throughout the department's programs in energy, science, and defense.

National security, weapons, non-proliferation and nuclear programs in DOE's National Nuclear Security Administration and labs are slated for a \$647 million (or 5.9 percent) increase.

The requested \$1.2 million (35.9 percent) increase for DOE's energy programs includes enhanced funding for vehicle technologies, solar and wind energy. Transportation-related goals include a focus on energy storage, electric motors and advanced power electronics. There is a "Grand Challenge" on integration of electric vehicles, building energy management and solar generation into the grid distribution system. Other priorities include the SunShot Grand Challenge to achieve cost-competitive solar power by 2020 and development of wide bandgap semiconductor technology for more energy efficient electronic devices.

The Office of Electricity Delivery and Energy Reliability is on tap for a \$32.8 million (24.1 percent) increase to support Smart Grid and clean energy transmission and reliability research. \$38 million is slated for cybersecurity for the energy delivery system and \$15 million for grid-scale energy storage R&D.

Despite sharp cuts proposed to fossil energy R&D, \$276.6 million is requested for research into carbon capture and storage and advanced energy systems to enhance the efficiency of fossil energy. The Nuclear Energy program is slated for a 13.9 percent cut, including a major reduction in defense activities, but the budget requests a 4.5% increase for Small Modular Reactor Licensing technical support.

ARPA-E would receive a \$104 million (37.8 percent) boost in funding, with a strategic focus on supporting transformative, breakthrough research in the areas of transportation and stationary power systems. DOE's Office of Science Programs would grow 4.4 percent to \$5.2 billion, including increases for Advanced Scientific Computational Research, Basic Energy Sciences, Fusion, and Nuclear Physics.

DEPARTMENT OF HOMELAND SECURITY

The Department of Homeland Security (DHS) FY 2014 budget proposal

includes a \$1.5 billion request (126.9 percent increase) for the DHS Science and Technology Directorate, the bulk of which supports homeland security-related research at DOE's laboratory facilities. Within the request, \$467 million is targeted at R&D "innovation" programs related to threat detection and characterization, cybersecurity, information infrastructure protection, and enhancement of tracking/screening information systems to minimize visa overstay.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA's \$17.7 billion FY 2014 budget request is essentially flat to FY 2012 funding levels, and supports electrotechnology-related research throughout all five of NASA's research-oriented program areas: science, aeronautics, space technology, and exploration, as well as in NASA's space operations and education programs.

Within the \$5 billion Science Directorate, new priorities include a doubling of NASA's efforts to identify and characterize potentially hazardous near-Earth objects (NEOs), assumption of the radioisotope power system development program infrastructure from the Department of Energy, investment in a new land imaging project (LandSat8), and the development of a new robotic science rover for a 2020 Mars mission. NASA also plans to continue work on the James Webb Space Telescope and to solicit proposals for its Advanced Information Systems Technology (AIST) and Advanced Component Technology (ACT) projects.

NASA's flat \$566 million request for the Aeronautics program includes an FY 2014 emphasis on technologies to reduce aircraft fuel burn, noise, and emissions, demonstration of a wireless sensor designed for lightning protection and detection of damage in composite structures, and continued development of NextGen air traffic management concepts and technology. Despite proposed cuts in fundamental aeronautics, NASA still plans to test new fixed and rotary wing concepts, explore advanced composites and hypersonic flight, and invest in computer-based tools and models. The Aeronautics test program includes a focus on modernizing electronic systems for ground and flight testing. The Aeronautics FY 2014 request also includes a \$22.3 million (or 21.4 percent) increase for Integrated Systems Research supporting expanded work on future aircraft engine designs, governance of unmanned systems in the civil airspace system, advanced composites and Phase 2 of the Environmentally Responsible

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Aviation project.

NASA's \$742.6 million request for the Space Technology program represents a 29.4 percent increase over FY 2012. The program draws on the talent of NASA employees, academia, small business, and the broader space enterprise to develop projects that support NASA's space technology roadmaps. FY 2014 priorities include ground and flight demonstrations of spaceflight concepts, demonstration of the CubeSat spacecraft cluster, development of alternative water processors and regenerative fuel cells that convert water to energy, and testing of new approaches for large scale deployable solar array systems, power processing units and advanced thrusters, including a Solar Electric Propulsion System for NASA's planned asteroid retrieval mission.

The Space Technology budget also includes increased funding for the Small Business Innovative Research and Small Business Technology Transfer programs, as well as a 51.0 percent bump in funding to NASA's cross-cutting space technology development program, with support for advanced manufacturing and nanotechnology. Other on-going space technology programs include the Laser Communications Demonstration project and the PhoneSat mission, which demonstrates use of affordable, off-the-shelf components for command and control of operational satellites. Finally, a 28.7 percent requested increase for Exploration Technology Development would support a variety of projects including solar-electric propulsion technologies, new solar array systems, power processing units, next-generation life support, human-robotics systems, telerobotics, high-efficiency solar cells for in-space power, nuclear systems, and autonomous systems.

The NASA request for Human Exploration and Operations drops 1 percent from FY 2012 levels to \$7.8 billion, but includes continued support of the International Space Station, reliance on commercial spaceflight for access to low-earth orbit, development of a new heavy-lift Space Launch System and Orion Multipurpose Crew Vehicle to enable manned deep-space exploration missions, and a future robotic mission to capture a small asteroid. The budget also supports investment in ground-systems modernization for space flight operations.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

As one of three federal S&T agencies targeted for significant growth in the America COMPETES Act [what you meant?], the National Institute of Standards and Technology (NIST) budget request seeks a \$177.5 million (23.6 percent) increase, bringing agency operations to \$928.3 million for FY 2014. New priorities within the budget request include increased emphasis on manufacturing, cybersecurity and forensics.

The bulk of the request (\$693.7 million) supports scientific and technical research through NIST's laboratory programs, including a host of on-going electronics and telecommunications projects in areas such as optical spectroscopy, advanced bioelectronics, CMOS device reliability, magnetohydrodynamics and spin electronics, superconductor electromechanics, biomagnetic imaging, power device and thermal metrology, MEMs measurement science, and thin film electronics. New funding priorities include cybersecurity R&D and standards (+\$15 million), advanced communications (+\$10 million), cyber-physical systems (+\$10 million) and health information technology (+\$3 million).

Electrotechnology companies also benefit from NIST's industrial technology services. The FY 2014 NIST budget proposal requests \$174.5 million for these programs, including increases of \$25 million for establishment of regional Manufacturing Technology Acceleration Centers to help small and mid-sized manufacturers adopt innovative technologies more quickly and \$21.4 million for new public-private consortia to prioritize research needs.

NATIONAL INSTITUTES OF HEALTH

Much of NIH's electrotechnology-related R&D is done through interdisciplinary projects and in partnership with other federal agencies. One example is the new \$100 million Brain Initiative announced by the White House in April 2013, which will leverage funds from NIH, DARPA, and the National Science Foundation (NSF) to develop new tools and technologies, including molecular scale sensors and "Big Data" tools and techniques, for use by neuroscientists to help them understand how the millions of brain cells interact. Another important NIH priority for FY 2014 is a \$50 million funding request for the development of an IT-based Cures Acceleration Network designed to integrate research results with

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clinical trial data in order to accelerate the development of “high speed cures.”

The primary focal point within the NIH research organization for electrotechnology-related R&D is the National Institute of Biomedical Imaging and Bioengineering (NIBIB), which funds projects in such areas as magnetic resonance imaging, image-guided interventions, modeling and simulation, micro- and nano-systems, ultrasound, and rehabilitative engineering. NIBIB fares poorly in the President’s FY 2014 budget request, growing only \$1M over its FY 2012 funding level of \$338 million.

NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is a primary beneficiary of the President’s FY 2014 STEM budget request, with a proposed increase of \$592.7 million or 8.2 percent over FY 2012. NSF’s Engineering Directorate (ENG) is on tap for an \$84.95 million increase (+10.3 percent).

Electrotechnology-related research is supported primarily through the ENG Electrical, Communications and Cyber-Systems (ECCS) division, which is slated for an \$11.2 million increase (10.5 percent). The overall ECCS budget request of \$117.9 million will support research on advanced devices and systems directed towards computing, data storage, networking, and data management. Other priorities include more efficient radio spectrum use and greatly improved low-power energy-conserving device technologies, as well as work on robotics, smart health research, and the integration of intelligent decision-making algorithms and hardware into physical systems

Electrotechnology research is also funded through multi-disciplinary projects supported by the other ENG divisions, engineering research centers, special programs such as NSF’s Innovation Corps and the Interdisciplinary Research and Education (INSPIRE) and Small Business Innovation Research programs, as well as by the Computer and Information Science and Engineering (CISE) Directorate. Multi-disciplinary funds are directed at cyber-enabled materials and smart systems, science and engineering for sustainability, advanced manufacturing techniques, robotics, cyber-physical systems, engineering modeling and simulation, smart networks, and sensors.

CISE is slated for an \$85 million or 9.8 percent increase to support work on advanced cyberinfrastructure, basic research in computing and communications, computer and network systems, information and intelligence systems, and general information technology research. However, most of this increase is due to the relocation of NSF's Office of Cyberinfrastructure into CISE.