

**Statement of Dr. John P. Holdren**  
**Director, Office of Science and Technology Policy**  
**Executive Office of the President of the United States**  
**to the**  
**Subcommittee on Science and Space**  
**Committee on Commerce, Science and Transportation**  
**United States Senate**  
**on**  
**Keeping America Competitive Through Investments in R&D**  
**March 6, 2012**

Chairman Nelson, Ranking Member Boozman, and Members of the Committee, it is my distinct privilege to be here with you today to discuss the current state of Federal research and development (R&D) in the context of the President's fiscal year (FY) 2013 Budget and the America COMPETES Reauthorization Act of 2010.

**Administration Initiatives in Innovation, Education, and Infrastructure**

President Obama, in his most recent State of the Union address, called on all of us to help create an American economy that is built to last. He called on us to work toward an America that leads the world in educating its people. An America that attracts a new generation of high-tech manufacturing and high-paying jobs. An America in control of our own energy. He called on us all to do what this Nation does best – investing in the creativity and imagination of the American people. In order to be globally competitive in the 21st century and create an American economy that is built to last, we must not only put this Nation on a sustainable fiscal path, but also create an environment where invention, innovation, and industry can flourish.

The President's 2013 Budget aims to do exactly that. It includes continuing investment in science and engineering research that can turn ideas into realities. And it provides support for the creation of new technologies, products, businesses, and industries that, despite barely having been imagined a few years ago, promise to become essential and even iconic.

The 2013 Budget recognizes today's difficult economic circumstances and makes tough choices, limiting spending in many areas that in other times would 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 will expand the frontiers of human knowledge, promote sustainable economic growth based in part on a revitalized American manufacturing sector, cultivate an American clean-energy future, improve health-care outcomes for more people at lower cost, address the challenge of global climate change, manage competing demands on environmental resources, and reinforce our national security. This Budget is designed to ensure that America will continue, in the President's words, to "out-innovate, out-educate, and out-build the rest of the world."

As past budgets from this Administration did, the President's new 2013 Budget proposes to invest intelligently in innovation, education, and infrastructure today to generate the industries, jobs, workforce, and environmental and national-security benefits of tomorrow. Obviously, 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 three years of the Administration. We hope to extend this partnership, with both the Senate and the House, across the entire science and technology portfolio represented in the President's budget.

In the remainder of this testimony, I elaborate on the reasons the Administration is most hopeful you'll provide that support.

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

In his State of the Union address, the President outlined a vision of working together to create an economy built on American manufacturing, American energy, and skills for American workers. We can help spur innovation to accomplish these goals by investing in research and development. The President's Fiscal Year 2013 Budget proposes \$140.8 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 for the future. To strengthen U.S. leadership in the 21st century's high-tech, knowledge-based economy, the 2013 Budget proposes a substantial increase in non-defense R&D to \$64.9 billion, an increase of 5.0 percent over the 2012 enacted level.

(My testimony discusses changes in current dollars, not adjusted for inflation. The latest economic projections show inflation of 1.7 percent between 2012 and 2013 for the economy as a whole, using the GDP deflator.)

This five percent increase notwithstanding, the Obama Administration's investments in innovation, education, and infrastructure fit within an overall discretionary budget that would be flat at 2011 enacted levels for the second year in a row, consistent with the Budget Control Act agreed to by Congress and the President last August. The Budget reflects strategic decisions to focus resources on those areas where the payoff for the American people is likely to be highest, while imposing hard-nosed fiscal discipline on areas lacking that kind of promise. For example, the \$74.1 billion proposed for development in the 2013 Budget represents a decline compared to the 2012 funding level. Across government, important programs will have to make do with less, as noted in several of the program descriptions below. And the Administration's commitment to making tough choices is not limited to development funding. The total (defense and nondefense) R&D budget would be \$140.8 billion, 1.4 percent above the 2012 enacted level but well below the \$142.7 billion enacted total for fiscal year 2011.

### **Budgets of Science Agencies**

Three agencies have been identified as especially important to this Nation's continued 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 enacted last January in large part due to the strong leadership of this Committee. Those three jewel-in-the-crown agencies are the National Science Foundation (NSF), a primary source of funding for basic curiosity-driven academic research which leads to discoveries, inventions, and job creation; the Department of Energy's (DOE's) Office of Science, which leads fundamental research relevant to energy and also builds and operates much of the major research infrastructure—advanced light sources, accelerators, supercomputers, and facilities for making nano-materials—on which our scientists depend for research breakthroughs; and the 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.

In recognition of the immense 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 put total funding for these agencies on a doubling trajectory. Funding constraints and new funding levels set in the Budget Control Act of 2011 mean delaying the original target completion date for doubling these budgets. But the 2013 Budget maintains the doubling commitment with a 4.3 percent increase between 2012 and 2013 for the three agencies' combined budgets, totaling \$13.1 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: ensuring that its research is aimed – and continuously re-aimed – at the frontiers of understanding; and certifying that every dollar goes to competitive, merit-reviewed, and time-limited awards with clear criteria for success. When these two conditions are met, the Nation gets the most intellectual and economic leverage from its research investments. In recognition of the time-proven truth that today's NSF grants are tomorrow's job-creating companies, the 2013 Budget request for NSF is \$7.4 billion, an increase of 4.8 percent above the 2012 funding level.

NSF puts the greatest share of its resources into the Nation's colleges and universities. Universities are the largest performers of basic research in the United States, conducting over 50 percent of all basic research. 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 2013 Budget provides \$243 million to sustain the number of new NSF Graduate Research Fellowships at 2,000. The 2013 Budget also includes \$64 million for the Advanced Technological Education (ATE) program to promote partnerships between higher-education institutions and employers to educate technicians for the high-technology fields that drive our nation's economy.

The 2013 Budget expands NSF's efforts in clean-energy research, advanced manufacturing, wireless communications, cyber-infrastructure, and other emerging technologies. NSF proposes to increase research funding to promote discoveries that can spark innovations for tomorrow's clean-energy technologies with a cross-disciplinary approach to sustainability

science. The Science, Engineering, and Education for Sustainability (SEES) portfolio will increase to \$203 million in the 2013 Budget for integrated activities involving renewable energy technologies, green chemistry, and complex environmental and climate processes. NSF supports job creation in advanced manufacturing and emerging technologies with \$257 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 the bioeconomy of the future, the 2013 Budget provides \$30 million for research at the interface of biology, mathematical and statistical sciences, the physical sciences, and engineering in the BioMaPS program. The Cyberinfrastructure Framework for 21<sup>st</sup> Century (CIF21) portfolio will expand to \$106 million in the 2013 budget for accelerating research, workforce development, advanced computing infrastructure, and new functional capabilities in computational and data-enabled science and engineering. The Budget proposes \$51 million for the NSF's Enhanced Access to the Radio Spectrum, or EARS, to support research into new and innovative ways to use the radio spectrum. NSF also proposes \$110 million for Secure and Trustworthy Cyberspace (SaTC), a cybersecurity basic research initiative.

### National Aeronautics and Space Administration (NASA)

The 2013 NASA Budget reaffirms the Administration's commitment to a bold and ambitious future for NASA, consistent with the bipartisan agreement between Congress and the Administration regarding the importance of NASA and its many programs. These critical efforts not only advance grand and inspirational undertakings such as space exploration, scientific discovery, and aeronautical research, but also provide an indispensable platform from which to study and understand our planetary home. Moreover, NASA's programs drive new technology development and innovation and help advance new products, services, businesses, and jobs with great potential for economic growth. In keeping with such considerations and the provisions of the 2010 NASA Authorization Act (the Act), the 2013 Budget funds continued development of the Space Launch System (SLS) and Orion Multi-Purpose Crew Vehicle (MPCV) to enable human-exploration missions beyond Earth's orbit; 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 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.

Within the context of a difficult budget environment and the Budget Control Act's spending caps freezing discretionary spending at 2011 levels for the second year in a row, NASA's budget request for 2013 is \$17.7 billion, a decrease of \$58 million from the 2012 enacted level. This budget incorporates difficult choices that honor the priorities of the Act while providing a balanced program of science, research, technology development, safe spaceflight operations, and exploration. The budget for the James Webb Space Telescope (JWST) is \$628 million in 2013 in support of a scheduled 2018 launch, thus assuring NASA the opportunity to continue work on this transformative facility, which will expand and deepen our understanding of how the first stars and galaxies formed after the Big Bang, of planets around other stars, and of dark energy. The budget for Mars exploration reflects an integrated strategy that ensures the next steps for the robotic Mars Exploration Program that support science and long-term human exploration goals. The 2013 Budget maintains Earth-science research funding levels consistent

with the 2012 Budget. The Budget also provides \$1.9 billion in FY 2013 funding for the SLS and \$1.0 billion for the Orion MPCV, advancing the continued development of these systems that will enable exploration to deep-space destinations beyond today's reach. In these activities NASA will build on the configuration and acquisition decisions that it has made over the last several months. Similarly, the Budget provides a solid foundation for the commercial crew and cargo transportation programs that are necessary to provide safe and cost-effective U.S. access to low Earth orbit, and will allow us to stop paying Russia for astronaut transport to the ISS.

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

The hugely 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 2013 Budget of \$708 million for NIST's intramural laboratories and construction of research facilities amounts to a 13.8 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, and disaster resilience. For NIST's extramural programs, the Budget includes \$128 million for the Hollings Manufacturing Extension Partnership and \$21 million for the Advanced Manufacturing Technology Consortia program, a new public-private partnership that will develop road maps of long-term industrial research needs and will fund research at leading universities and government laboratories directed at meeting those needs. All of these NIST programs are important components of *A National Strategy Strategic Plan for Advanced Manufacturing*, a comprehensive strategic plan to guide Federal advanced manufacturing R&D investments that was released in February.

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

NOAA plays a vital role supporting research on the Earth's oceans, atmosphere, and marine habitats which directly and indirectly are enormous sources of economic activity. The NOAA budget of \$5 billion allows NOAA to strengthen the scientific basis for environmental decision-making; improve critical weather and climate services that protect life and property; invest more heavily in restoring our oceans and coasts to ensure their ongoing ecological stability and commercial vigor; and ensure satellite continuity.

The 2013 Budget provides \$1.8 billion to continue the development and acquisition of NOAA's polar-orbiting and geostationary weather satellite systems, as well as satellite-borne measurements of sea level and potentially damaging solar storms. The Budget includes funding to continue work on the instruments and spacecraft for the Joint Polar Satellite System, or JPSS. NOAA will also conduct Arctic research (including bellwether studies of changing conditions), improve regional projections of climate change, and support research on coastal and marine resources and development of marine sensor technologies to address harmful algal blooms and ocean acidification.

## Department of Energy (DOE)

The Department of Energy (DOE) 2013 Budget positions the United States to lead in the clean-energy economy of the future with an R&D portfolio that totals \$11.9 billion, an increase of \$884 million or 8.0 percent over the 2012 enacted level. (This does not include DOE's non-R&D cleanup and energy-deployment programs.) The Administration's clean-energy R&D priorities focus on developing cutting-edge technologies with real-world applications to advance a clean-energy economy, increase energy efficiency in industry and manufacturing, reduce energy use in buildings, and reach the goal of having 1 million advanced technology vehicles on the road by 2015.

The 2013 Budget invests in DOE's clean-energy programs to reduce dependence on oil and to move toward a clean-energy future, including \$2.3 billion for Energy Efficiency and Renewable Energy (EERE). Within this total, the Budget provides \$290 million to expand activities on innovative manufacturing processes and advanced materials to enable U.S. companies to cut manufacturing costs by using less energy. The Budget also moves closer to the goal of 1 million advanced technology vehicles on the road by investing \$420 million within EERE to advance vehicle technologies and to make electric vehicles cost competitive, and by enhancing advanced vehicle tax incentives. The Budget also includes \$12 million for DOE as part of a \$45-million priority research and development initiative by the Department of Energy, the Department of the Interior's U.S. Geological Survey, and the Environmental Protection Agency to understand and minimize the potential environmental, health, and safety impacts of natural gas development through hydraulic fracturing (fracking).

The 2013 Budget provides \$350 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 high-risk, high-reward energy research with real-world applications 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 is a signature component of the America COMPETES Act, and was reauthorized in the America COMPETES Reauthorization Act.

The 2013 Budget also supports research through Energy Innovation Hubs funded in 2012 to solve specific energy challenges as part of DOE's overall research and development strategy. Each of the five Energy Innovation Hubs focuses top 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 operations. The Budget proposes \$20 million to create a new Energy Innovation Hub on Electricity Systems to focus on grid systems, emphasizing the interface between transmission and distribution systems. Each of these Hubs will bring 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. Complementing the Hubs, the Department plans to continue coordination with the Office of Science's Energy Frontier Research Centers, which tackle the toughest scientific hurdles to building a new 21st century clean energy economy.

The Department of Energy's Office of Science pursues fundamental discoveries and supports major scientific research facilities that provide the foundation for long-term progress in

energy-related domains such as nanotechnology, the physical sciences, advanced materials, high-end computing, energy supply and end-use efficiency, and climate change. The Office stewards 10 DOE National Laboratories and supports the research of more than 25,000 Ph.D. scientists, graduate students, and postdoctoral associates at over 300 universities and national laboratories nationwide. About 26,500 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 strengthen our economic competitiveness. The 2013 Budget of \$5.0 billion for the Office of Science, 2.4 percent above the 2012 enacted level, provides support for facilities and cutting-edge research.

#### Environmental Protection Agency (EPA)

Environmental Protection Agency (EPA) R&D funding totals \$576 million in the 2013 Budget, \$8 million more than 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 2013 Budget supports high-priority research of national importance in such areas as potential endocrine disrupting chemicals, innovative chemical design, green infrastructure, computational toxicology, drinking water, and STEM fellowships. The 2013 Budget proposes a total of \$14 million for EPA for the above-mentioned collaboration with USGS and DOE on hydraulic fracturing.

#### United States Geological Survey (USGS)

The total budget of the United States Geological Survey (USGS), Interior's lead science agency, is \$1.1 billion, a \$35 million increase from the 2012 enacted level. The 2013 Budget proposes \$19 million for USGS for the above-mentioned collaboration with EPA and DOE on hydraulic fracturing. The Budget also sustains USGS funding for water and ecosystems science programs; research to mitigate natural hazards such as earthquakes, landslides, floods, and volcanoes; and climate change science.

#### Department of Homeland Security (DHS)

Department of Homeland Security (DHS) R&D totals \$729 million in the 2013 Budget, up 26.3 percent from the 2012 enacted level in order to partially restore steep cuts enacted in 2012 appropriations. The 2013 Budget funds important R&D advances in cybersecurity, nuclear materials and explosives detection, and biological response systems. The Budget does not fund construction of the National Bio- and Agro-Defense Facility (NBAF) in 2013; rather, DHS will conduct a comprehensive assessment of the requirements for a large animal foreign and emerging disease research and diagnostic laboratory facility in the United States.

#### Department of Transportation (DOT)

The 2013 Budget provides \$1.1 billion for Department of Transportation (DOT) R&D, a \$132 million 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 interagency effort, which strives to reduce delays, expand capacity, and improve the safety and environmental impact of air transportation. The Federal Highway

Administration (FHWA) also 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, and environmental mitigation and streamlining.

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

The 2013 Budget requests \$5.85 million for White House Office of Science and Technology Policy (OSTP) operations, above the \$4.50 million 2012 enacted funding level but 12.0 percent below the \$6.65 million 2011 enacted funding level. OSTP works with the Office of Management and Budget (OMB) to set S&T priorities for all the executive branch departments and agencies with S&T and STEM-education missions. OSTP also provides science and technology advice and analysis in support of the activities of the other offices in the Executive Office of the President and supports me in my role as the Assistant to the President for Science and Technology, with the responsibility to provide the President with such information about science and technology issues as he may request in connection with the policy matters before him. In addition, OSTP coordinates a wide array of interagency research initiatives with significant economic implications through administration of the National Science and Technology Council (NSTC) and serves as the lead White House office in a range of bilateral and multilateral S&T activities internationally. 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 National Security and International Affairs), additional technical experts, and a small administrative team. In addition, there are approximately 50 scientific and technical experts detailed to OSTP from all across the executive branch along with approximately a dozen other experts brought in under the Intergovernmental Personnel Act or various fellowship arrangements. This mix of personnel allows OSTP to tap a wide range of expertise and leverage a multitude of high-value resources to ensure that the science and technology work of the Federal government is appropriately supported, coordinated and amplified. The reduced 2012 OSTP funding level required significant reductions in staffing and support levels; the 2013 Budget would return OSTP personnel and support funding closer to historical levels.

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

In his remarks at the second White House Science Fair in early February, the President called for an “all-hands-on-deck” approach to science, technology, engineering, and mathematics (STEM) education. “Let’s train more teachers. Let’s get more kids studying these subjects. Let’s make sure these fields get the respect and attention that they deserve,” he said. To support this important effort, the 2013 Budget invests \$3.0 billion in programs across the Federal government on STEM education, a 2.6 percent increase over the 2012 enacted funding level. The 2013 Budget makes disciplined choices guided by drafts of the Federal STEM education strategic plan, cutting back on lower-priority programs to make room for targeted increases and reducing duplication and overlap. The Budget proposes elimination or consolidation of programs that would reduce the total number of Federal STEM education programs to 209 from 235 in FY 2012.

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 the coming year. As a crucial component of achieving this goal, the 2013 Budget proposes an investment of \$135 million through the Department of Education (ED) and NSF to provide effective teachers in every classroom across America who are well qualified in the STEM subjects they teach. This coordinated effort between NSF and ED will help prepare teachers with both strong teaching skills and deep content knowledge. The 2013 Budget in ED proposes setting aside \$80 million from the Effective Teachers and Leaders State Grants program to support the expansion of promising and effective models of STEM teacher preparation, which will be an important step toward the President's goal. In NSF, \$55 million is proposed for the Robert Noyce Scholarship Program, to encourage talented STEM majors and professionals to become K-12 mathematics and science teachers.

In February, the President announced that the 2013 Budget will also establish undergraduate STEM education reform as a top priority, in part to fulfill PCAST's most recent report on undergraduate STEM education, released last month in conjunction with the second White House Science Fair, calling for the United States to establish a goal of training one million additional STEM graduates over the next decade. Federal agencies will contribute to this goal through programs designed to engage students and improve teaching and learning in STEM fields from early learning through K-12 and undergraduate levels. For example, the 2013 Budget proposes a significant boost in funding at NSF for undergraduate education, and improved coordination between undergraduate STEM education programs at NSF and ED. The Budget proposes \$61 million for NSF's Transforming Undergraduate Education in STEM (TUES) program, which will provide research and development funds to design, test, and implement more effective educational materials, curriculum, and methods to improve undergraduate learning and completion rates in STEM for a diverse population. The Budget also proposes \$60 million for a jointly administered NSF and ED mathematics education initiative that will allocate funds for early research, development, validation, and scale-up of effective practices. Similar to ED's Investing in Innovation (i3) program, this initiative will support collaborations between researchers and practitioners to develop and test promising approaches and support widespread adoption of practices found to be effective through rigorous evaluations.

These efforts in the 2013 Budget are part of a broader Administration commitment to look carefully at the effectiveness of all STEM programs and find ways to improve them. To further this goal, last year I established a Committee on STEM Education under the NSTC as called for in Section 101 of the America COMPETES Reauthorization Act. In December, the Committee released the most comprehensive inventory of all 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 Budget, as called for in the COMPETES reauthorization. The final strategic plan, to be released this spring, will outline a path to increase coordination and collaboration among the 13 agencies that support STEM education and increase the efficiency and impact of the Federal portfolio of STEM education programs.

OSTP looks forward to continuing to work with this Committee on our common vision of improving STEM education for all of America's students in order to build the skilled workforce the Nation needs.

## **Advanced Manufacturing, Innovation, Entrepreneurship, and Job Creation**

In June 2011, the President launched the Advanced Manufacturing Partnership (AMP), a national effort that brings together industry, universities, and the Federal government to invest in emerging technologies that will create high-quality manufacturing jobs and enhance our global competitiveness. The partnership is a key recommendation of *The Report to the President on Ensuring American Leadership in Advanced Manufacturing*, released by the President's Council of Advisors on Science and Technology (PCAST) in June 2011. The 2013 Budget builds on many of the PCAST report's recommendations and the priorities outlined by the President in his 2012 State of the Union address by proposing \$2.2 billion for Federal advanced-manufacturing R&D at NSF, NIST, DOD, DOE, and other agencies. For example, the Budget provides DOE with \$290 million to expand R&D on innovative manufacturing processes and advanced industrial materials that will enable U.S. companies to cut the costs of manufacturing by using less energy, while improving product quality and accelerating product development. Also, as part of the broader effort, the Budget invests in the National Robotics Initiative (NRI) to develop robots that work with or beside people to extend or augment human capabilities. Another important component of the broader Federal R&D agenda that contributes to advanced manufacturing is the Materials Genome Initiative: in the same way that the Human Genome Project accelerated a range of biological sciences by identifying and deciphering the human genetic code, this initiative will speed our understanding of the fundamentals of materials science, providing a wealth of practical information that American entrepreneurs and innovators will be able to use to develop new products and processes.

Last year, in response to Section 102 of the America COMPETES Reauthorization Act, we created the NSTC interagency working group on Advanced Manufacturing. This group recently released *A National Strategic Plan for Advanced Manufacturing*, a comprehensive strategic plan to guide Federal advanced manufacturing R&D investments as called for by the COMPETES reauthorization. The plan documents the fundamental importance of advanced manufacturing to the economic strength and national security of the United States and sets forth five objectives for Federal policy: (1) accelerating investment in advanced manufacturing technology, especially by small- and medium-sized manufacturers; (2) making the education and training system more responsive to the demand for skills; (3) optimizing Federal advanced manufacturing R&D investments by taking a portfolio perspective; (4) increasing total public and private investments in advanced manufacturing R&D; and (5) fostering national and regional partnerships among all stakeholders in advanced manufacturing. In December, the White House created an Office of Manufacturing Policy to drive interagency coordination and announced that NIST will host an advanced manufacturing national program office. The duties of the NIST-hosted office will include carrying out a portfolio analysis of the Federal advanced manufacturing R&D investment, as called for by the strategic plan.

Through these efforts in advanced manufacturing, I am confident that the United States will remain the world leader in bringing advanced technologies from initial conception to commercialization in our important manufacturing sector.

In addition to the investments in R&D I have described, the President's 2013 Budget targets other strategic investments to spur innovation in the public and private sectors and to maximize the impact of the Federal R&D investment for innovation, with the goal of transforming the Nation's economy and improving the lives of all Americans.

One way to spur innovation in the public and private sectors and to maximize the impact of the Federal R&D investment for innovation is to use prizes or challenges. Over the past three years, OSTP has been leading the Administration's efforts to make prizes a standard tool in every agency's toolbox.

Section 105 of the America COMPETES Reauthorization Act granted all Federal agencies broad authority to conduct prize competitions to spur innovation, solve tough problems, and advance their core missions. By giving agencies a clear legal path, the legislation makes it easier for agencies to use prizes to supplement more traditional R&D funding mechanisms such as grants and contracts. By significantly expanding the authority of all Federal agencies to conduct prize competitions, the legislation is an important step forward that enables agencies to pursue more ambitious prizes with robust incentives.

Over the past year, the Administration has laid the policy and legal groundwork to take maximum advantage of the new prize authority in the years to come. Policy and legal staff in OSTP and the Office of Management and Budget (OMB) jointly developed a Fact Sheet and Frequently Asked Questions memorandum issued in August 2011 to streamline implementation of the new, government-wide authority. As required by the COMPETES reauthorization, GSA launched a new contract vehicle to allow agencies to more easily tap private-sector prize expertise, in addition to their continued promotion of Challenge.gov. In December 2011, the Administration launched a government-wide Center of Excellence for Collaborative Innovation led by NASA to provide agencies guidance on all aspects of implementing prize competitions. Agencies, such as the Department of Health and Human Services (HHS), have begun to establish strategies and policies to further accelerate widespread use of the new prize authority granted to them through the COMPETES reauthorization.

This month, OSTP will be submitting to Congress a full progress report on how the America COMPETES Reauthorization Act's prize authority is being implemented throughout the Federal government and how this authority is boosting innovation.

In addition, the Budget proposes a permanent extension of the research and experimentation (R&E) tax credit to spur private investment in R&D by providing certainty that the credit will be available for the duration of the R&D investment. The 2013 Budget proposes to expand and simplify the credit as part of making it permanent.

The 2013 Budget also sustains the Administration's effort to promote regional innovation clusters as significant sources of entrepreneurship, innovation, and quality jobs. These efforts are taking place in several agencies working together, including the Small Business Administration (SBA), DOE, and especially the Economic Development Administration (EDA) within the Department of Commerce. EDA will be pursuing several programs in research parks, regional innovation clusters, and entrepreneurial innovation activities, as authorized in the America COMPETES Reauthorization Act. And as mentioned earlier, the 2013 Budget continues to support the Hollings Manufacturing Extension Partnership (MEP) in NIST to disseminate the latest advanced manufacturing techniques and innovative processes to small- and medium-sized manufacturers around the Nation. It also supports an expansion of NSF's Innovation Corps (I-Corps) program with \$19 million to bring together technological, entrepreneurial, and business know-how to move research discoveries toward commercialization. Taken together, these

investments will help ensure that Federal investments in innovation, education, and infrastructure translate into commercial activity, real products, and jobs.

In addition to Federal investments, we are also working to build public-private partnerships in innovation and entrepreneurship. The Advanced Manufacturing Partnership (AMP) described above is one such partnership. Also, in late January, the Administration celebrated the one-year anniversary of Startup America (SUA), a campaign to inspire and accelerate high-growth entrepreneurship throughout the Nation. Earlier this month, SUA unveiled a number of Administration and private-sector actions geared toward expanding access to capital, cutting red tape, and accelerating innovation for small businesses and entrepreneurs. The private sector answered the President's call to action last year by forming the Startup America Partnership, a nonprofit alliance of successful business owners, major corporations, and service providers dedicated to making entrepreneurship more successful in this country. In just one year, the Partnership has mobilized over \$1 billion in business resources to serve as many as 100,000 startups over the next three years. In February, the Partnership launched nine new entrepreneur-led regional networks across the country—in the District of Columbia, Hawaii, Kansas, Michigan, Missouri, Nebraska, Rhode Island, Virginia, and Vermont—while previously launched Startup Regions celebrated SUA's anniversary in Florida, Iowa, Illinois, Massachusetts, and Tennessee.

### **Other America COMPETES Reauthorization Act Initiatives**

The Administration recognizes that improving access to the results of federally funded research can lead to more rapid dissemination of knowledge to the private sector and the taxpayers who supported that research and can boost innovation. OSTP has been active for some time on issues around access to the results of federally funded scientific research. Section 103 of the America COMPETES Reauthorization Act calls upon OSTP to coordinate agency policies on public access to and long-term stewardship of the results of federally funded unclassified research. OSTP established two interagency policy groups under the NSTC—the Task Force on Public Access to Scholarly Publications and the Interagency Working Group on Digital Data—to identify the specific objectives and public interests that need to be addressed by any policies in these two areas. OSTP had previously conducted a public consultation about policy options for expanding public access to federally funded peer-reviewed scholarly articles in 2009-10. In response to the COMPETES reauthorization, OSTP conducted a second public consultation last November by issuing two Requests for Information (RFI)—one on Public Access to Peer-Reviewed Scholarly Publications Resulting From Federally Funded Research and the other on Public Access to Digital Data Resulting From Federally Funded Scientific Research.

The public comments resulting from the RFI's are now available on the OSTP website. We had 375 comments on public access to peer-reviewed scholarly publications and 118 on the management of and access to digital data resulting from federally funded scientific research. We are now in the process of analyzing those comments. We expect to deliver a report updating Congress on the status of these efforts and comments in late March. The two NSTC interagency working groups are working to develop policy options in these two areas.

OSTP recognizes that scientific collections are also a vital part of the common infrastructure for science in the United States, and is working with Federal agencies to implement the 2009 NSTC report *Scientific Collections: Mission-Critical Infrastructure for Federal Science Agencies*, which highlights the many ways collections contribute to improving

health, enhancing national security, protecting commerce and trade, studying climate and ecosystems, and understanding our environment. In October 2010, I issued a Policy on Scientific Collections memorandum to Federal agencies, and in January 2011 Section 104 of the America COMPETES Reauthorization Act reinforced the memo's call for a coordinated Federal government policy toward scientific collections. In order to help Federal agencies realize the requirements listed in these documents – to properly assess and realistically project budgets for collections, to share best practices for maintaining collections, and to create an online clearinghouse of information about these collections – the NSTC interagency group on scientific collections has formed three working groups to focus on these tasks. These groups are making progress, and we hope to present the results of their work to Congress in the near future.

## **Interagency Initiatives**

A number of priority interagency S&T initiatives are highlighted in the President's 2013 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 2013 Budget provides \$3.8 billion for NITRD, an increase of \$69 million over the 2012 funding level. This initiative celebrated its 20<sup>th</sup> anniversary last month.

Networking and computing capabilities are more critical than ever for a range of national priorities, including supporting national and homeland security, reforming the healthcare system, understanding and responding to environmental stresses, increasing energy efficiency and developing renewable energy sources, strengthening the security of our critical infrastructures including cyberspace, and revitalizing our educational system for the jobs of tomorrow. The 2013 Budget includes a focus on research in an area of ever-growing importance: how best to derive value and scientific inferences from unprecedented quantities of data. It also 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 2013 Budget provides \$1.8 billion for the multi-agency National Nanotechnology Initiative (NNI), an increase of \$70 million over the 2012 funding level. Research and development in the NNI focuses on the development of materials, devices, and systems that exploit the fundamentally distinct properties of matter at the nanoscale—on the order of a billionth of a meter—and on environmental and health studies relating to nanomaterials. NNI-supported R&D is enabling breakthroughs in disease detection and treatment, manufacturing at or near the nanoscale, environmental monitoring and protection, energy conversion and storage, and the design of novel electronic devices. 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, and nanoelectronics through close alignment of existing and planned research programs, public-private partnerships, and research roadmaps.

The NNI agencies are guided by two strategic documents developed by the Nanoscale Science, Engineering, and Technology Subcommittee of the NSTC. The 2011 NNI Strategic Plan aligns nanoscale science and technology research with the NNI's four goals and includes specific, measurable objectives for each goal. The 2011 NNI Environmental, Health, and Safety Research Strategy delineates a research and implementation framework that will produce the information necessary to protect public health and the environment, foster product development and commercialization, and consider the ethical, legal, and societal issues associated with nanotechnology development.

### U.S. Global Change Research Program

The Budget includes an expanded commitment to global change research, with the understanding that insights derived today will pay off with interest in the years and decades ahead as our Nation works to limit and adapt to shifting environmental conditions. Investments in climate science over the past several decades have contributed enormously to our 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 2013 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 we adapt to those changes that are inevitable. Specifically, the 2013 Budget provides \$2.6 billion for the multi-agency U.S. Global Change Research Program (USGCRP)—an increase of 5.6 percent or \$136 million over the 2012 enacted level—to continue its important work of improving our ability to understand, predict, mitigate, and adapt to global change, including but not limited to climate change.

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 2013 Budget supports the four objectives set forth in USGCRP's new decadal strategic plan, to be released shortly, 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 adaptation and mitigation; (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 2013 Budget will support an integrated and continuing National Climate Assessment of climate-change science, impacts, vulnerabilities, and response strategies, as mandated by Congress.

## **Conclusion**

This Administration's 2013 Budget reflects a clear understanding of the critical importance of science and technology, STEM education, and 21<sup>st</sup> century infrastructure to the challenges the Nation faces. Recognizing the importance of responsibly reducing projected budget deficits and holding the line on government spending, the Administration has made disciplined choices in order to maintain and in some cases increase critical investments that will pay off by generating the American jobs and industries of the future—all in the context of a discretionary budget that stays flat for a second year in a row. Indeed, the science and technology investments in the 2013 Budget are essential to keep this country on a path to revitalized economic growth, real energy security, intelligent environmental stewardship, better health outcomes for more Americans at lower costs, strengthened national and homeland security, and continuing leadership in space.

As this Committee has long emphasized, and as the America COMPETES Reauthorization Act makes clear, the best environment for innovation in all technologies is a broad and balanced research program for all the sciences. Such a broad base of scientific research will provide the foundation for a cornucopia of multidisciplinary discoveries—some expected and planned, others entirely unexpected—with enormous benefits for our society. This country's overall prosperity in the last half century is due in great measure to America's "innovation system"—a three-way partnership among academia, industry, and government—and that same partnership will allow us to maintain that prosperity in the decades to come.

That is why the Obama Administration believes that leadership across the frontiers of scientific knowledge is not merely a cultural tradition of our nation, but is also an economic and national security imperative. This Administration wants to ensure that America remains at the epicenter of the global revolution in scientific research and technological innovation that promises to generate new knowledge, create new jobs, and build new industries.

I look forward to working with this Committee to make the vision of the President's FY2013 Budget proposal a reality. I will be pleased to answer any questions the Members may have.