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Electrotechnology-Related Research in the FY 2015 Budget

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HIGHLIGHTS

– The FY 2015 federal budget request continues to prioritize a wide variety of electrotechnology-related research in areas such as smart grid, the electrification of transportation, robotics, cyber-physical systems, and advanced sensors.

– The $3.8 billion request for the Networking and Information Technology Research and Development (NITRD) Program supports agency research efforts in cybersecurity, high-end computing systems, advanced networking, software development, high-confidence systems, health IT, wireless spectrum sharing, cloud computing, and other information technologies.

– The $1.5 billion request for support of the National Nanotechnology Initiative includes a research emphasis on nanoscale sensors, nanoelectronics, nanoinformatics, and applying nanotechnology to manufacturing and solar energy.

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 computing, communications, defense, health, and manufacturing. The breadth of the discipline and the multi-disciplinary nature of many federal R&D programs make it impractical to provide a detailed "cross-cut" of the FY 2015 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, and nanotechnology in Chapter 23. Requested increases or decreases are referenced against FY 2014 enacted funding levels, and are not adjusted for inflation.

DEPARTMENT OF DEFENSE

With its $63.5 billion FY 2015 request for Research, Development, Test and Evaluation (RDT&E), the Department of Defense (DOD) remains the primary source of federal funding for electrotechnology-related R&D, 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).

The FY 2015 request shifts the emphasis to applied research and development work intended to drive innovation in military capabilities and speed the development of technological platforms. Within the $11.5 billion request for defense science and technology base programs (6.1-6.3) emphasis is given to five broad technology-driven missions: overcoming anti-access/area-denial challenges ($2 billion) countering weapons of mass destruction ($1 billion), operating effectively in cyberspace and space ($0.9 billion), electronic warfare ($0.5 billion) and high-speed kinetic strike ($0.3 billion).

Army S&T priorities include advanced aviation technologies, electronic and electronic devices, sensors and electronic survivability, electronic warfare, and tactical electronic surveillance. Navy priorities include applied research in electromagnetic systems, future naval capabilities, and directed energy and electrical weapons systems. The Air Force continues work on high energy lasers, aerospace sensors, directed energy technology, and electronic combat technology. Increased funding is provided for dominant information sciences and methods.

Electrotechnology-related R&D priorities in the Defense-wide agencies include information and communications technology, cybersecurity, electronics technology, counter proliferation, micro- and advanced electronics, command and control systems, senor technology and software engineering. DARPA is a prime beneficiary with a $2.9 billion FY 2015 request (a 4.8 percent increase over FY 2014).

DEPARTMENT OF ENERGY

The Department of Energy (DOE) is poised to see a 2.6 percent budget increase over the FY 2014 enacted level.

The Office of Science (SC), which is the single largest supporter of basic research in the physical sciences in the United States, has a FY 2015 request of $5.1 billion – a $44.8 million (0.9 percent) increase over FY 2014. The request would support about 22,000 investigators at over 300 U.S. academic institutions and at all of the DOE laboratories, who will probe some of the most fundamental questions in high energy, nuclear, and plasma physics; materials and chemistry; biological systems and earth system components; and mathematics—plus basic research that underpins advances in clean energy.

DOE's energy programs would see an overall 3.7 percent increase versus FY 2014. The Office of Energy Efficiency and Renewable Energy (EERE) would see an increase of $416.1 million. This includes funding for hydrogen and fuel cell technologies, bioenergy technologies, solar energy, wind energy, geothermal technologies, vehicle technologies, building technologies, crosscutting grid integration activities and advanced manufacturing, among other areas. One EERE FY 2015 priority is an Electric Vehicle Everywhere Grand Challenge that focuses on the U.S. becoming the first nation in the world to produce plug-in electric vehicles that are as affordable as today's gas-powered vehicles.

The Office of Electricity Delivery and Energy Reliability (OE) is on tap for a $32.8 million (22.2 percent) increase over FY 2014. This request supports increasing electric grid resilience, including managing risks, increasing system flexibility and robustness, increasing visualization and situational awareness, and deploying advanced control capabilities.

The Advanced Research Projects Agency-Energy (ARPA-E) would receive a $45 million (16.1 percent) funding increase, with a strategic focus on supporting transformative, breakthrough research in the areas of transportation systems and stationary power systems.

DEPARTMENT OF HOMELAND SECURITY

The Department of Homeland Security (DHS) FY 2015 budget proposal includes a $1.07 billion request (12.2 percent decrease) 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 "innovation" programs related to threat detection and characterization, baggage and passenger screening, biometric entry/exit screening systems, and cybersecurity "leap ahead" technologies. Funding for university programs would drop by over 20%

to $31 million. DHS's overall $1.25 billion budget request for cybersecurity-related activities includes $67.5 million for R&D to secure the nation's current and future cyber and critical infrastructures.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA's $17.5 billion request (1.1% decrease) for FY 2015 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 $5.0 billion Science Directorate request (a 3.5 percent decrease), NASA would support over 95 research platforms currently in orbit or preparing for launch, including the James Webb Space Telescope, Solar Probe Plus, Mars Rover 2002, the MOMA/ExoMars missions to Mars, and the robotic OSIRIS-Rex mission to retrieve samples from an asteroid. The request would mothball NASA's Strategic Observatory for Infrared Astronomy due to high operating costs. Pre-formulation work continues on the Wide Field Infrared Survey Telescope (WFIRST)/Astrophysics Focused Telescope Assets (AFTA) infrared space observatory.

The $551.1 million request (down 2.6 percent) for NASA's Aeronautics program includes funding to support development of technologies to enable more efficient operations at congested airports; design software to analyze and reduce sonic booms; ultra-efficient commercial vehicles and low carbon propulsion; diagnostic systems that rely on advanced sensors to detect faults and hazards between maintenance inspections; advanced technologies to reduce noise and improve performance of vertical lift systems; flight testing advancements to add or improve mobile telemetry capability; autonomous flight; supersonic test capability; and data acquisition and processing.

The Space Technology budget would grow to $706 million (a 22 percent increase) in order to support the technology needs of future science and exploration missions. Projects include development of the Sunjammer solar sail, space-to-ground laser communication, high-powered solar electric propulsion, and capabilities for deep space exploration including life support, entry, descent, and landing technologies, advanced space robotic systems, advanced thermal management technologies, advanced batteries, and fuel cells.

The NASA request for Human Exploration and Operations drops slightly to $7.88 billion, but includes continued support of the International Space Station, reliance on commercial spaceflight for access to low-earth orbit, and continued development of the new heavy-lift Space Launch System and the Orion Multipurpose Crew Vehicle to enable future manned deep-space exploration missions. The budget also supports $343 million in Exploration R&D, with a focus on systems development for reliable life support, deep space habitats, crew mobility systems, advanced space suits, public-private partnerships for lander capabilities, in-space in-situ resource utilization, and autonomous space operations.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

The National Institute of Standards and Technology (NIST) budget request seeks a $50 million (5.9 percent) increase, bringing agency operations to $900 million for FY 2015. New priorities within the budget request include increased emphasis on manufacturing, cyber physical systems and forensics.

The bulk of the request ($680 million) supports scientific and technical research through NIST's laboratory programs. $7.5 million of the NIST increase is targeted at lab work to improve the design, performance and integration of cyber-physical systems to reduce costs, increase efficiency and reliability, improve safety and provide security in the areas of advanced manufacturing, health care, energy, defense, homeland security and transportation. New funding is also requested for measurement and standards-related work in the areas of forensic science, advanced materials, synthetic biology and technology commercialization (from lab to market). Other 2015 electrotechnology priorities including future electronics, solar photovoltaics, electrical and electronics metrology, advanced wireless, wireless interoperability and spectrum sharing technologies, optical communications, photonics medical imaging, spintronics, thin film semiconductors, smart manufacturing and robotics, smart buildings, cloud computing, cybersecurity automation, health information technology, Next Generation Internet technologies, and quantum information.

Electrotechnology companies also benefit from NIST's industrial technology services. The FY 2015 NIST budget proposal requests $161 million for these programs (a 12.6 percent increase), including a $13 million increase in funding for the Hollings Manufacturing Extension

Partnership and a $5 million increase to establish five new regional Manufacturing Innovation Institutes.

NATIONAL INSTITUTES OF HEALTH

Much of NIH's electrotechnology-related R&D is done through interdisciplinary projects and in partnership with other federal agencies. Two highlights within an otherwise flat NIH budget request for FY 2015 are:

- $100 million requested for NIH support of the BRAIN Initiative collaboration between NIH, DARPA and the National Science Foundation to develop new tools and technologies, including molecular scale sensors and "Big Data" tools and techniques to help neuroscientists understand how the millions of brain cells interact.

- $88 million to support NIH's Big Data to Knowledge (BD2K) Initiative, roughly double FY 2014 funding levels, to develop new analytical methods, software and training to facilitate the broad use and sharing of large, complex biomedical datasets and address important problems in biomedical analytics, computational biology, and medical informatics.

NIH's National Institute of Biomedical Imaging and Bioengineering (NIBIB) is a primary focal point within NIH for electrotechnology-related R&D. The FY 2015 funding request for NIBIB's Applied Science and Technology Program is $155.8 million, a $2.26 million increase (1.5 percent). In addition to work related to the Brain Initiative, NIBIB's request will fund research related to development of biomedical imaging; magnetic, biomagnetic and bioelectric devices; magnetic resonance imaging; a minimally invasion neurosurgical intracranial robot; and a hand-held intraoperative Optical Coherence Tomography system that reads reflected light like an optical ultrasound.

NATIONAL SCIENCE FOUNDATION

In FY 2015, the National Science Foundation (NSF) proposes an increase of $83.1 million or 1.2 percent over the FY 2014 estimate. The NSF's Engineering Directorate (ENG) would increase $7.1 million (0.8 percent). According to NSF, ENG provides about 37 percent of the federal funding for basic research in engineering at academic institutions.

The ENG Electrical, Communications and Cyber-Systems (ECCS) division, which addresses fundamental research issues underlying device and component technologies, power, controls, computation, networking, communications and cyber technologies, has a budget request of $110.4 million – a $350,000 increase (0.3 percent) over the FY 2014 estimate. The overall ECCS budget request supports 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 cyber-physical systems. According to NSF, in general, 67 percent of the ECCS portfolio is available for new research grants.

Electrotechnology research is also funded through interdisciplinary projects supported by the other ENG divisions. For example, Chemical, Bioengineering, Environmental and Transport Systems (CBET), Civil, Mechanical, and Manufacturing Innovation (CMMI), and ECCS will be focusing on computational and data-enabled science and engineering research, infrastructure and community building, and access and connections to cyberinfrastructure facilities. Additionally, ENG support for clean energy technology-related activities, solar energy technologies, biofuels and bioenergy, wind energy generation, and renewable energy storage will be strategically divided among all divisions.

The Directorate for Computer and Information Science and Engineering (CISE) request is $893.4 million in FY 2015, and includes support for cyber-enabled materials, advanced manufacturing, cyber-physical systems, the National Robotics Initiative, clean energy technology, and NSF's Secure and Trustworthy Cyberspace (SaTC) initiative.