

**Statement of Dr. John P. Holdren**  
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**Executive Office of the President of the United States**  
**to the**  
**Committee on Science, Space and Technology**  
**United States House of Representatives**  
**on**  
**Research and Development in the President's Fiscal Year 2014 Budget**  
**April 17, 2013**

Chairman Smith, Ranking Member Johnson, and Members of the Committee, it is my distinct privilege to be here with you today to discuss the civilian science and technology (S&T) components of the President's fiscal year (FY) 2014 Budget.

**A World-Leading Commitment to Science and Research**

President Obama, in his most recent State of the Union address, called upon all of us to help create a growing American economy built on a solid foundation of free enterprise, individual initiative, and opportunity for everyone. He called on the American people inside and outside of government to work toward that vision, and he committed his Administration to doing its part by setting clear and ambitious priorities and investing in domains that will support broad-based and long-term growth.

He articulated in particular three priorities: making America a magnet for new jobs and manufacturing; unlocking the promise of American energy; and educating our citizens with the skills and training to fill the jobs of the future. He called upon Americans to create and sustain an economic and social environment where invention, innovation, and industry can flourish, and where a growing middle class could thrive.

The President's 2014 Budget supports that vision by investing in science and engineering research that can turn game-changing ideas into life-changing realities. And it provides support for the creation of new technologies, products, and industries that—despite barely having been imagined a few years earlier—have the potential to create some of the biggest businesses and best jobs of the future.

At the same time, the 2014 Budget recognizes today's fiscal constraints and makes tough but discriminating choices, limiting spending in many areas that in other times would likely be deemed worthy of greater support. But the Budget also focuses on and shows confidence in the future. By building and fueling America's engines of discovery, it promises to expand the frontiers of human knowledge; promote sustainable economic growth and good middle-class jobs by revitalizing America's manufacturing sector; cultivate a clean-energy future for the Nation; improve health-care outcomes for more people at lower cost; manage competing demands on environmental resources while addressing global climate-change challenges; and strengthen our national security.

As past budgets from this Administration did, the President's 2014 Budget proposes to invest intelligently in research, innovation, education, and infrastructure to lay the foundations for the industries, jobs, workforce, and environmental and national-security benefits of

tomorrow. But, of course, we need the continued support of the Congress to get it done. I say “continued support” because much of the President’s Federal research and education investment portfolio enjoyed bipartisan support during the first term of the Administration. Congress has recognized that retaining America’s global leadership position in science, technology, and innovation is not a partisan issue—and not an issue to gamble with. We hope to extend and to build on this mutual understanding and appreciation in the second term, in our interactions with both the Senate and the House, so we can continue to strengthen the Nation’s science and technology portfolio and all the economic and other societal benefits it underpins.

In the remainder of this testimony, I will elaborate on how the science and technology components of the President’s 2014 Budget support this agenda.

## **The Federal R&D Budget**

History has shown that one of the most effective and efficient ways to invest in America—one of the best ways to assure that the Nation remains a magnet for new jobs and manufacturing and a fertile training ground for a new generation of innovators and entrepreneurs—is to invest in research and development (R&D). The President’s Fiscal Year 2014 Budget proposes \$142.8 billion for Federal research and development (R&D) to do just that—to build American innovation in manufacturing, to promote clean American energy, and to nurture a highly-skilled American workforce. To assure continued U.S. leadership in the increasingly competitive knowledge-based economy, the 2014 Budget proposes a substantial increase in non-defense R&D to \$69.6 billion, an increase of 9.2 percent over the 2012 enacted level, appropriately offset elsewhere in recognition of fiscal limits.

Specifically, the Obama Administration’s investments in research, innovation, education, and infrastructure fit within an overall discretionary budget capped at Budget Control Act of 2011 levels. The Budget reflects strategic decisions to focus resources on those areas where the payoff for the American people is likely to be highest, and allows for cuts in areas of lesser leverage. For example, the \$71.5 billion proposed for development – the “D” in “R&D” – in the 2014 Budget represents a decline of \$3.8 billion compared to 2012 enacted funding levels.<sup>1</sup>

## **Budgets of Science Agencies**

Three agencies have been identified as especially important to this Nation’s continued scientific and economic leadership by the President’s Plan for Science and Innovation, the America COMPETES Act of 2007, the Administration’s Innovation Strategy, and the America COMPETES Reauthorization Act of 2010: the National Science Foundation (NSF), a primary source of funding for basic curiosity-driven academic research that leads to discoveries, inventions, and job creation; the Department of Energy’s Office of Science, which leads fundamental research relevant to energy and also builds and operates much of the Nation’s major research infrastructure—advanced light sources, accelerators, supercomputers, and facilities for making nanomaterials—on which our scientists depend for research breakthroughs; and the

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<sup>1</sup> All comparisons in the testimony are between the 2014 Budget and enacted 2012 appropriations. The testimony discusses changes in current dollars, not adjusted for inflation. The latest economic projections show inflation of 1.9 percent between 2013 and 2014 for the economy as a whole, using the GDP deflator. The inflation projections show economy-wide inflation at 4.0 percent for the two years between 2012 and 2014. All budget figures exclude the potential effects in FY 2014 of budget sequestration, as established by the Budget Control Act of 2011.

National Institute of Standards and Technology (NIST) laboratories, which support a wide range of technically and economically essential pursuits, from accelerating standards development for health information technology to conducting measurement-science research to enable net-zero-energy buildings and advanced manufacturing processes. These three agencies were authorized through FY 2013 in the America COMPETES Reauthorization Act of 2010. I look forward to working with this Committee in coming months on reauthorizing the COMPETES legislation.

In recognition of the leverage these three agencies offer and their key role in maintaining America's preeminence in the global marketplace, Congress and this Administration have worked together to increase funding for these agencies significantly over the past 4 years. The 2014 Budget maintains the commitment to increase funding for these agencies with an 8.0 percent increase between 2012 and 2014 for the three agencies' combined budgets, totaling \$13.5 billion. I want to emphasize that the proposed increases for these agencies are part of a fiscally responsible budget focused on deficit reduction, meaning these increases are fully offset by cuts in other programs.

I now turn to the budgets of individual agencies in a bit more detail. I will focus on the agencies under the jurisdiction of the Committee. Therefore, I will not provide details of the defense R&D portfolio (the Department of Defense and DOE's defense programs) or the budget of the National Institutes of Health (NIH).

#### National Science Foundation (NSF)

The National Science Foundation (NSF) is the primary source of support for academic research for most non-biomedical disciplines, and it is the only Federal agency dedicated to the support of basic research and education across all fields of science and engineering. NSF has always operated under the belief that optimal use of Federal funds relies on two conditions: that its research is aimed – and continuously re-aimed – at the frontiers of understanding; and that funds are best awarded through competitive, merit-review processes through time-limited awards. When these two conditions are met, the Nation gets the most intellectual and economic leverage from its research investments. In recognition of the strong connection between NSF's investments in fundamental science and engineering research and education and the technological innovation and technical workforce that fuel tomorrow's job-creating companies, the 2014 Budget request for NSF is \$7.6 billion, an increase of 8.4 percent above the 2012 funding level.

NSF puts the greatest share of its resources into the Nation's colleges and universities. Universities perform over half of all basic research in the United States. Basic research funding such as that provided by NSF is important not only because it leads to new knowledge and applications but also because it trains the researchers and the technical workforce of the future, ensuring the Nation will benefit from a new generation of makers and doers. In order to maximize this dual benefit to society and NSF's special contribution, the 2014 Budget provides \$325 million to NSF for a new, enhanced National Graduate Research Fellowship program. The Budget also proposes to consolidate a number of science, technology, engineering, and mathematics (STEM) undergraduate education activities into a new NSF program, which will promote evidence-based reforms. These proposals are part of a government-wide reorganization of STEM education programs that I discuss later in my testimony.

The NSF 2014 Budget supports job creation in advanced manufacturing and emerging technologies with \$300 million in Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS) for multidisciplinary research targeted at new materials, smart systems, advanced manufacturing technologies, and robotics technologies. To encourage interdisciplinary research for a future bio-economy, the Budget proposes \$51 million for innovative proposals at the interface of biology, mathematics, the physical sciences, and engineering in the BioMaPS program. NSF intends to support approximately \$20 million in FY 2014 in research to advance the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative announced earlier this month by the President. NSF research could involve the development of molecular-scale probes that can sense and record the activity of neural networks; advances in “Big Data” that are necessary to analyze the huge amounts of information that will be generated, and increased understanding of how thoughts, emotions, actions, and memories are represented in the brain. NSF will collaborate on this initiative with NIH, the Department of Defense’s Defense Advanced Research Projects Agency (DARPA), and private-sector partners. The Budget’s proposal for NSF also includes \$155 million for the Cyberinfrastructure Framework for 21<sup>st</sup> Century Science, Engineering, and Education (CIF21) initiative, nearly double the 2012 enacted level, to accelerate the pace of discovery in all research disciplines by advancing high performance computing, creating new research networks and data repositories, and developing new systems to visualize data. The Budget proposes \$25 million, an increase of \$17 million above the 2012 enacted level, for the public-private Innovation Corps (I-Corps) program at NSF, which is aimed at bringing together the technological, entrepreneurial, and business know-how necessary to bring discoveries ripe for innovation out of the university lab. The Budget also provides \$63 million to continue the Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) initiative that is changing the way the agency solicits and funds innovative cross-disciplinary proposals. The 2014 Budget also proposes \$372 million for fundamental research that is directly relevant to future clean energy technologies such as solar power generation and energy efficiency.

#### National Aeronautics and Space Administration (NASA)

The 2014 NASA Budget reaffirms the Administration’s commitment to that agency’s wide-ranging and important agenda, consistent with the bipartisan agreement reached between Congress and the Administration in the NASA Authorization Act of 2010 (the Act). NASA’s programs not only advance U.S. leadership in human and robotic space exploration, planetary science, astronomy, and cosmology, but through their contributions to aeronautical research and Earth observation they directly support U.S. economic competitiveness and the Nation’s capacity to deal with the challenges of a changing environment. Consistent with the provisions of the Act, the 2014 Budget funds continued development of the Space Launch System (SLS) and Orion Multi-Purpose Crew Vehicle (MPCV) to enable human-exploration missions to new destinations; the operation and enhanced use of the International Space Station (ISS), which has been extended through at least 2020; the development of private-sector systems to carry cargo and crew into low Earth orbit, thus re-establishing a cost-effective U.S. human spaceflight capability and shortening the duration of our sole reliance on Russian launch vehicles for access to the ISS; a balanced portfolio of space and Earth science, including a continued commitment to new satellites and programs for Earth observation; a dynamic space-technology development program; and a strong aeronautics research effort. I look forward to working with the Committee this year on reauthorizing NASA for the next several years.

Within the context of a difficult budget environment and the Budget Control Act's spending caps, NASA's 2014 budget is \$17.7 billion, a slight decrease from the 2012 enacted level. The Budget provides \$821 million in NASA funding that will be coupled with private-sector investments to develop new U.S. capabilities to transport human crews to the International Space Station. It also provides \$2.7 billion for the next-generation, deep-space crew capsule Orion MPCV and the heavy-lift SLS rocket that will send human-exploration missions to new destinations – including a bold plan to send humans to an asteroid – and it invests \$942 million for the development of innovative new technologies that can expand the potential and lower the cost of our space science and exploration efforts as well as benefit other U.S. government and commercial space activities. NASA has unique expertise in Earth observation satellite and sensor development, and the Budget makes best use of that expertise, providing \$1.8 billion to the Earth Science program, including funds to begin work on land imaging capabilities beyond the Landsat Data Continuity Mission; to study approaches to continue the long history of measurements of solar irradiance, atmospheric ozone, and Earth's radiation of energy to space; and to support other Earth-science efforts. The Budget fully funds the James Webb Space Telescope, the successor to the Hubble Space Telescope that will be 100-times more capable, at \$658 million to keep it on track for launch in 2018.

To enhance U.S. capabilities to defend our planet against near-earth objects (NEOs) such as asteroids, the subject of my testimony before the Committee last month, the Budget accelerates efforts to develop the capabilities to defend Earth from asteroid impacts by identifying potentially hazardous objects and further investigating their scientific attributes. This work will also support NASA's new asteroid mission, which itself would serve as a key stepping stone to manned missions to Mars and other destinations. The Budget provides a total of \$105 million for initial investments in the asteroid mission, \$78 million to develop needed technologies and study alternative approaches for a robotic mission to rendezvous with a small asteroid and redirect it and \$27 million to accelerate efforts to detect and characterize potentially hazardous asteroids.

Over the past year, NASA's Mars exploration program has continued to advance our understanding of Mars and engage the American people, particularly through the feats of the Mars Science Laboratory Curiosity, roaming the surface of Mars and conducting previously unimaginable scientific studies there. The \$1.2 billion 2014 budget for Planetary Science, including \$234 million for Mars exploration, reflects an integrated strategy that ensures the robotic Mars Exploration Program supports both science and long-term human exploration goals.

#### Department of Commerce National Institute of Standards and Technology (NIST)

The complex web of technology that keeps this Nation's equipment and economy running smoothly depends on largely invisible but critical support in the fields of measurement science and standards. The National Institute of Standards and Technology (NIST) laboratories stand at the core of this Nation's unparalleled capacity in these areas, promoting U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology. Reflecting NIST's vital role in supporting the economy and infrastructure, the 2014 Budget of \$754 million for NIST's intramural laboratories and construction of research facilities amounts to a 21 percent increase over the 2012 enacted level. That increase will support high-performance laboratory research and facilities for a diverse portfolio of investigations in areas germane to advanced manufacturing, nanotechnology, cybersecurity, disaster resilience, and forensic science. For NIST's extramural programs, the Budget provides a \$25 million increase to

the Hollings Manufacturing Extension Partnership (MEP) to establish Manufacturing Technology Acceleration Centers to assist manufacturers in adopting new technologies to improve their competitiveness. It also includes \$21 million for the Advanced Manufacturing Technology Consortia program, a public-private partnership that supports innovative approaches to addressing common manufacturing challenges faced by American businesses.

And as stated by the President in his State of the Union address, the Administration proposes a one-time, \$1 billion investment to launch a network of up to 15 manufacturing innovation institutes across the country in a National Network for Manufacturing Innovation (NNMI). Leveraging the strengths of a particular region, each institute will bring together companies, universities and community colleges, and government to co-invest in the development of world-leading manufacturing technologies and capabilities that U.S.-based manufacturers can apply in production. At the beginning of this year, OSTP and Federal agency partners released a Preliminary Design report for the NNMI, which provides greater detail on the proposal. In the meantime, in August 2012, the Administration launched a pilot institute in Youngstown, Ohio, with a \$45 million commitment from five Federal agencies, led by the Department of Defense. In his State of the Union address, the President stated that while Congress continues to consider the broader proposal, the Administration will launch three new manufacturing innovation institutes in 2013 with appropriated funds. NIST's proposals in manufacturing are part of a Federal government-wide \$2.9 billion investment in advanced manufacturing R&D, an increase of 87 percent over the 2012 enacted level.

#### Department of Commerce National Oceanic and Atmospheric Administration (NOAA)

NOAA plays a vital role supporting the monitoring and stewardship of the Earth's oceans, atmosphere, and marine habitats, which directly and indirectly are enormous sources of economic activity. The NOAA budget of \$5.4 billion in appropriations, including \$733 million for R&D, strengthens support for critical weather satellite programs, Earth observations, and NOAA's other core science and stewardship responsibilities.

The 2014 Budget provides \$2.0 billion to continue the development of polar-orbiting and geostationary weather satellite systems, as well as satellite-borne measurements of sea level and potentially damaging solar storms. The Budget includes significant investments in NOAA's ocean and coastal research and observing programs, while increasing support for stock assessments and habitat and species-conservation activities that are essential to restoring and maintaining healthy, sustainable fisheries.

#### Department of Energy (DOE)

DOE's 2014 Budget positions the United States to compete as a world leader in clean energy and advanced manufacturing, and to respond to the threat of climate change, with the R&D portion totaling \$12.7 billion, an increase of \$1.9 billion or 18 percent over the 2012 enacted level. This excludes DOE's non-R&D cleanup, weapons, and energy demonstration and deployment programs. The 2014 Budget's priorities build on progress made over the last four years in putting the United States on the path to a cleaner and more secure energy future. Since the beginning of the Administration, responsible domestic oil and gas production has increased each year, while net oil imports have fallen to a 20-year low; renewable electricity generation from wind, solar, and geothermal sources has doubled; and U.S. greenhouse gas emissions have

fallen to their lowest level in nearly two decades. The Budget continues this approach that has been working for the economy, our energy security, and the environment.

The 2014 Budget invests in DOE's clean-energy programs to accelerate R&D and further increase the cost-competitiveness and deployment of renewable power, electric vehicles, next-generation biofuels, advanced energy-efficient manufacturing, and other energy-efficiency technologies, including \$2.8 billion for the Office of Energy Efficiency and Renewable Energy (EERE). The Budget includes a new \$25 million prize for the first natural-gas combined-cycle power plant to demonstrate carbon capture and storage. The Budget also includes \$12 million for DOE to continue a research initiative to understand and minimize the potential environmental, health, and safety impacts of natural gas development from hydraulic fracturing, in collaboration with the Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS).

As the President announced in his visit to the Argonne National Laboratory in Illinois last month, the Budget also establishes an Energy Security Trust to support research into a range of transportation technologies that would shift our cars and trucks off oil and insulate American families from volatile gas prices. The proposal, \$200 million in 2014 and \$2 billion over ten years, would set aside and redirect some of the royalty revenues generated by oil and gas development in Federal waters of the Outer Continental Shelf (OCS) to fund this research. This proposal is designed to invest in breakthrough research that will make future technologies cheaper and better through a reliable stream of funding for research focused on developing cost-effective transportation alternatives to current vehicle technologies. Funding would support research into technologies such as advanced vehicles that run on electricity, homegrown biofuels, fuel cells, and domestically produced natural gas.

The 2014 Budget provides \$379 million for the Advanced Research Projects Agency – Energy (ARPA-E) within DOE to support transformational discoveries and accelerate solutions in the development of clean energy technology. ARPA-E performs short-term, high-risk, high-reward energy research focused on creating real-world solutions in areas ranging from grid technology and power electronics to batteries and energy storage. First funded as part of the American Recovery and Reinvestment Act (ARRA), ARPA-E was first authorized in the America COMPETES Act, and was reauthorized in the America COMPETES Reauthorization Act of 2010.

The 2014 Budget also supports research through Energy Innovation Hubs first funded in 2010 to solve specific energy challenges as part of DOE's overall research and development strategy. Each of the five existing Energy Innovation Hubs focuses scientific and engineering talent on a specific problem: improving batteries and energy storage, reducing constraints from critical materials, developing fuels that can be produced directly from sunlight, improving energy-efficient building systems design, and using modeling and simulation for advanced-nuclear-reactor design and analysis. The Electricity Systems Hub proposed in the 2014 Budget would focus on the interface between transmission and distribution as the point where power and information flow intersect with markets and regulations. Each of these Hubs brings together a multidisciplinary team of researchers in an effort to speed research and shorten the path from scientific discovery to technological development and commercial deployment of highly promising energy-related technologies.

The Department of Energy's Office of Science pursues fundamental discoveries and supports major scientific user facilities—including large-scale x-ray and neutron sources, particle

colliders, supercomputers, fusion devices, and sophisticated facilities for nanoscience and genomic sequencing— that are key to maintaining U.S. leadership in many areas of research, especially those related to energy, the environment, and climate change. The Office of Science’s portfolio includes the Energy Frontier Research Centers (EFRCs) which support multi-year, multi-investigator scientific collaborations focused on overcoming hurdles in basic science that block transformational discoveries in energy science. The 2014 Budget includes funding for new EFRCs to replace some of the Recovery Act awards that will be completed. The Office of Science stewards 10 DOE National Laboratories and supports the research of about 25,000 Ph.D. scientists, graduate students, and postdoctoral associates, and engineers at over 300 universities and national laboratories nationwide. Nearly 29,000 researchers from academe, national laboratories, and industry make use of its advanced scientific user facilities each year, pursuing discoveries at the frontiers of science that enhance the Nation’s energy security and economic competitiveness. The 2014 Office of Science Budget of \$5.2 billion, an increase of 5.7 percent above the 2012 enacted funding level, increases funding for both research and cutting-edge facilities and maintains the President’s commitment to increase funding for three key science agencies.

#### Environmental Protection Agency (EPA)

EPA R&D funding totals \$560 million in the 2014 Budget, a slight decrease from the 2012 funding level. With this investment, EPA will focus on enhancing and strengthening the planning and delivery of science in its restructured research and science programs, making these efforts more integrated and cross-disciplinary. The 2014 Budget supports high-priority research of national importance in such areas as potential endocrine disrupting chemicals, green chemistry, green infrastructure, computational toxicology, and drinking water. The 2014 Budget proposes a total of \$14 million for EPA’s research collaboration with USGS and DOE to reduce the potential health and environmental impacts of natural gas development using hydraulic fracturing.

#### Department of the Interior and United States Geological Survey (USGS)

The 2014 Budget for the Department of the Interior provides \$963 million for R&D, an increase of 17 percent or \$143 million over the 2012 enacted level, to invest in science to support decision-making in the Department’s resource management and trust responsibilities and to support other Federal, state, local, and tribal entities in making sound, science-based decisions that affect environmental and human health and safety. This funding supports scientific monitoring, research, and analysis to assist decision-making in resource management and the special trust responsibilities of Interior and other federally mandated and nationally significant programs. Specific science activities include energy permitting, ecosystem management, rapid response to natural disasters, climate change adaptation, oil-spill restoration, water and wildlife monitoring, and tribal natural resource management. The total budget of Interior’s United States Geological Survey (USGS) is \$1.2 billion, or a \$99 million increase from the 2012 enacted level. The 2014 Budget proposes \$19 million for USGS to continue its collaboration with EPA and DOE to conduct a research initiative to understand and minimize the potential environmental, health, and safety impacts of natural gas development from hydraulic fracturing.

## Department of Homeland Security (DHS)

DHS R&D totals \$1.4 billion in the 2014 Budget, up \$893 million from the 2012 enacted level in order to restore steep cuts enacted in 2011 and 2012 appropriations and to fully fund construction of a state-of-the-art biomedical-countermeasures facility. The 2014 Budget funds important R&D on cybersecurity, nuclear materials and explosives detection, and chemical/biological response systems. The Budget increases investments to develop state-of-the-art technologies and solutions for Federal, State, and local homeland security operators. The Budget also proposes \$714 million to construct the National Bio- and Agro-Defense Facility (NBAF), a state-of-the-art laboratory to study and develop countermeasures for foreign animal, emerging, and zoonotic diseases that threaten human health and our agricultural industry.

## Department of Transportation (DOT)

The 2014 Budget provides \$942 million for DOT R&D, an increase compared to the 2012 funding level. The Budget request includes funding for several R&D activities in the Federal Aviation Administration's (FAA) Next Generation Air Transportation System, known as NextGen. The Joint Planning and Development Office coordinates this important effort with NASA and other participating agencies. The Federal Highway Administration (FHWA) manages a comprehensive, nationally coordinated highway research and technology program, engaging and cooperating with other highway- research stakeholders. FHWA performs research activities associated with safety, infrastructure preservation and improvements, operations, and environmental mitigation and streamlining. Other DOT agencies conduct critical targeted research in support of transportation safety goals.

## White House Office of Science and Technology Policy (OSTP)

The 2014 Budget requests \$5.65 million for operation of the White House Office of Science and Technology Policy (OSTP). This request is above the FY 2012 enacted level of \$4.50 million but well below the \$6.65 million amount enacted in FY 2011. OSTP's budget supports the Office's mission of coordinating science and technology efforts across the Executive Branch. OSTP works with the Office of Management and Budget (OMB) to set S&T priorities for all those executive branch departments and agencies with S&T and STEM-education missions and provides science and technology advice and analysis in support of the activities of the other offices in the Executive Office of the President. OSTP staff also supports me in my role as the Assistant to the President for Science and Technology in providing the President with such information about science and technology issues as he may request in connection with the policy matters before him. Through the National Science and Technology Council (NSTC), OSTP works closely with departments and agencies to coordinate a wide array of interagency science and technology initiatives to ensure that efforts are complementary, that data and facilities are appropriately shared, and that the maximum utility is gained from every research dollar. In addition, OSTP serves as the lead White House office in a range of international S&T activities. This work is accomplished with approximately 27 full-time equivalent staff supported by the OSTP appropriation, which includes the OSTP Director, four Associate Directors (for Science, Technology, Environment and Energy, and National Security and International Affairs), and a small administrative staff; approximately 50 scientific and technical experts detailed to OSTP from all across the executive branch; approximately a dozen other experts brought in under the Intergovernmental Personnel Act or various fellowship arrangements; and a handful of interns. This mix of personnel provides OSTP with a wide range

of expertise and leverages a multitude of resources to ensure that the science and technology work of the Federal government is appropriately supported, coordinated, and amplified.

### **Interagency Initiatives**

A number of high-priority interagency S&T initiatives are highlighted in the President's 2014 Budget. These initiatives are coordinated through the NSTC, which as noted above is administered by OSTP.

#### Networking and Information Technology R&D

The multi-agency Networking and Information Technology Research and Development (NITRD) provides strategic planning for and coordination of agency research efforts in cyber security, high-end computing systems, advanced networking, software development, high-confidence systems, information management, and other information technologies. The 2014 Budget proposes \$4.0 billion for the NITRD Program, an increase of 4.2 percent over the 2012 enacted level. The 2014 Budget includes a focus on research to improve the ability to derive value and scientific inferences from unprecedented quantities of data ("big data") and continues to emphasize foundations for assured computing and secure hardware, software, and network design and engineering to address the goal of making Internet communications more secure and reliable.

#### National Nanotechnology Initiative

The 2014 Budget proposes \$1.7 billion for the multi-agency National Nanotechnology Initiative (NNI)—a \$159 million reduction from the 2012 enacted level. To accelerate nanotechnology development in support of the President's priorities and innovation strategy, the NNI member agencies focus on R&D of materials, devices, and systems that exploit the unique physical, chemical, and biological properties that emerge in materials at the nanoscale (approximately 1 to 100 nanometers). Participating agencies continue to support fundamental research for nanotechnology-based innovation, technology transfer, and nanomanufacturing through individual investigator awards; multidisciplinary centers of excellence; education and training; and infrastructure and standards development, including openly-accessible user facilities and networks. Furthermore, agencies have identified and are pursuing Nanotechnology Signature Initiatives in the national-priority areas of nanomanufacturing, solar energy, sustainable design of nanoengineered materials, nanoscale sensors, and nanoelectronics, through close alignment of existing and planned research programs, public-private partnerships, and research roadmaps.

#### U.S. Global Change Research Program

The Budget continues the commitment to global-change research, with the understanding that insights derived today will pay off with interest in the years and decades ahead as the Nation works to limit and adapt to shifting environmental conditions. Investments in climate science over the past several decades have contributed enormously to understanding of global climate. The trends in global climate are clear, as are their primary causes, and the investments in this research arena in the 2014 Budget are a critical part of the President's overall strategy to mitigate U.S. greenhouse-gas emissions and move toward a clean-energy economy even as the Nation adapts to those changes that are inevitable. The 2014 Budget provides \$2.7 billion for the multi-

agency U.S. Global Change Research Program (USGCRP), an increase of 6.0 percent over the 2012 enacted level.

The USGCRP was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606) to improve understanding of uncertainties in climate science, expand global observing systems, develop science-based resources to support policymaking and resource management, and communicate findings broadly among scientific and stakeholder communities. Thirteen departments and agencies participate in the USGCRP. OSTP and the Office of Management and Budget (OMB) work closely with the USGCRP to establish research priorities and plans to maximize research-dollar efficiencies and ensure that the program is aligned with the Administration's priorities and reflects agency planning.

The 2014 Budget supports the four objectives set forth in USGCRP's 2012-2021 strategic plan, which are to (1) Advance Science: advance scientific knowledge of the integrated natural and human components of the Earth system; (2) Inform Decisions: provide the scientific basis to inform and enable timely decisions on mitigation of and adaptation to global environmental change; (3) Conduct Sustained Assessments: build sustained assessment capacity that improves the United States' ability to understand, anticipate, and respond to global-change impacts and vulnerabilities; and (4) Communicate and Educate: advance communications and education to broaden public understanding of global change.

Funding in the 2014 Budget will support an integrated and continuing National Climate Assessment of climate-change science, impacts, vulnerabilities, and response strategies, as mandated by Congress. In FY 2014, USGCRP agencies will give emphasis to research that advances our understanding of vulnerabilities in human and natural systems and their relationships to climate extremes, thresholds, and tipping points. Specific areas where progress will be needed include promoting new and maintaining existing observations to detect trends in extremes; integration of observation into models for prediction and climate simulation at spatial and temporal scales conducive to decision making, including enhancing and making more effective use of supercomputing capabilities; research to better understand attribution of change to human or natural causes; and deploying research findings and National Climate Assessment outputs in a Global Change Information System in support of adaptation responses to changing frequency and intensity of extreme events.

### **Science, Technology, Engineering, and Mathematics (STEM) Education**

President Obama strongly believes that the United States must equip many more students to excel in STEM fields. That's why the President's 2014 Budget invests \$3.1 billion in programs across the Federal government on STEM education, a 6.7 percent increase over the 2012 enacted funding level. The 2014 Budget includes critical investments in several key areas that will benefit aspiring students: preparing and supporting excellent STEM teachers; supporting more STEM-focused high schools and districts; improving undergraduate STEM education; improving the reach of informal STEM-learning efforts; and investing in breakthrough research on STEM teaching and learning.

In addition, the 2014 Budget makes disciplined choices to consolidate and cut back lower-priority programs to make room for targeted increases. This includes the proposed elimination or consolidation of 114 programs, with approximately \$180 million in savings reinvested in new or existing STEM programs. This reorganization will substantially decrease

the fragmentation of STEM programs across agencies, allowing potential for easier coordination and strong evaluations of what's working. The reorganization also includes increasing capacity at key agencies, including \$5 million for a new Office of STEM at the Department of Education. The Administration is proposing to reorganize STEM-education programs into four key areas: K-12 instruction; undergraduate education; graduate fellowships; and informal education activities that typically take place outside the classroom. Each key area would have a lead agency. The Department of Education's role in K-12 education would be to develop STEM innovation networks, support STEM Teacher Pathways to help reach the President's goal of preparing 100,000 effective STEM teachers over the next decade, and create a STEM Master Teacher Corps to build the STEM instructional skills of others. NSF would promote reform of STEM undergraduate education and enhance graduate fellowships to reach more students and address national needs. The Smithsonian Institution would improve the reach of classroom and informal education materials and activities by ensuring they are aligned with State standards and are relevant to what is being taught in school. Efforts within the Department of Education, NSF, and the Smithsonian Institution will be closely coordinated with the activities and assets of other Federal science agencies.

In his 2011 State of the Union address, the President called for a new effort to prepare 100,000 effective STEM teachers with strong teaching skills and deep content knowledge over the next decade. That call had roots in a groundbreaking analysis by the President's Council of Advisors on Science and Technology (PCAST) and remains a priority for this Administration. In this effort, we have been assisted by a robust set of partnerships with the private sector. Last month, I hosted a roundtable of more than 30 professionals from inside and outside government committed to the cause of improving the Nation's corps of K-12 science and math teachers. That day, one of our partners, the Howard Hughes Medical Institute (HHMI), announced that it would donate \$22.5 million to the National Math and Science Initiative (NMSI) to accelerate the scale-up of the UTeach program in American universities. UTeach, pioneered at the University of Texas-Austin, is a program that allows undergraduates to earn simultaneously a teaching certificate and a Bachelor's degree in a STEM field. Along with other initiatives such as 100Kin10 (a collaborative effort between nonprofit, philanthropic, and other private organizations), NMSI and UTeach are helping to achieve the President's goal of preparing 100,000 effective STEM teachers over the next decade. In the 2014 Budget, the Department of Education is investing \$80 million to support this goal.

In line with the government-wide STEM-education reorganization, the Department of Education will also restructure its existing efforts to lead a cohesive and robust initiative around improving K-12 instruction. The Budget invests \$150 million to help school districts, individually or in consortia, to build strategic partnerships with universities, Federal science agencies, businesses, museums, skilled volunteers and other educational entities. These partnerships – STEM Innovation Networks – will help district leaders harness local, regional, and national resources to transform STEM teaching and learning by, for example, implementing innovative research-based practices, and building teacher capacity. Each network will engage in activities based on local needs, such as providing quality professional development to STEM teachers and developing and evaluating instructional models that help students meet STEM-focused, college and career-ready standards. The Innovation Networks are modeled on successful State and local efforts such as the partnership between the Ohio STEM Learning Network, the Cleveland Metropolitan School District, GE, and MC2High School. This investment also includes \$5 million to support a STEM Virtual Learning Network, a national, online community of STEM educators that will enable them to exchange STEM education

materials and best practices, including those developed through the Innovation Networks. Additionally, Networks will leverage the expertise of the Nation's most talented science and math teachers—through the Budget's \$35 million investment in a new STEM Master Teachers Corps—to help improve instruction in their schools and districts, and to serve as a national resource for best practices in math and science teaching. This effort builds on the foundation of the \$150 million Math-Science Partnership program, which provides grants to every State to implement and improve STEM education.

The President continues to support undergraduate STEM education reform as a top priority, in part to fulfill PCAST's most recent report on undergraduate STEM education, released last February, calling for the United States to establish a goal of training one million additional STEM graduates over the next decade. To further this goal, the Administration proposes consolidating disparate STEM undergraduate-education activities into a new consolidated program at NSF. This reform will increase the efficiency and effectiveness of these investments by promoting implementation of evidence-based instructional practices and supporting an expanded evidence base. It also supports research on how new technologies can facilitate adoption and use of new approaches to instruction. The 2014 Budget provides \$123 million for this new program.

The Administration is also committed to increasing the number of college graduates with degrees in technical fields. Opportunities to work on real-world research problems can help inspire students to pursue such degrees. The 2014 Budget proposes \$79 million, an increase of \$13 million above the 2012 enacted level, for NSF's Research Experiences for Undergraduates (REU). Since early opportunities to conduct research can be especially influential in maintaining a student's interest in STEM fields, the program will increase its investment in research experiences for those in their first or second year of college.

By reorganizing or eliminating smaller fellowship programs, the Budget will provide \$325 million to expand and enhance NSF's Graduate Research Fellowship program, creating a new National Graduate Research Fellowship. The program will not only continue to support the Nation's most promising students in any STEM field, but will also allow students to gain specialized experiences in areas of significant national need or of particular interest to mission agencies. Reorganizing graduate fellowships will position the Administration to implement a national strategy for fellowships and for graduate education more broadly, streamline the application and award process, and reduce administrative costs.

The Budget adds \$25 million to the Smithsonian Institution to improve the reach of informal STEM education by ensuring that materials are aligned to what students are learning in the classroom. The Smithsonian will work with Federal S&T agencies such as the National Aeronautics and Space Administration (NASA), the U.S. Department of Agriculture (USDA), the National Institutes of Health (NIH), and other science partners to harness their unique expertise and resources to create relevant materials and curricula, on-line resources, and effective delivery and dissemination mechanisms to reach more teachers and students both inside and outside the classroom.

The Budget also proposes additional steps to increase the capacity of the Department of Education to invest in breakthrough innovation. The Budget proposes up to \$65 million for the Advanced Research Projects Agency for Education (ARPA-ED) within the Investing in Innovation (i3) program. ARPA-ED will catalyze the development and deployment of new tools

and technologies to significantly improve student learning. ARPA-ED will push the education research, development, and demonstration field forward by: sponsoring the synthesis and vetting of public and private R&D efforts; identifying breakthrough development opportunities; shaping the next wave of R&D; investing in the development of new education technologies and tools; and identifying and transitioning the best and most relevant R&D from other federal agencies.

These efforts are part of a broader Administration commitment to look carefully at the effectiveness of all STEM-education programs and find ways to improve them. To further this goal, I continue to co-chair the Committee on STEM Education under the NSTC. In December 2011, the Committee released the most comprehensive inventory of Federal STEM efforts ever compiled. The work of this Committee is closely aligned with the vision for STEM education outlined by Congress in the America COMPETES Reauthorization Act and has focused on improving the coordination and effectiveness of all Federal STEM education programs. In this spirit, the Administration released a description of a 5-year Federal STEM education strategic plan and an update to the Federal STEM inventory along with the 2013 Budget. The final strategic plan will be released this spring along with another update to the Federal STEM-education inventory. The strategic plan will outline a path to increased coordination and collaboration among the Federal agencies that invest in STEM education and increase the efficiency and impact of the Federal portfolio of STEM-education programs.

OSTP looks forward to working with this Committee on our common vision for improving STEM education for all of America's students.

## **Conclusion**

The Administration's 2014 Budget reflects the President's deep appreciation of the profound importance of continued progress in science and technology even as we work to reduce budget deficits and hold the line on government spending. To achieve that balance, the Administration has made strategic choices in order to maintain and in some cases increase critical investments that will give rise to new industries and strengthen existing ones; generate well-paying and secure American jobs; help Americans enjoy longer and healthier lives; protect the global climate and other essential environmental conditions and processes; enhance national security while supporting open-ended exploration here on Earth and in space; and educate and train the innovators of tomorrow—all in the context of a disciplined approach to deficit reduction.

As this Committee has long emphasized, the best approach to supporting across-the-board innovation and long-term economic growth is to invest in a broad and balanced research portfolio—one that will produce not just the planned-for and predictable benefits to the Nation but also the entirely unexpected windfalls for society and the world. This country's overall prosperity in the last half century is due in great measure to America's pursuit of this formula and its commitment to a three-way partnership including academia, industry, and government. It is the Administration's goal that the 2014 Budget be applied to and coordinated with these complementary sectors to maintain the momentum of America's prosperity for many decades to come.

The Obama Administration recognizes that leadership across the frontiers of scientific knowledge is not merely a cultural tradition of our Nation; it is an economic, environmental, and national-security imperative. This Administration is committed to ensuring that America remains

at the epicenter of the global revolution in scientific research and technological innovation—a revolution that promises to generate new knowledge, create new jobs, build new industries, and propel the Nation to a vibrant future.

I look forward to working with this Committee to make the vision of the President's 2014 Budget proposal a reality. I will be pleased to answer any questions the Members may have.