



A World-Class Commitment to Science and Research

Science, Technology, Innovation, and STEM Education in the 2014 Budget

April 8, 2013

"If we want to make the best products, we also have to invest in the best ideas. That is why the Budget maintains a world-class commitment to science and research, targeting resources to those areas most likely to directly contribute to the creation of transformational technologies that can create the businesses and jobs of the future."

- The Budget Message of the President
April 2013

A growing, globally competitive economy that creates good, middle-class jobs on a solid foundation of free enterprise, individual initiative, and opportunity for everyone is the vision guiding the President's 2014 Budget. The Budget supports the vision by investing in science and engineering research that can turn the best 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 earlier, can create the businesses and jobs of the future.

The 2014 Budget recognizes today's fiscal circumstances and makes tough but smart 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 on a revitalized American manufacturing sector with good, middle-class jobs, cultivate a clean-energy future for America, improve health-care outcomes for more people at lower cost, address global climate-change challenges, manage competing demands on environmental resources, and strengthen our national security.

We can work together to make America a magnet for new jobs and manufacturing, to invest in American energy, and to equip Americans with the skills and training to create and fill the jobs of the future. We can help spur innovation to accomplish these and other crucial goals by investing in research and development (R&D). The President's 2014 Budget proposes \$142.8 billion for Federal R&D to do just that.

- **Sustaining a World-Class Commitment to Science and Research.** To meet America's challenges, including those related to the economy, manufacturing, health, energy, climate, environment, and national security, the 2014 Budget calls for a Federal basic and applied research portfolio totaling \$68.1 billion, up \$4.8 billion or 7.5 percent compared to the 2012 enacted level. (All comparisons are in current, not-adjusted-for-inflation dollars; because 2013 appropriations were enacted only at the end of March, all comparisons are to 2012 enacted funding levels.)
- **Spurring Innovation.** To strengthen U.S. leadership in the 21st century's knowledge-based economy within budget constraints, 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. The Budget also invests \$73.2 billion for defense R&D.

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- **Maintaining Our Commitment to Three Key Science Agencies.** Three key science agencies—the National Science Foundation (NSF), the Department of Energy (DOE) Office of Science, and the National Institute of Standards and Technology (NIST) laboratories—are critical to preserving America’s place as the world leader in innovation. The 2014 Budget maintains the President’s commitment to increase funding for basic research at these three science agencies by providing a total of \$13.5 billion, an increase of 8.0 percent above 2012 funding levels.
 - **Making America a Magnet for Manufacturing.** In support of a national effort to bring together industry, universities, and the Federal government to invest in emerging technologies that will create high-quality manufacturing jobs, the 2014 Budget provides \$2.9 billion for Federal advanced manufacturing R&D, an 87 percent increase from 2012. These investments will expand R&D on innovative manufacturing processes, advanced industrial materials, and robotics. And they will complement ongoing efforts to encourage entrepreneurship and to improve the transitions from discovery to the marketplace. The Budget includes 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).
 - **Advancing Clean, American Energy.** To unlock the promise of American energy and continue on the path to a cleaner and more secure energy future, the Budget continues to advance the President’s “all-of-the-above” strategy of investing in clean energy R&D, promoting energy efficiency, and encouraging responsible domestic energy production. The 2014 Budget proposes \$379 million for transformational energy R&D in DOE’s Advanced Research Projects Agency-Energy (ARPA-E). The Budget proposes \$2.8 billion for DOE’s Energy Efficiency and Renewable Energy office, with a focus on improving clean-vehicle technologies to move closer to one million advanced vehicles on the road, and on developing advanced materials and processes to cut the costs of manufacturing by using less energy. The Budget establishes an Energy Security Trust to support research into a range of cost-effective technologies, \$200 million in 2014 and \$2 billion over ten years from revenue generated by Federal oil and gas development.
 - **Combating the Threat of Global Climate Change.** The clean-energy proposals in the Budget will help to reduce the emissions implicated in climate and global change. The 2014 Budget also proposes \$2.7 billion for the U.S. Global Change Research Program (USGCRP) to understand, predict, mitigate, and adapt to global change. The Budget funds new investments in actionable science on climate change impacts and the development of technical resources, data, and tools for communities. And it supports efforts to make information about the Earth that is collected in several Federal agencies consistent and more usable.
 - **Supporting Medical Research to Improve the Health of All Americans.** To maintain American leadership in biomedical research, improve the health of Americans, and build the American bioeconomy of the future, the 2014 Budget proposes \$31.2 billion in discretionary appropriations for the National Institutes of Health (NIH).
 - **Educating Our Children in Science, Technology, Engineering, and Math.** To ensure our educational system is preparing students for careers in the 21st century economy in which they can be the highly skilled American workers and innovators of tomorrow, the 2014 Budget proposes [\$3.0 billion] for the Federal investment in science, technology, engineering, and mathematics (STEM) education. The Budget includes a reorganization and consolidation of STEM education programs to improve the effectiveness of Federal investments.

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- **Expanding Private Sector Investment.** To provide incentives for U.S. industries to keep investing in American innovation, the 2014 Budget proposes to expand, simplify, and make permanent the Research and Experimentation (R&E) Tax Credit, which will provide companies the certainty they need that the credit will be available for the duration of their R&D investments.
 - **Making Smart Choices.** The Budget's science, technology, and innovation investments fit within an overall discretionary budget capped at Budget Control Act of 2011 levels that continues to reduce annual budget deficits. The Budget proposes cuts in order to allow for high-priority investments. For example, the \$71.5 billion proposed for development in the 2014 Budget represents a decline of \$3.8 billion compared to 2012 enacted funding levels.

Priorities for Federal Research and Development in the 2014 Budget

"Now, if we want to make the best products, we also have to invest in the best ideas. Every dollar we invested to map the human genome returned \$140 to our economy -- every dollar. Today, our scientists are mapping the human brain to unlock the answers to Alzheimer's. They're developing drugs to regenerate damaged organs; devising new material to make batteries 10 times more powerful. Now is not the time to gut these job-creating investments in science and innovation. Now is the time to reach a level of research and development not seen since the height of the Space Race. We need to make those investments."

- President Barack Obama
February 2013

The President's 2014 Budget proposes \$142.8 billion for the Federal investment in research and development (see Table 1). Within a budget that reduces projected deficits and caps overall discretionary spending as required by the Budget Control Act of 2011, Federal R&D increases \$1.9 billion or 1.3 percent over the 2012 enacted level. The 2014 Budget sets priorities and makes tough but smart choices to make room for high-priority investments in innovation. In that spirit, the 2014 Budget proposes a decline in defense-related development but **proposes non-defense R&D of \$69.6 billion, an increase of 9.2 percent over the 2012 enacted level.** (All comparisons between 2012 appropriations and the 2014 Budget are in current, not-adjusted-for-inflation dollars. All figures exclude the potential effects of budget sequestration.)

The 2014 Budget recognizes the enduring role of the Federal government in fostering groundbreaking scientific and technological breakthroughs with a special emphasis on **basic and applied research** to fundamentally improve our understanding of nature, revolutionize key fields of science, and boost long-term economic growth and quality of life through new technologies. **The Federal research portfolio (comprising basic and applied research) totals \$68.1 billion in the 2014 Budget (see Figure 1 and Table 3), up \$4.8 billion or 7.5 percent compared to the 2012 enacted level.**

The 2014 Budget provides \$71.5 billion for development, a decline compared to the 2012 level, mostly due to reductions in the Department of Defense (DOD) weapons-systems development activities as its programs mature and transition to the production phase. R&D facilities and capital equipment funding totals \$3.2 billion, an increase of \$875 million above the 2012 enacted funding level to recapitalize research infrastructure.

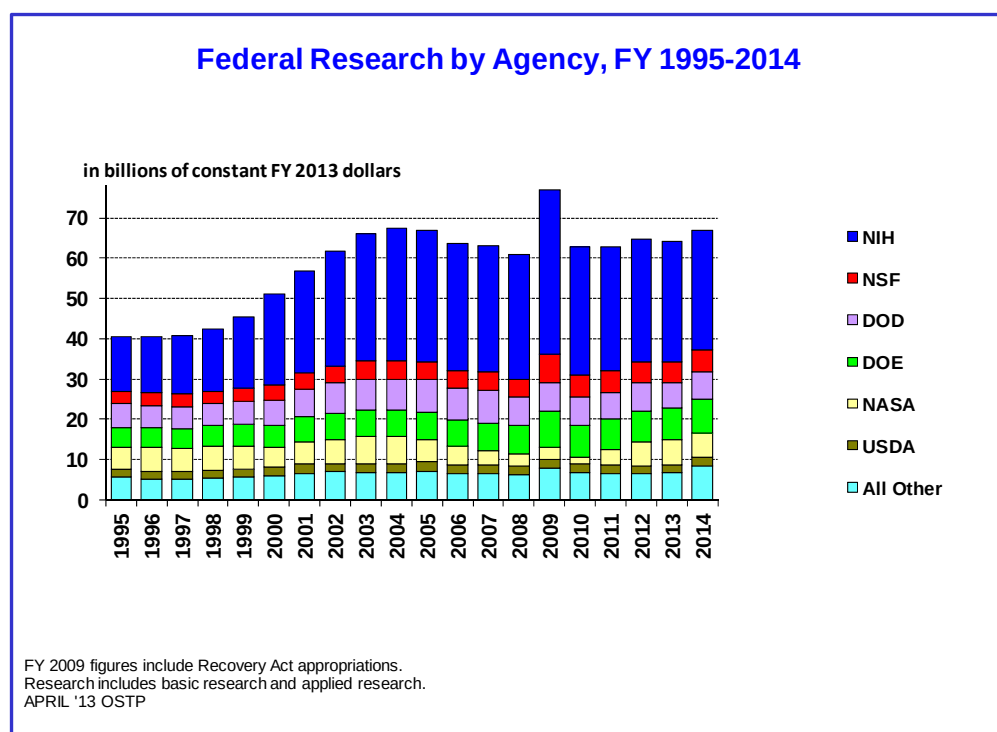


Figure 1.

Highlights of Key R&D Funding Agencies in the 2014 Budget

The **National Institutes of Health (NIH)** supports high-quality, innovative biomedical research aimed at developing knowledge and therapies that will lead to longer and healthier lives for all Americans. NIH accomplishes this goal through a robust program of intramural and extramural research, education, and training conducted or sponsored by its Institutes and Centers. **The 2014 Budget provides \$31.2 billion in discretionary appropriations for NIH, an increase of \$471 million or 1.5 percent over the 2012 funding level.** The 2014 Budget continues to support basic and applied biomedical research across a broad range of scientific and health opportunities, including delivering on the Administration's commitment to enhanced investment in Alzheimer's research. The Budget will increase focus on research that aims to increase understanding of the brain, improve the clinical trials network, and enhance the development of new therapeutics to treat diseases and disorders that affect millions of Americans. NIH will make an initial investment of \$40 million through the NIH Blueprint for Neuroscience Research for the development of new tools and training opportunities in support of the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative. NIH will implement new policies to improve research oversight, including managing its research portfolio to increase the number of new grants and collecting better data on trainees and institutions' administrative costs. Within other agencies of the Department of Health of Human Services (HHS), the 2014 Budget includes \$10 million within the Centers for Disease Control and Prevention (CDC) to support research on the causes and prevention of gun violence. The Budget also includes \$40 million for a new advanced molecular diagnostics initiative within CDC to more quickly determine where emerging diseases come from, whether microbes are resistant to antibiotics, and how microbes move through a population.

The **National Science Foundation (NSF)** is the primary source of support for academic research for most non-biomedical disciplines, integrating fundamental research and education across the entire spectrum of the sciences and engineering. **The increase in NSF funding to \$7.6 billion in 2014, or 8.4 percent more than the 2012 enacted level,** will expand the frontiers of knowledge, lay the foundation for

economic growth and job creation, and educate a globally-competitive workforce. NSF supports job creation in advanced manufacturing and emerging technologies with \$300 million 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 (BioMaPS). NSF will invest approximately \$20 million to accelerate integrative research in neuroscience and cognitive science, supporting the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative. NSF also proposes \$154 million, nearly double the 2012 enacted level, for cyberinfrastructure initiative that will 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 (CIF21). The Budget proposes \$25 million, an increase of \$17 million above the 2012 enacted level, for the public-private “Innovation Corps” program at NSF. The Budget proposes to consolidate science and engineering undergraduate education activities across government into a new consolidated program at NSF. The Budget provides \$123 million for this new program. The Budget also provides \$325 million for a newly consolidated NSF graduate research fellowship program. (Additional NSF highlights can be found in OSTP’s STEM Education fact sheet.)

The 2014 Budget invests in the **Department of Defense’s (DOD)** long-term scientific and technological innovation to ensure that the Nation has access to the best defense systems in the world. The Budget **proposes \$68.3 billion for DOD R&D, a \$4.6 billion decrease from the 2012 funding level.** The decrease represents reductions in development activities as programs mature and transition to production. The Budget proposes \$11.9 billion for DOD’s S&T program, which consists of basic research, applied research and advanced technology development. The Budget proposes \$2.9 billion for the Defense Advanced Research Projects Agency (DARPA) for its support of longer-term breakthrough research. Investing in DARPA’s high-risk and high-reward science is an Administration priority and critical to maintaining the technological superiority of the U.S. military. DARPA plans to invest \$50 million in a set of programs with the goal of understanding the dynamic functions of the brain and demonstrating breakthrough applications, in support of the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative. The 2014 Budget sustains DOD’s basic research (“6.1”) with a record commitment of \$2.1 billion for research in high-priority areas such as cybersecurity, robotics, advanced learning, “big data,” cleaner and more efficient energy, advanced manufacturing, and biodefense.

The **National Aeronautics and Space Administration (NASA)** 2014 Budget **provides \$17.7 billion.** While making tough choices, the Budget reinforces NASA’s current balanced portfolio of aeronautics and space technology development, Earth and space science, the development of rockets and capsules to carry explorers deeper into space, and the use of innovative commercial partnerships for crew and cargo transport to the International Space Station. 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 and heavy lift rocket that will send human-exploration missions to new destinations, and it invests \$743 million for the development of innovative new technologies that can expand the potential and lower the cost of our space science and exploration efforts. NASA has unique expertise in 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 revamp the Landsat satellite program. 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 while leveraging human and robotic synergies as the initial mission of a grand strategy for exploration that leads to Mars. The Budget fully funds the James Webb Space Telescope, a 100-times more- capable successor to the Hubble Telescope, at \$658 million to keep it on track for launch in 2018 while maintaining a world-leading astrophysics program.

NASA's R&D portfolio totals \$11.6 billion in the 2014 Budget, an increase of \$290 million or 2.6 percent over the 2012 enacted level (see Table 1).

The **Department of Energy (DOE)** 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 an **R&D portfolio that totals \$12.7 billion, an increase of \$1.9 billion or 18 percent over the 2012 enacted level** (see Table 1). DOE's Office of Science (DOE SC) delivers discoveries and scientific tools that transform our understanding of energy and nature. The 2014 DOE SC Budget of \$5.2 billion increases funding for both research and cutting-edge facilities and maintains the President's commitment to increase funding for three key science agencies. 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 energy efficiency, including \$2.8 billion for Energy Efficiency and Renewable Energy (EERE). The 2014 Budget provides \$379 million for the Advanced Research Projects Agency – Energy (ARPA-E) within DOE to support transformational discoveries and to accelerate solutions in the development of clean energy technology. The Budget also invests in research to ensure safe and natural gas production and includes a new \$25 million prize for the first natural-gas combined-cycle power plant to integrate carbon capture and storage. The Budget also includes \$12 million for DOE, in collaboration with the Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS), to continue a research initiative to understand and minimize the potential environmental, health, and safety impacts of natural gas and oil production from hydraulic fracturing. In DOE's defense-related portfolio, the Budget includes \$4.9 billion, an increase of \$631 million over the 2012 enacted level, for R&D in support of the nuclear stockpile, nuclear nonproliferation, and the Navy's nuclear propulsion. The Budget also establishes an Energy Security Trust to support research into a range of cost-effective technologies, \$200 million in 2014 and \$2 billion over ten years from revenue generated by Federal oil and gas development.

R&D in the **U.S. Department of Agriculture (USDA)** increases \$192 million to **\$2.5 billion** in the 2014 Budget. The Budget increases funding to \$383 million for the National Institute of Food and Agriculture's (NIFA) key competitive research program, the Agriculture Food and Research Initiative (AFRI), and targets areas that are fundamental to American scientific leadership: human nutrition and obesity reduction, food safety, bioenergy, sustainable agriculture, and climate change. The Budget also increases in-house research in select areas such as crop protection, sustainable agriculture, climate change, childhood obesity, and food safety, and fully funds the Census of Agriculture. The Budget includes \$155 million for the full cost of renovation and construction of a USDA poultry disease bio surveillance and research facility to reduce poultry diseases that could affect human health and the agricultural sector

The Department of Commerce's **National Institute of Standards and Technology (NIST)** promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology. The 2014 Budget of **\$754 million for NIST's intramural laboratories, a 21 percent increase over the 2012 enacted level**. NIST's 2014 Budget maintains the President's commitment to increase funding for three key science agencies. This funding will accelerate advances in a variety of important areas, ranging from cybersecurity and smart manufacturing to advanced communications and disaster resilience. The Budget provides a \$25 million increase for 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 road maps and research to address common manufacturing challenges faced by American businesses. The Budget includes 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). The **National Oceanic and Atmospheric Administration (NOAA)**, also part of the Department of

Commerce, plays a vital role supporting research on the Earth's oceans, atmosphere, and marine habitats. The NOAA budget of [\$5 billion], 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 habitat and species conservation activities that are essential to restoring and maintaining healthy, sustainable fisheries.

Department of Homeland Security (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 facility. The 2014 Budget funds important R&D advances in 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 facility to study and develop countermeasures for emerging zoonotic diseases that threaten human health and our agricultural industry.

The **Department of Education** R&D portfolio totals **\$352 million in the 2014 Budget.** The Budget continues to move toward the President's goal of educating 100,000 effective STEM teachers over the next decade. The Budget invests \$265 million, redirected from within the Department and from other agencies, to support STEM Innovation Networks, which would be consortia of districts working in partnership with universities, science agencies, businesses, and other educational entities. To reinforce the Department's transformation of STEM teaching and learning, the Budget continues support for the joint K-16 Math Initiative and the Advanced Research Projects Agency for Education (ARPA-ED). (Additional Education highlights can be found in OSTP's STEM Education fact sheet.)

The **Department of Veterans Affairs (VA)** 2014 Budget provides \$586 million for medical and prosthetic research and \$586 million in medical care support for a total of \$1.2 billion for R&D across VA programs. VA research focuses on biomedical topics of special relevance to wounded warriors and supports a robust program of clinical and translational research. VA's research program benefits from clinical care and research occurring together, allowing discoveries to be directly coordinated to the care of veterans.

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. This funding supports scientific monitoring, research, and analysis to assist decision-making in resource management and the special trust responsibilities of DOI and other federally mandated and nationally-significant programs. Specific activities supported include energy permitting, ecosystem management, oil spill restoration, Earth observations (such as water and wildlife monitoring), and tribal natural resource management. The total budget of the **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 and oil production from hydraulic fracturing.

Environmental Protection Agency (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 and oil production using hydraulic fracturing.

The 2014 Budget provides **\$942 million for Department of Transportation (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) 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.

The 2014 Budget **provides \$250 million for R&D programs in the Smithsonian Institution**, an increase of \$7 million over the 2012 enacted level. The Smithsonian is an important partner in the Federal effort to improve the reach of informal education activities in STEM fields by ensuring that they are aligned with State standards and are relevant to the classroom.

Multi-agency initiatives

A number of R&D investments are being addressed through multi-agency activities coordinated through the National Science and Technology Council (NSTC) and other interagency forums. Table 2 shows details of three such efforts: global change research, networking and information technology R&D, and nanotechnology R&D.

U.S. Global Change Research Program: The 2014 Budget provides **\$2.7 billion for the multi-agency U.S. Global Change Research Program (USGCRP), an increase of 7.5 percent over the 2012 enacted level** (see Table 2). The U.S. Global Change Research Program (USGCRP) integrates and coordinates Federal research and application to assist the Nation and the world to understand, predict, mitigate, and adapt to human-induced and natural processes of global change, including but not limited to climate change. Within coordinated USGCRP interagency investments, the 2014 Budget supports the goals set forth in the program's 2012-2021 strategic plan, which include: advancing scientific knowledge of the integrated natural and human components of the Earth system; providing the scientific basis to inform and enable timely decisions on adaptation and mitigation; building sustained assessment capacity that improves the United States' ability to understand, anticipate, and respond to global change impacts and vulnerabilities; and advancing communications and education to broaden public understanding of global change. The 2014 Budget also supports an integrated and ongoing National Climate Assessment of climate change science, impacts, vulnerabilities, and response strategies. Reports and general information about the USGCRP and its various research activities are available on the program's website, www.globalchange.gov.

Networking and Information Technology R&D: The 2014 Budget proposes **\$4.0 billion for the multi-agency Networking and Information Technology Research and Development (NITRD) Program, an increase of 4.2 percent over the 2012 enacted level**. The multi-agency Networking and Information Technology Research and Development (NITRD) Program plans and coordinates agency research efforts in cyber security, high-end computing systems, advanced networking, software development, high-confidence systems, health IT, wireless spectrum sharing, cloud computing, and other information technologies. The 2014 Budget includes a focus on research to improve our 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. Budget information for NITRD is available at www.nitrd.gov.

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 National Nanotechnology Initiative (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 (for details see nano.gov/initiatives/government/signature). Budget information is available at www.nano.gov.

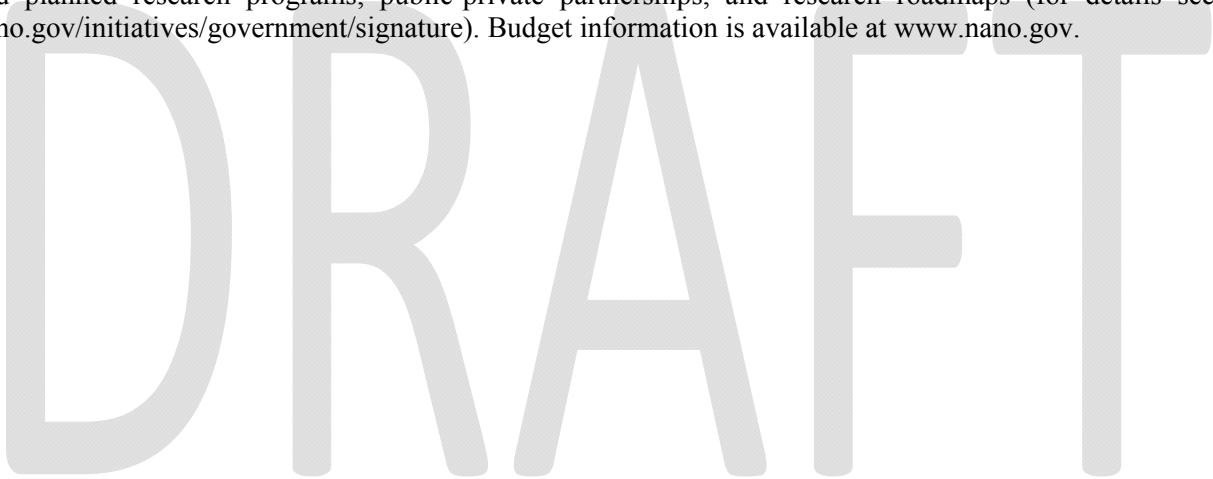


Table 1. R&D in the 2014 Budget

Table 1. R&D in the FY 2014 Budget by Agency

(budget authority in millions of dollars)

	FY 2012 Actual	FY 2013 CR	FY 2014 Budget	Change FY 12-14	
				Amount	Percent
Total R&D					
Defense (military)	72,916	73,839	68,291	-4,625	-6.3%
Health and Human Services	31,377	31,734	32,046	669	2.1%
<i>Nat'l Institutes of Health</i>	30,012	30,231	30,490	478	1.6%
<i>All Other HHS R&D</i>	1,365	1,503	1,556	191	14.0%
NASA	11,315	11,282	11,605	290	2.6%
Energy 1/	10,811	11,406	12,739	1,928	17.8%
<i>Atomic Energy Defense R&D</i>	4,257	4,600	4,888	631	14.8%
<i>Office of Science</i>	4,463	4,491	4,744	281	6.3%
<i>Energy R&D 1/</i>	2,091	2,315	3,107	1,016	48.6%
National Science Foundation	5,636	5,643	6,148	512	9.1%
Agriculture	2,331	2,249	2,523	192	8.2%
Commerce 2/	1,254	1,338	2,682	1,428	113.9%
NOAA	574	587	733	159	27.7%
NIST 2/	557	572	1,626	1,069	191.9%
Interior	820	841	963	143	17.4%
<i>U.S. Geological Survey</i>	673	682	761	88	13.1%
Transportation	921	852	942	21	2.3%
Environmental Protection Agency	568	571	560	-8	-1.4%
Veterans Affairs	1,160	1,170	1,172	12	1.0%
Education	397	342	352	-45	-11.3%
Homeland Security	481	514	1,374	893	185.7%
Smithsonian	243	241	250	7	2.9%
Patient Centered Outcomes Res.	120	304	498	378	315.0%
Int'l Assistance Programs	188	188	182	-6	-3.2%
All Other	374	389	446	72	19.3%
Total R&D	140,912	142,903	142,773	1,861	1.3%
Defense R&D	77,173	78,439	73,179	-3,994	-5.2%
Nondefense R&D	63,739	64,464	69,594	5,855	9.2%
Basic Research	31,740	31,826	33,162	1,422	4.5%
Applied Research	31,618	32,318	34,963	3,345	10.6%
Total Research	63,358	64,144	68,125	4,767	7.5%
Development	75,244	76,650	71,463	-3,781	-5.0%
R&D Facilities and Equipment	2,310	2,109	3,185	875	37.9%

1/ DOE 2014 total includes mandatory proposal for the Energy Security Trust.

2/ NIST 2014 total includes mandatory proposal for the National Network for Manufacturing Innovation.

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All comparisons are between 2012 and 2014 because of the late completion of 2013 appropriations.

Table 2. Interagency Science and Technology Initiatives

Table 2. Interagency Science and Technology Initiatives
(budget authority in millions)

	FY 2012 Actual	FY 2013 CR	FY 2014 Budget	Change FY 12-14	
				Amount	Percent
National Nanotechnology Initiative (NNI)					
National Science Foundation	466	426	431	-35	-7.6%
Defense	426	214	217	-209	-49.1%
Energy	314	354	370	56	17.8%
NASA	19	19	18	-1	-5.9%
Commerce (NIST)	95	93	102	7	7.0%
Health and Human Services	480	486	488	8	1.7%
Agriculture	25	18	23	-1	-5.2%
Environmental Protection Agency	18	18	17	0	-1.7%
Homeland Security	19	19	35	16	86.5%
DOT - FHWA	1	0	2	1	100.0%
All Other	2	2	2	0	0.0%
Total Nanotechnology	1,863	1,649	1,704	-159	-8.6%
Networking and Information Technology R&D (NITRD)					
Commerce	119	120	170	51	42.6%
Defense	1,279	1,284	1,317	38	3.0%
Energy	498	533	541	44	8.8%
Homeland Security	54	57	77	22	40.6%
Health and Human Services 1/	558	552	552	-6	-1.0%
NASA	78	76	76	-2	-1.9%
National Science Foundation	1,216	1,138	1,227	11	0.9%
All Other	7	7	8	1	10.0%
Total NITRD	3,809	3,768	3,968	159	4.2%
U.S. Global Change Research Program (USGCRP)					
National Science Foundation	333	333	326	-7	-2.1%
Energy	211	219	220	8	4.0%
Commerce (NOAA, NIST)	319	318	371	52	16.4%
Agriculture	116	107	126	10	8.9%
Interior (USGS)	59	58	72	13	22.0%
Environmental Protection Agency	18	19	20	2	10.5%
National Institutes of Health	14	15	15	1	7.4%
NASA	1,390	1,444	1,493	103	7.4%
Smithsonian	8	8	8	0	0.0%
All Other	15	15	18	3	20.0%
Total USGCRP	2,484	2,535	2,670	186	7.5%

1/ Includes funds from offsetting collections for Agency for Healthcare Research and Quality (AHRQ).

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All comparisons are between 2012 and 2014 because of the late enactment of 2013 appropriations.

Table 3. Research in the 2014 Budget

Table 3. Research in the FY 2014 Budget

(budget authority in millions of dollars)

	FY 2012 Actual	FY 2013 CR	FY 2014 Budget	Change FY 12-14	
				Amount	Percent
RESEARCH (basic + applied)					
Defense (military)	6,742	6,111	6,736	-6	-0.1%
<i>Basic Research ("6.1")</i>	<i>2,014</i>	<i>1,874</i>	<i>2,134</i>	<i>120</i>	<i>6.0%</i>
Health and Human Services	31,128	31,530	31,842	714	2.3%
<i>Nat'l Institutes of Health</i>	<i>29,879</i>	<i>30,097</i>	<i>30,356</i>	<i>477</i>	<i>1.6%</i>
NASA	5,831	6,049	6,301	470	8.1%
Energy 1/	7,496	8,065	8,534	1,038	13.8%
<i>Office of Science</i>	<i>3,839</i>	<i>3,959</i>	<i>4,053</i>	<i>214</i>	<i>5.6%</i>
National Science Foundation	5,101	5,137	5,600	499	9.8%
Agriculture	2,051	1,974	2,081	30	1.5%
Commerce 2/	941	1,004	2,278	1,337	142.1%
NOAA	396	413	504	108	27.3%
NIST 2/	461	475	1,515	1,054	228.6%
Interior	704	723	831	127	18.0%
<i>U.S. Geological Survey</i>	<i>573</i>	<i>573</i>	<i>640</i>	<i>67</i>	<i>11.7%</i>
Transportation	651	633	658	7	1.1%
Environmental Protection Agency	480	482	473	-7	-1.5%
Veterans Affairs	1,088	1,098	1,100	12	1.1%
Education	233	209	212	-21	-9.0%
Homeland Security	161	172	274	113	70.2%
Smithsonian	200	205	214	14	7.0%
Patient Centered Outcomes Res.	120	304	498	378	315.0%
Int'l Assistance Programs	163	163	157	-6	-3.7%
All Other	268	285	336	68	25.4%
Total Research	63,358	64,144	68,125	4,767	7.5%

1/ DOE 2014 total includes mandatory proposal for the Energy Security Trust.

2/ NIST 2014 total includes mandatory proposal for the National Network for Manufacturing Innovation.

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All comparisons are between 2012 and 2014 because of the late completion of 2013 appropriations.



The President's Plan for Science and Innovation

Increasing Funding for Key Science Agencies in the 2014 Budget

"Now is not the time to gut these job-creating investments in science and innovation. Now is the time to reach a level of research and development not seen since the height of the Space Race. We need to make those investments."

- President Barack Obama
February 2013

The 2014 Budget maintains the President's commitment to increase funding for basic research at three key science agencies in order to spur American innovation. Building on previous budgets proposed by the Administration, the 2014 Budget provides increases in funding for the National Science Foundation (NSF), the Department of Energy's Office of Science (DOE SC), and the National Institute of Standards and Technology (NIST) laboratories. These investments will expand the frontiers of human knowledge and help create new industries and jobs. Within these agencies, funds will be focused on basic research directed at priority areas, such as clean energy technologies, advanced manufacturing, biotechnology, and new materials.

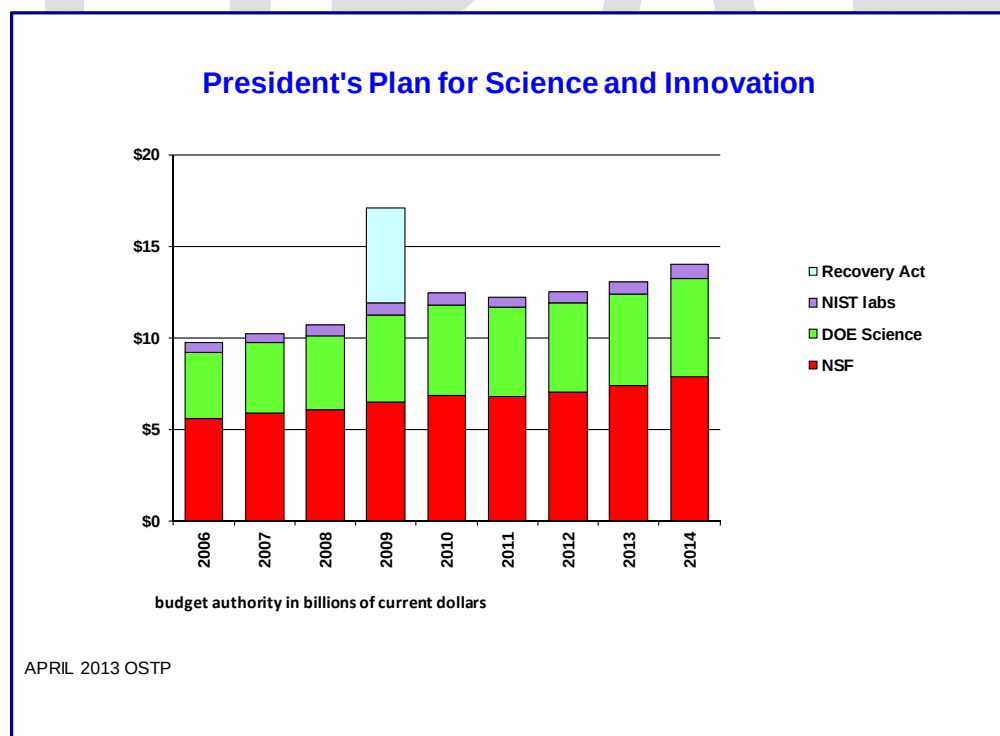


Figure 1.

The President is committed to increasing the budgets of NSF, DOE SC, and the NIST labs. The 2014 Budget proposes \$13.5 billion total for these three agencies, an increase of \$1.0 billion or 8.0 percent above the 2012 enacted total. (All comparisons are in current, not-adjusted-for-inflation dollars;

because 2013 appropriations were enacted only at the end of March, all comparisons are to 2012 enacted funding levels.) The President's Plan for Science and Innovation (a key pillar of *A Strategy for American Innovation* announced in September 2009 and revised in February 2011), the America COMPETES Act of 2007 (P.L. 110-69), and the America COMPETES Reauthorization Act of 2010 (P.L. 111-358) have all identified NSF, DOE SC, and NIST as critical to preserving America's place as the world leader in science and innovation. Consistent with the Budget Control Act spending caps, these fiscally responsible increases are part of a 2014 Budget that reduces projected deficits while making crucial investments in manufacturing, energy, infrastructure, and education.

Science Agencies in the President's Plan for Science and Innovation

The **National Science Foundation (NSF)** is the primary source of support for academic research for most non-biomedical disciplines, integrating fundamental research and education across the entire spectrum of the sciences and engineering. The increase in NSF funding to \$7.6 billion in 2014, or 8.4 percent more than the 2012 enacted level, will catalyze fundamental advances in science and engineering and support the people who generate them. The 2014 Budget expands NSF's efforts in clean-energy research, fundamental disciplinary research, advanced manufacturing, and other emerging research areas.

The **Department of Energy's Office of Science** delivers discoveries and scientific tools that transform our understanding of energy and matter through a wide range of research in economically significant areas such as nanotechnology, high-end computing, and energy. The 2014 Budget of \$5.1 billion, or 5.7 percent more than the 2012 enacted level, increases funding for both cutting-edge research and facilities. The increase in Office of Science funding augments foundational clean-energy and environmental research and fundamental research in the physical sciences.

The Department of Commerce's **National Institute of Standards and Technology (NIST)** invests in technological innovation through research, advanced measurement, and standards development. The 2014 Budget of \$743 million for NIST's intramural laboratories, a 21 percent increase over the 2012 enacted level, will support high-performance laboratory research and facilities in areas such as advanced manufacturing, cybersecurity, and nanotechnology.

Table. President's Plan for Science and Innovation in the 2014 Budget
(budget authority in millions of dollars)

	2012	2014	Change '12-'14	
			\$ increase	% increase
National Science Foundation	7,033	7,626	593	8.4%
Department of Energy Office of Science	4,874	5,153	279	5.7%
NIST laboratories ^	622	754	132	21.1%
TOTAL	12,529	13,533	1,004	8.0%

^ - National Institute of Standards and Technology (NIST) Scientific and Technical Research and Services (STRS) and Construction of Research Facilities (CRF) accounts.



Preparing a 21st Century Workforce

Science, Technology, Engineering, and Mathematics (STEM) Education in the 2014 Budget

“We’ll reward schools that develop new partnerships with colleges and employers, and create classes that focus on science, technology, engineering, and math – the skills today’s employers are looking for to fill jobs right now and in the future.”

President Barack Obama
2013 State of the Union

President Obama strongly believes that the United States must equip many more students to excel in the fields of science, technology, engineering and math (STEM). That’s why the President’s 2014 Budget invests \$X billion in programs across the Federal government on STEM education. This includes critical investments in a number of areas that will benefit aspiring students:

- Recruiting, preparing and supporting excellent STEM teachers, with \$80 million to support the President’s goal of preparing 100,000 excellent STEM teachers and \$35 million to launch a pilot STEM Master Teacher Corps.
- Supporting more STEM-focused districts and high schools, with an investment of \$150 million to create new STEM Innovation networks to better connect school districts with regional and national resources, such as the partnership between the Ohio STEM Learning Network, the Cleveland Metropolitan School District, GE and MC2High School. In addition, the Department of Education will invest \$300 million to support re-design of high schools, to encourage partnerships with colleges, employers, or community partners, many with a focus on STEM subjects.
- Improving undergraduate STEM education, with the National Science Foundation launching a \$120 million effort to improve retention of undergraduates that are interested in STEM and meet the President’s goal of preparing 1 million more STEM graduates over the next decade.
- Investing in breakthrough research, with approximately \$50M for an “ARPA for Education,” (ARPA-ED) which would allow the Department of Education to support high-risk, high-return research on next-generation learning technologies, including for STEM education.

In addition, by decreasing the number of STEM programs from 235 to approximately 150, the President’s Budget makes disciplined choices to reorganize and cut back lower-priority programs to make room for targeted increases. This includes the proposed elimination or reorganization of 78 programs, with approximately \$180 million in savings strategically reinvested in new or existing STEM programs. This reorganization effort will substantially decrease the fragmentation of STEM programs across the federal government and improve opportunities for

rigorous evaluation of the remaining programs. The reorganization also includes increasing capacity at critical agencies.

K-12 Education

The President's 2014 Budget includes investments at the Department of Education to improve STEM education in schools, with a priority on excellent teachers, rigorous courses, and partnerships that leverage the scientific and higher education community while broadening participation from underrepresented groups. These investments include:

- Preparing 100,000 Excellent STEM Teachers over the Next Decade: In his 2011 State of the Union address, the President called for a new effort to prepare 100,000 STEM teachers over the next decade with strong teaching skills and deep content knowledge. Answering the President's call to action, over 150 organizations, led by Carnegie Corporation of New York, have formed a coalition called *100Kin10*. Members of the coalition have made over 100 commitments to support STEM teacher preparation. Last month, Howard Hughes Medical Institute announced another \$22.5M investment in support of the President's goal. To build on these private-sector investments, the President's Budget requests \$80 million for a new competition by the Department of Education to support evidence-based, effective STEM teacher preparation programs.
- STEM Master Teacher Corps: The President's Budget also includes \$35 million to launch a pilot of the STEM Master Teacher Corps, a new effort enlisting some of America's best and brightest science and math teachers that will help to improve instruction in their schools and districts, and to serve as a national resource for best practices in math and science teaching.
- STEM Innovation Networks: The Budget invests \$150 million to support the ability of 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 allow many more district leaders to harness local, regional, and national resources to transform STEM teaching and learning by implementing research-based practices, supporting innovation, and building capacity. These networks will build on the continuing \$150 million investment in the Department of Education's Math and Science Partnership program.
- STEM-focused schools: The President's Budget includes \$300 million investment for a new competition to kick-start a redesign of high schools to emphasize real-world learning. The President's plan will invest in redesigning high school to focus on providing challenging, relevant experiences, while rewarding schools that develop new partnerships with colleges, community partners or employers - creating opportunities that focus on STEM subjects and skills, preparing students for college and career, and ensuring that our nation's capacity to create and innovate is never limited by a shortage of talent.

In addition, the President's Budget also includes investments to improve K-12 in the other science and technology agencies:

- Greater leadership role by the Smithsonian in informal STEM learning: The Budget adds \$25 million to the Smithsonian Institution to improve its reach of informal STEM education activities, with a focus on aligning materials with instruction, and harnessing the expertise of other S&T agencies such as NASA and NOAA.
- Identifying innovative STEM education practices. The Administration proposes \$X million to support NSF's Discovery Research K-12, which supports research on teaching and learning STEM, and to create research-based scalable resources, models, and tools. The Administration proposes \$XX for NSF's Advancing Informal Science Learning program (formerly Informal Science Education), focusing on the research and model-building contributions of the program to better understand effective means and innovative models for engaging today's young people and adults in science outside of school settings.

Undergraduate and Graduate STEM Education

The focus of the President's 2014 Budget's undergraduate STEM investments is on implementing a cross-agency priority goal to increase the number of well-prepared graduates with science, technology, engineering, and math (STEM) degrees by 1 million over the next 10 years. Informed by a PCAST recommendation highlighting this shortfall, in Fall 2012, the Administration launched a Federal government-wide effort will support the achievement of this goal through improvements to the quality of STEM undergraduate education and improving retention of STEM undergraduates.

The President's Budget includes investments to support this goal, including:

- Transforming undergraduate teaching and learning with NSF investments: The Budget proposes over \$120 million for an integrated program – Catalyzing Advances in Undergraduate STEM Education (CAUSE) – to support the President's goal of producing one million more STEM graduates in the next decade by improving undergraduate teaching and learning. Priorities will include improving instruction during the first two years of a student's college career, as well as supporting research teams across STEM disciplines, discipline-based education research, cognitive science, educational psychology, and the learning sciences.
- Improving K-16 mathematics education and knowledge building. The Budget proposes \$60 million for a jointly administered NSF and ED mathematics education initiative. This new program will create a STEM tiered evidence initiative on K-16 mathematics that will combine NSF's strength in mathematics education research with ED's expertise in working with state and district education agencies .
- Supporting individuals from groups traditionally underrepresented in STEM. The Administration proposes \$100 million for the Department of Education to increase the

number of Hispanic and other low-income students attaining degrees in STEM fields and to develop model transfer and articulation agreements between 2-year and 4-year Hispanic Serving Institutions (HSIs) in such fields. In addition, the Administration proposes \$30 million for the NASA Minority University Research and Education Program.

- Improving STEM education at community colleges. The Administration proposes \$64 million for NSF's Advanced Technological Education (ATE) program, which focuses on education of technicians for the high-technology fields, with a focus on partnerships between academic institutions and employers.

Graduate Fellowships

The focus of the 2014 Budget's graduate STEM investments is on preparing highly skilled scientists and engineers, and leveraging the National Science Foundation's strong expertise in managing fellowships. This includes:

- Substantial increase in NSF's graduate fellowship program: By reorganizing or eliminating lower-priority fellowship programs, the Budget provides \$335 million for a new integrated NSF graduate research fellowship program, a substantial increase over \$240 million requested for the NSF's Graduate Research Fellowship (GRF) program in the President's 2013 Budget.
- Continued support for major graduate training programs, such as \$217 million for HHS's Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants, which provide funding to prepare individuals for careers in the biomedical, behavioral and social sciences.

Supporting Innovation

Building on the President's Strategy for American Innovation and the opportunity to tackle the Grand Challenges of the 21st Century, the Budget proposes approximately \$50M to launch an "ARPA for Education." This would allow the Department of Education to support high-risk, high-return research on next-generation learning technologies for STEM education.

Housed within the Department of Education, the Advanced Research Projects Agency–Education (ARPA-ED) will catalyze the development and deployment of new tools and technologies to significantly improve student learning. ARPA-ED will advance the education research, development and demonstration field 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, learning systems, and digital learning materials; and identifying and transitioning the best and most relevant R&D from other federal agencies.

Making Hard Choices

The 2014 Budget makes hard choices to increase the impact of the federal government's investments in STEM education, including reorganizing or eliminating 78 STEM education programs in 9 agencies. This will reduce the number of STEM education programs from 235 to less than 150, a 33 percent reduction. These decisions will:

- Reduce fragmentation of the federal STEM education investment, reorganizing efforts around more clearly defined priorities;
- Enable rigorous evaluation and evidence-building strategies for the programs that remain;
- Increase the efficiency of federal investments in important areas such as graduate education by having fewer programs with more resources;
- Provide additional resources to meet a smaller number of national priorities, such as preparing and recruiting 100,000 high-quality K-12 STEM teachers, strengthening the infrastructure for supporting STEM instruction and engagement; increasing the number of undergraduates with a STEM degree by 1 million, and broadening participation in STEM fields by underrepresented groups.



Combating the Threat of Global Climate Change

The U.S. Global Change Research Program in the 2014 Budget

The 2014 Budget reflects the President's commitment to global-change research by sustaining coordinated, government-wide efforts to understand, predict, mitigate, and adapt to global change, including but not limited to climate change, and to inform the Nation's transition to a clean-energy economy. Investments in global-change science over the past several decades have produced major advances in our understanding of global change. Building from these important advances, the U.S. Global Change Research Program (USGCRP) is now poised meet its Congressional mandate more fully and effectively than ever before. **The 2014 Budget provides \$2.7 billion for the multi-agency USGCRP, an increase of 7.5 percent over the 2012 enacted level** (see Table). (All comparisons between 2012 appropriations and the 2014 Budget are in current, not-adjusted-for-inflation dollars. Figure 1 shows historical trends in inflation-adjusted dollars.)

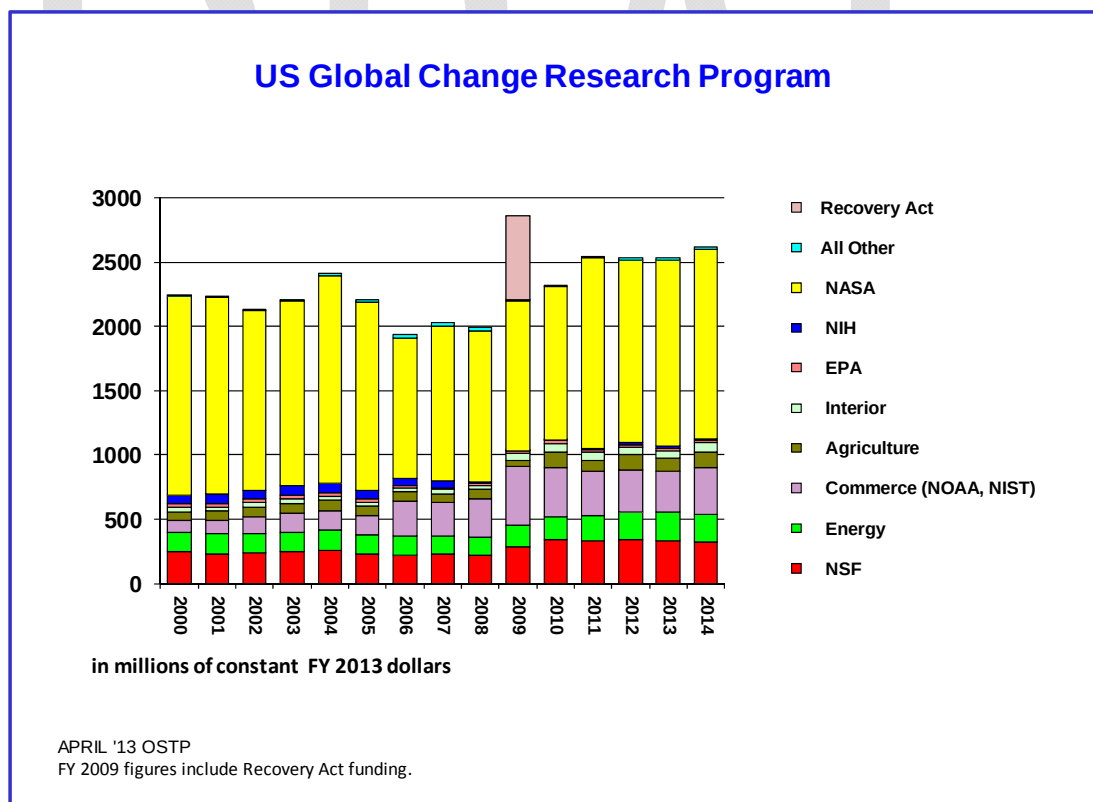


Figure 1.

Over the past four years, the Obama Administration has revitalized and strengthened the USGCRP (see Figure 1). The 2014 Budget increases USGCRP funding while emphasizing interagency coordination to improve the program's overall performance and ensure that these important Federal investments are efficient and non-redundant. All increases are part of a 2014 Budget that, consistent with Budget Control

Act caps, reduces projected deficits while making investments needed to enhance coordination, increase effectiveness, and build a sustainable future.

The USGCRP was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606) to conduct work aimed at understanding, assessing, and responding to global change. This has included expanding global observing systems, developing enhanced predictive capabilities, creating science-based resources to support policymaking and resource management, and communicating findings broadly among scientific and stakeholder communities. Thirteen departments and agencies participate cooperatively in the USGCRP under a common vision for a Nation globally engaged and guided by science to meet the challenges of global change.

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 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. 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 securing necessary 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. Reports and general information about the USGCRP and its various research activities are available on the program's website, www.globalchange.gov.

Table. U.S. Global Change Research Program
(discretionary budget authority in millions)

	FY 2012 Actual	FY 2014 Budget	Change FY 12-14	
			Amount	Percent
U.S. Global Change Research Program (USGCRP)				
National Science Foundation	333	326	-7	-2.1%
Energy	211	220	8	4.0%
Commerce (NOAA, NIST)	319	371	52	16.4%
Agriculture	116	126	10	8.9%
Interior (USGS)	59	72	13	22.0%
Environ. Protection Agency	18	20	2	10.5%
National Institutes of Health	14	15	1	7.4%
NASA	1,390	1,493	103	7.4%
Smithsonian	8	8	0	0.0%
DOT	15	18	3	20.0%
Total USGCRP	2,484	2,670	186	7.5%