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Federal Research and Development Funding: FY2016

John F. Sargent Jr., Coordinator
Specialist in Science and Technology Policy

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Summary

President Obama's budget request for FY2016 includes $145.694 billion for R&D in FY2016, an increase of $7.625 billion (5.5%) over the estimated FY2015 R&D funding level of $138.069 billion. The request represents the President's R&D priorities; Congress may opt to agree with part or all of the request, or it may express different priorities through the appropriations process. In particular, Congress will play a central role in determining the growth rate and allocation of the federal R&D investment in a period of intense pressure on discretionary spending. Budget caps may limit overall R&D funding and may require movement of resources across disciplines, programs, or agencies to address priorities.

Funding for R&D is concentrated in a few departments and agencies. Under President Obama's FY2016 budget request, seven federal agencies would receive 95.6% of total federal R&D funding, with the Department of Defense (DOD, 49.5%) and the Department of Health and Human Services (HHS, 21.3%) accounting for more than 70% of all federal R&D funding. The largest increases in agency R&D funding in the President's request would go to the Department of Defense (DOD, up $4.670 billion, 6.9%), Department of Energy (DOE, up $861 million, 7.3%), and the Department of Commerce (DOC, up $601 million, 39.4%).

Legislation targeted the R&D budgets of the National Institute of Standards and Technology, National Science Foundation, and DOE Office of Science seeking to double them from their FY2006 levels. The America COMPETES Act aimed to double funding over 7 years, and the America COMPETES Reauthorization Act of 2010 over 11 years. The President's FY2016 budget requests increases for these accounts, like the FY2015 and FY2014 requests. It departs from earlier Obama and Bush Administration budgets that explicitly stated the doubling goal. Enacted funding for FY2015 for these accounts represents a compound annual growth rate of 3.25% since FY2006, a rate that would result in doubling in 22 years.

The President's FY2016 request continues support for three multi-agency R&D initiatives—the National Nanotechnology Initiative (NNI), the Networking and Information Technology Research and Development (NITRD) program, and the U.S. Global Change Research Program (USGCRP). The request also continues support for the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative, the Materials Genome Initiative, and the National Robotics Initiative. The President has proposed FY2016 discretionary funding for seven new manufacturing institutes as part of his proposed National Network for Manufacturing Innovation (NNMI), in addition to the nine that have already been planned, competed, or awarded. The President also proposes $1.9 billion in mandatory funding for the establishment of 29 additional institutes between FY2017 and FY2024. In addition, the FY2016 budget proposes a new multiagency R&D initiative, the Precision Medicine Initiative which seeks to build on research and discoveries that allow medical treatments to be tailored to an individual's unique characteristics (e.g., a patient's genes) or the genetic profile of an individual's tumor.

In recent years, continuing resolutions and sequestration have resulted in the annual appropriations process being completed after the start of the fiscal year. This can affect agencies' execution of their R&D budgets, including the delay or cancellation of planned R&D activities and acquisition of R&D-related equipment.

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Overview

The 114th Congress continues to take a strong interest in the health of the U.S. research and development (R&D) enterprise and in providing support for federal R&D activities. The federal government has played an important role in supporting R&D efforts that have led to scientific breakthroughs and new technologies, from jet aircraft and the Internet to communications satellites, shale gas extraction, and defenses against disease. However, widespread concerns about the federal debt and recent and projected federal budget deficits are driving difficult decisions about the prioritization of R&D, both in the context of the entire federal budget and among competing needs within the federal R&D portfolio.

The U.S. government supports a broad range of scientific and engineering R&D. Its purposes include specific concerns such as addressing national defense, health, safety, the environment, and energy security; advancing knowledge generally; developing the scientific and engineering workforce; and strengthening U.S. innovation and competitiveness in the global economy. Most of the R&D funded by the federal government is performed in support of the unique missions of individual funding agencies.

The federal R&D budget is an aggregation of the R&D components of each federal agency. There is no single, centralized source of funds that is allocated to individual agencies. Agency R&D budgets are developed internally as part of each agency's overall budget development process and may be included either in accounts that are entirely devoted to R&D or in accounts that include funding for non-R&D activities. These budgets are subjected to review, revision, and approval by the Office of Management and Budget (OMB) and become part of the President's annual budget submission to Congress. The federal R&D budget is then calculated by aggregating the R&D components of each federal agency.

Congress plays a central role in defining the nation's R&D priorities as it makes decisions about the level and allocation of R&D funding—overall, within agencies, and for specific programs. Some Members of Congress have expressed concerns about the level of federal spending (for R&D as for other purposes) in light of the current federal deficit and debt. As Congress acts to complete the FY2016 appropriations process, it faces two overarching issues: the extent to which federal R&D investments can grow in the face of increased pressure on discretionary spending and the prioritization and allocation of the available funding. Budget caps may limit overall R&D funding and may require movement of resources across disciplines, programs, or agencies to address priorities. Moving funding between programs/accounts/agencies can become more complex and difficult because the funding for different programs/accounts/agencies is often provided through different appropriations bills.

Structurally, this report begins with a discussion of the overall level of the President's FY2016 R&D request, followed by analyses of the R&D funding request from a variety of perspectives and for selected multiagency R&D initiatives. The report concludes with discussion and analysis of the R&D budget requests of selected federal departments and agencies that, collectively, account for more than 98% of total federal R&D funding. Selected terms associated with federal R&D funding are defined in the text box on the next page. **Appendix** provides a list of acronyms and abbreviations.

Definitions Associated with Federal Research and Development Funding

Two key sources of definitions associated with federal research and development funding are the White House Office of Management and Budget (OMB) and the National Science Foundation.

Office of Management and Budget. The Office of Management and Budget provides the following definitions of R&D-related terms in OMB Circular No. A-11, "Preparation, Submission, and Execution of the Budget" (July 2013). This document provides guidance to agencies in the preparation of the President's annual budget and instructions on budget execution.

Conduct of Research. Research and development activities comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture, and society, and the use of this stock of knowledge to devise new applications. Includes administrative expenses for R&D, including the operating costs of research facilities and equipment; does not include physical assets for R&D such as R&D equipment and facilities or routine product testing, quality control, mapping, collection of general-purpose statistics, experimental production, routine monitoring and evaluation of an operational program, and the training of scientific and technical personnel.

Basic Research. Basic research is defined as systematic study directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. Basic research, however, may include activities with broad applications in mind.

Applied Research. Applied research is defined as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

Development. Development is defined as systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

R&D Equipment. Amounts for major equipment for research and development. Includes acquisition or design and production of movable equipment, such as spectrometers, research satellites, detectors, and other instruments. At a minimum, this line should include programs devoted to the purchase or construction of R&D equipment.

R&D Facilities. Amounts for the construction and rehabilitation of research and development facilities. Includes the acquisition, design, and construction of, or major repairs or alterations to, all physical facilities for use in R&D activities. Facilities include land, buildings, and fixed capital equipment, regardless of whether the facilities are to be used by the government or by a private organization, and regardless of where title to the property may rest. Includes fixed facilities such as reactors, wind tunnels, and particle accelerators.

National Science Foundation. The National Science Foundation provides the following definitions of R&D-related terms in its *Science and Engineering Indicators: 2014* report.

Research and Development. Research and development, also called research and experimental development; comprises creative work undertaken on a systematic basis to increase the stock of knowledge—including knowledge of man, culture, and society—and its use to devise new applications.

R&D Plant. In general, R&D plant refers to the acquisition of, construction of, major repairs to, or alterations in structures, works, equipment, facilities, or land for use in R&D activities.

Basic Research. The objective of basic research is to gain more comprehensive knowledge or understanding of the subject under study without specific applications in mind. Although basic research may not have specific applications as its goal, it can be directed in fields of present or potential interest. This is often the case with basic research performed by industry or mission-driven federal agencies.

Applied Research. The objective of applied research is to gain knowledge or understanding to meet a specific, recognized need. In industry, applied research includes investigations to discover new scientific knowledge that has specific commercial objectives with respect to products, processes, or services.

Development. Development is the systematic use of the knowledge or understanding gained from research directed toward the production of useful materials, devices, systems, or methods, including the design and development of prototypes and processes.

The President's FY2016 Budget Request

On February 2, 2015, President Obama released his proposed FY2016 budget. This report provides government-wide, multi-agency, and individual agency analyses of the President's FY2016 request as it relates to R&D and related activities. The President's budget proposes $145.694 billion for R&D in FY2016, an increase of $7.625 billion (5.5%) over the estimated FY2015 R&D funding level of $138.069 billion.[1] Adjusted for anticipated inflation of approximately 1.6%, the President's FY2016 R&D request represents a real increase of 3.9% from the FY2015 estimated level.[2]

Increasing federal funding for physical science and engineering research was a primary science and technology policy effort pursued by Congress, President George W. Bush, and President Obama in his first four years in office. Referred to frequently as the "doubling effort," Congress and Presidents Obama and Bush sought to increase support for the physical sciences and engineering by doubling funding for accounts at three federal agencies with a strong R&D emphasis in these disciplines: the Department of Energy (DOE) Office of Science, the National Science Foundation (NSF), and the Department of Commerce (DOC) National Institute of Standards and Technology (NIST) core laboratory research and construction of research facilities (collectively referred to as the "targeted accounts"). The doubling goal was expressed in President Bush's American Competitiveness Initiative, in budget requests from President Obama before FY2014, and implicitly in the America COMPETES Act (P.L. 110-69) and the America COMPETES Reauthorization Act of 2010 (P.L. 111-358). The America COMPETES Act and the reauthorization act set appropriations authorization levels consistent with a doubling pace of 7 years and 11 years, respectively.[3] In aggregate, appropriations provided to these accounts fell short of the levels authorized in P.L. 110-69 and P.L. 111-358.

In his FY2015 budget, the President requested a 1.2% increase in aggregate funding for the targeted accounts, a pace that would require more than 58 years to double. Though not explicitly mentioning the doubling goal or timeframe, in his FY2016 budget, the President is requesting a 5.7% increase in aggregate funding for the targeted accounts over the FY2015 level, a pace that would result in doubling in about 12 years. See "Efforts to Double Certain R&D Accounts" below for more details.

[1] Funding levels included in this document are in current dollars unless otherwise noted. Inflation diminishes the purchasing power of federal R&D funds, so an increase that falls short of the inflation rate may reduce real purchasing power. Final FY2015 funding for the Department of Homeland Security had not been enacted at the time of the President's proposed FY2016 budget. Therefore, the Office of Management and Budget used the President's FY2015 budget request for DHS in estimates of FY2015 funding.

[2] As calculated by CRS using the GDP (chained) price index for FY2015 and FY2016 in Table 10.1, Gross Domestic Product and Deflators Used in the Historical Tables: 1940–2020, *Budget of the United States Government, Fiscal Year 2016*, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/hist10z1.xls.

[3] As used in this report, the term "doubling pace" means the number of years required for funding for the targeted accounts to double, relative to the FY2006 baseline year, if the compound annual growth rate (CAGR) were to continue. For example, the doubling pace of the America COMPETES Act is based on the 10.3% CAGR from FY2006 to FY2010, the last year of authorizations under the act. At 10.3% annual growth, funding for the targeted accounts would double in approximately 7 years. Similarly, the CAGR for the America COMPETES Reauthorization Act of 2010, which authorized appropriations through FY2013, was 6.3%, a rate that would take approximately 11 years to double.

More broadly, in a 2009 speech before members of the National Academy of Sciences, President Obama put forth a goal of increasing the national (public and private) investment in R&D to more than 3% of the U.S. gross domestic product (GDP). President Obama did not provide details on how this goal might be achieved (e.g., through increases in direct federal R&D funding or through indirect mechanisms such as the research and experimentation (R&E) tax credit).[4] When President Obama set forth the goal in 2009, total U.S. R&D expenditures were approximately 2.90% of GDP. In 2012, R&D as a percentage of GDP was 2.89%, with the federal government contributing 0.86% (down from 0.91% in 2009) and non-federal sources contributing 2.02% (up from 1.98% in 2009).[5] Achieving the 3% goal would likely require a substantial increase in government and corporate R&D spending. In 2012, achieving the 3% goal would have required approximately $18 billion in additional R&D funding above the actual U.S. R&D funding level of $452.6 billion.

Analysis of federal R&D funding is complicated by several factors, such as inconsistency among agencies in the reporting of R&D and the inclusion of R&D activities in accounts with non-R&D activities. As a result, figures reported by OMB and the White House Office of Science and Technology Policy (OSTP), including those shown in **Table 1**, may differ from the agency budget analyses that appear later in this report.

Federal R&D Funding Perspectives

Federal R&D funding can be analyzed from a variety of perspectives that provide different insights. The following sections examine the data by agency, by the character of the work supported, by a combination of these two perspectives, and by whether R&D is defense-related or not.

Federal R&D by Agency

Congress makes decisions about federal R&D funding through the authorization and appropriations process primarily from the perspective of individual agencies and programs. **Table 1** provides data on R&D by agency for FY2014 (actual), FY2015 (estimate), and FY2016 (request).[6]

Under President Obama's FY2016 budget request, seven federal agencies would receive more than 95% of total federal R&D funding: the Department of Defense (DOD), 49.5%; Department of Health and Human Services (HHS) (primarily the National Institutes of Health (NIH)), 21.3%; Department of Energy (DOE), 8.6%; National Aeronautics and Space Administration (NASA), 8.4%; National Science Foundation (NSF), 4.3%; Department of Agriculture (USDA), 2.0%; and Department of Commerce (DOC), 1.5%. This report provides an analysis of the R&D budget

[4] The research and experimentation tax credit is frequently referred to as the research and development tax credit or R&D tax credit, through the credit does not apply to development expenditures. For additional information about the R&E tax credit, see CRS Report RL31181, *Research Tax Credit: Current Law and Policy Issues for the 114th Congress*, by Gary Guenther.

[5] National Science Foundation, National Center for Science and Engineering Statistics, *National Patterns of R&D Resources* (annual series).

[6] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2016,* February 2015, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/ap_19_research.pdf.

requests for these agencies, as well as for the Department of Homeland Security (DHS), Department of the Interior (DOI), Department of Transportation (DOT), Department of Veterans Affairs (VA), and Environmental Protection Agency (EPA). In total, these 12 agencies accounted for more than 98% of current and requested federal R&D funding.

The largest agency R&D increases in the President's FY2016 request (as measured in dollars), compared with FY2015, are for DOD, $4.670 billion (6.9%); DOE, $861 million (7.3%); DOC, $601 million (39.4%); HHS, $565 million (1.9%); USDA, $438 million (17.9%); and NSF, $310 million (5.2%). DHS would see a decrease of $463 million (44.9%).

Table 1. Federal Research and Development Funding by Agency, FY2014-FY2016

(budget authority, dollar amounts in millions)

				Change, FY2015-FY2016	
Department/Agency	**FY2014 Actual**	**FY2015 Estimate**	**FY2016 Request**	**Dollar**	**Percent**
Department of Defense	$66,018	$67,451	$72,121	$4,670	6.9%
Department of Health and Human Services	30,685	30,475	31,040	565	1.9%
Department of Energy	11,996	11,736	12,597	861	7.3%
National Aeronautics and Space Administration	11,906	12,145	12,238	93	0.8%
National Science Foundation	5,827	5,999	6,309	310	5.2%
Department of Agriculture	2,380	2,446	2,884	438	17.9%
Department of Commerce	1,556	1,526	2,127	601	39.4%
Department of Veterans Affairs	1,101	1,090	1,147	57	5.2%
Department of Transportation	853	900	1,115	215	23.9%
Department of the Interior	840	904	985	81	9.0%
Department of Homeland Security	1,032	1,032[a]	569	-463	-44.9%
Environmental Protection Agency	539	523	559	36	6.9%
Other	1,602	1,842	2,003	161	8.7%
Total	**136,335**	**138,069**	**145,694**	**7,625**	**5.5%**

Source: EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2016,* February 2015, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/ap_19_research.pdf.

Note: Totals may differ from the sum of the components due to rounding. Amounts in this table may differ from amounts reported in the agency chapters of this report due to a variety of factors, including R&D funding in accounts that also include funding for non-R&D activities.

a. Because DHS appropriations had not been enacted at the time the President's FY2016 budget request was released, the Administration's figure for FY2015 DHS R&D funding was based on the FY2014 appropriations not the FY2015 appropriation that was subsequently enacted.

Federal R&D by Character of Work, Facilities, and Equipment

Federal R&D funding can also be examined by the character of work it supports—basic research, applied research, or development—and by funding provided for construction of R&D facilities and acquisition of major R&D equipment. (See **Table 2**.) President Obama's FY2016 request includes $32.728 billion for basic research, up $831 million (2.6%) from FY2015; $34.146 billion for applied research, up $1.235 million (3.8%); $75.976 billion for development, up $5.294 million (7.5%); and $2.844 billion for facilities and equipment, up $265 million (10.3%).

Table 2. Federal R&D Funding by Character of Work and Facilities and Equipment, FY2014-FY2016

(budget authority, dollar amounts in millions)

				Change, FY2015-FY2016	
	FY2014 Actual	FY2015 Estimate	FY2016 Request	Dollar	Percent
Basic research	$32,187	$31,897	$32,728	$ 831	2.6%
Applied research	32,546	32,911	34,146	1,235	3.8%
Development	68,985	70,682	75,976	5,294	7.5%
Facilities and Equipment	2,617	2,579	2,844	265	10.3%
Total	**136,335**	**138,069**	**145,694**	**7,625**	**5.5%**

Source: EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2016,* February 2015, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/ap_19_research.pdf.

Note: Totals may differ from the sum of the components due to rounding.

Federal Role in U.S. R&D by Character of Work

A primary policy foundation for public investments in basic research and for incentives (e.g., tax credits) for the private sector to conduct research is the view, widely held by economists, that the private sector will, left on its own, underinvest in basic research from a societal perspective. The usual argument for this view is that the social returns (i.e., the benefits to society at large) exceed the private returns (i.e., the benefits accruing to the private investor, such as increased revenues or higher stock value). Other factors that may inhibit corporate investment in basic research include long time horizons for commercial applications (diminishing the potential returns due to the time value of money), high levels of technical risk/uncertainty, shareholder demands for shorter-term returns, and asymmetric and imperfect information.

The federal government is the nation's largest supporter of basic research, funding 52.6% of U.S. basic research in 2012.[7] Industry funded 21.3% of U.S. basic research in 2012, with state governments, universities, and other non-profit organizations funding the remaining 26.0%.[8]

[7] National Science Foundation, National Center for Science and Engineering Statistics, 2013, *National Patterns of R&D Resources: 2011–12 Data Update*, NSF 14-304, http://www.nsf.gov/statistics/nsf14304/. More recent data are not yet available.

[8] Ibid.

In contrast to basic research, industry is the primary funder of applied research in the United States, accounting for an estimated 54.0% in 2012, while the federal government accounted for an estimated 36.2%.[9]

Industry also provides the vast majority of funding for development. Industry accounted for 76.4% of development in 2012, while the federal government provided 22.1%.[10]

Federal R&D by Agency and Character of Work Combined

Combining these perspectives, federal R&D funding can be viewed in terms of each agency's contribution to basic research, applied research, development, and facilities and equipment. (See **Table 3**.) The overall federal R&D budget reflects a wide range of national priorities, including supporting advances in spaceflight, developing new and affordable sources of energy, and understanding and deterring terrorist groups. These priorities and the mission of each individual agency contribute to the composition of that agency's R&D spending (i.e., the allocation among basic research, applied research, development, and facilities and equipment). In the President's FY2016 budget request, the Department of Health and Human Services, primarily NIH, would account for nearly half (48.8%) of all federal funding for basic research. HHS would also be the largest federal funder of applied research, accounting for about 43.5% of all federally funded applied research in the President's FY2016 budget request. DOD is the primary federal funder of development, accounting for 85.6% of total federal development funding in the President's FY2016 budget request.[11]

Table 3. Top R&D Funding Agencies by Character of Work, Facilities, and Equipment, FY2014-FY2016

(budget authority, dollar amounts in millions)

	FY2014 Actual	FY2015 Enacted	FY2016 Request	Change, FY2015-FY2016	
				Dollar	Percent
Basic Research					
Dept. of Health and Human Services	15,862	15,482	15,966	484	3.1%
National Science Foundation	4,752	4,834	5,062	228	4.7%
Dept. of Energy	4,095	4,120	4,245	125	3.0%
Applied Research					
Dept. of Health and Human Services	14,621	14,791	14,864	73	0.5%
Dept. of Defense	4,664	4,775	4,819	44	0.9%
Dept. of Energy	4,550	4,363	4,683	320	7.3%
Development					
Dept. of Defense	58,986	60,366	65,036	4,670	7.7%
NASA	6,004	6,481	6,423	-58	-0.9%

[9] Ibid.

[10] Ibid.

[11] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2015,* Table 21-1.

	FY2014 Actual	FY2015 Enacted	FY2016 Request	Change, FY2015-FY2016	
				Dollar	Percent
Dept. of Energy	2,559	2,322	2,621	299	12.9%
Facilities and Equipment					
Dept. of Energy	792	931	1,048	117	12.6%
National Science Foundation	397	437	445	8	1.8%
Dept. of Commerce	213	233	402	169	72.5%

Source: EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2016,* February 2015, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/ap_19_research.pdf.

Note: The top three funding agencies in each category, based on the FY2016 request, are listed.

Defense-Related and Nondefense-Related R&D

Federal R&D funding can also be characterized as defense-related or nondefense-related. Defense-related R&D is provided for primarily by the Department of Defense, but also includes some activities at the Department of Energy and the Federal Bureau of Investigation. Defense-related R&D has fluctuated between 50% and 70% of total federal R&D funding for more than three decades. Defense-related R&D grew from 52.7% of total federal R&D funding in FY2001 to 60.5% in FY2008, then declined over several years to 56.8% in 2012.[12] The President's FY2016 budget includes $76.9 billion in defense-related R&D funding (about 52.8% of the total R&D request) and $68.8 billion for non-defense R&D (about 47.2% of the total R&D request).[13]

Multiagency R&D Initiatives

Although this report focuses primarily on the R&D activities of individual agencies, President Obama's FY2016 budget request supports several multiagency R&D initiatives.

Efforts to Double Certain R&D Accounts[14]

In 2006, President Bush announced the American Competitiveness Initiative (ACI) which, in part, sought to increase federal funding for physical sciences and engineering research by doubling funding over 10 years (by FY2016 from their FY2006 levels) for targeted accounts at NSF, DOE, and DOC. The targeted accounts include all NSF accounts, the DOE Office of Science, and the NIST Scientific and Technical Research and Services (STRS) and construction of research facilities (CRF) accounts.

[12] CRS analysis of National Science Board, *Science and Engineering Indicators 2014*, NSB 14-01, 2014, Appendix table 4-33, http://www.nsf.gov/statistics/seind14/.

[13] John P. Holdren, Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy, "The 2016 Budget: Investing in America's Future," presentation at the American Association for the Advancement of Science, Washington, DC, February 2015.

[14] For more information, see CRS Report R41951, *An Analysis of Efforts to Double Federal Funding for Physical Sciences and Engineering Research*, by John F. Sargent Jr.

In 2007, Congress authorized substantial increases for these targeted accounts under the America COMPETES Act (P.L. 110-69), which set the combined authorization levels for these accounts for FY2008 to FY2010 at a seven-year doubling pace from the FY2006 baseline. However, funding provided for these agencies in the Consolidated Appropriations Act, 2008 (P.L. 110-161), the Omnibus Appropriations Act, 2009 (P.L. 111-8), and the Consolidated Appropriations Act, 2010 (P.L. 111-117), fell below these targets.[15] (See **Table 4**.)

Table 4. Funding for Accounts Targeted for Doubling, FY2006-FY2016

(budget authority, in millions of current dollars)

	FY2006 Actual	FY2007 Actual	FY2008 Actual	FY2009 Actual[a]	FY2009 ARRA	FY2010 Actual
NSF	$5,646	$5,884	$6,084	$6,469	$2,402	$6,972
DOE/Office of Science	3,632	3,837	4,083	4,807	1,633	4,964
NIST/STRS	395	434	441	472	220	515
NIST/CRF	174	59	161	172	360	147
Total	**9,846**	**10,214**	**10,768**	**11,920**	**4,615**	**12,598**

	FY2011 Actual	FY2012 Actual	FY2013 Actual	FY2014 Actual	FY2015 Actual	FY2016 Request
NSF	$6,913[b]	$7,033	$6,884	$7,172	$7,344	$7,724
DOE/Office of Science	4,843	4,874	4,681	5,071	5,071	5,340
NIST/STRS	497	567	580	651	651	755
NIST/CRF	70	55	56	56	59	59
Total	**12,323**	**12,529**	**12,201**	**12,950**	**13,125**	**13,877**

Sources: NIST budget requests, FY2008-FY2016, available at http://www.nist.gov/public_affairs/budget/index.cfm; DOE budget requests, FY2008-FY2016, available at http://www.cfo.doe.gov/crorgcf30.htm; NSF budget requests, FY2008-FY2016, available at http://www.nsf.gov/about/budget; and the President's FY2016 budget, available at http://www.whitehouse.gov/omb/budget/Appendix.

Notes: Totals may differ from the sum of the components due to rounding.

a. The FY2009 agency funding levels do not include funding provided by the American Recovery and Reinvestment Act of 2009 (ARRA, P.L. 111-5).

b. Includes $54 million transferred to the U.S. Coast Guard for icebreaking services (per P.L. 112-10).

In 2010, Congress passed the America COMPETES Reauthorization Act of 2010 (P.L. 111-358) which, among other things, authorized appropriations for the targeted accounts for FY2011 to FY2013.[16] The aggregate authorization levels for the targeted accounts in this act were consistent

[15] In 2009, the American Recovery and Reinvestment Act of 2009 (P.L. 111-5) provided $5.202 billion in supplemental funding for several of the targeted accounts. This increased aggregate funding for the accounts above the target levels in that year.

[16] For more information, see CRS Report R41231, *America COMPETES Reauthorization Act of 2010 (H.R. 5116) and the America COMPETES Act (P.L. 110-69): Selected Policy Issues*, coordinated by Heather B. Gonzalez.

with an 11-year doubling path. Congress has not authorized appropriations for the targeted accounts beyond FY2013.[17]

Aggregate FY2013 funding subsequently appropriated for the targeted accounts was approximately $12.201 billion, $2.904 billion less than authorized in the act. This funding level set a pace to double over more than 22 years from the FY2006 level—more than triple the length of time originally envisioned in the 2007 America COMPETES Act and about twice as long as the doubling period established by the America COMPETES Reauthorization Act of 2010. Using the FY2006 as the base year funding level, FY2014 appropriations set a 20-year doubling pace while FY2015 appropriations set a 22-year pace.

Budget constraints appear to have put the future of the doubling path in question. In his FY2010 *Plan for Science and Innovation,* President Obama stated that he, like President Bush, would seek to double funding for basic research over 10 years (FY2006 to FY2016) in the targeted accounts.[18] In his FY2011 budget documents, President Obama extended the period over which he intended to double funding for the targeted accounts to 11 years (FY2006 to FY2017).[19] The FY2013 budget request reiterated President Obama's intention to double funding for the targeted accounts from their FY2006 levels but did not specify the length of time over which the doubling was to take place. President Obama's FY2014 budget expressed a commitment to increasing funding for the targeted accounts, but did not commit to doubling. The President's FY2015 budget contained no explicit statement of commitment to increasing funding for the targeted accounts. For FY2016, President Obama is requesting $13.877 billion in aggregate funding for the targeted accounts, an increase of $752 million (5.7%) above the estimated FY2015 aggregate funding level of $13.125 billion. If enacted, this funding level would set a doubling pace of about 20 years over the FY2006 level.

Figure 1 shows total funding for the targeted accounts as a percentage of their FY2006 funding level, and illustrates how actual (FY2006-FY2015), requested (FY2007-FY2016), and authorized appropriations (FY2008-FY2013) compare to different doubling rates using FY2006 as the base year. The thick black line at the top of the chart is at 200%, the doubling level. The data used in **Figure 1** are in current dollars, not constant dollars; the effect of inflation on the purchasing power of these funds is not taken into consideration.

Some analysts have raised questions about the efficacy and unintended consequences of the doubling policy. Among the questions: What is the basis for asserting that a doubling of funding is the correct target for increases (as opposed to, say, an increase of 30%, 80%, or 120%)? What is the basis for setting the time period for doubling (e.g., 7 years, 11 years)? Is the optimal approach to double funding for specific agencies? If so, should the doubling for the selected agencies be done in aggregate or individually? Are the chosen agencies the right agencies? Should specific programs or appropriations accounts be targeted rather than entire agencies? What are the adjustment costs of a post-doubling slowdown in funding increases?

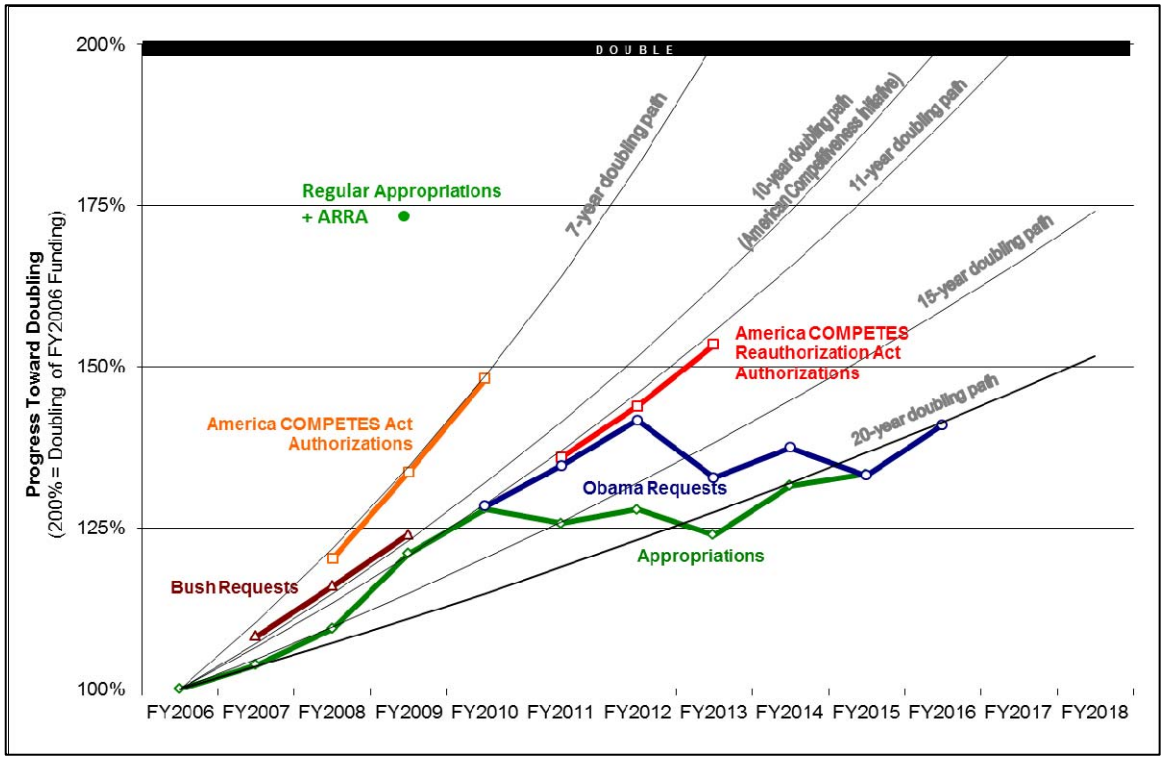
[17] For additional information on reauthorization efforts, see CRS Report R43880, *The America COMPETES Acts: An Overview*, by Heather B. Gonzalez.

[18] EOP, OSTP, *The President's Plan for Science and Innovation: Doubling Funding for Key Basic Research Agencies in the 2010 Budget*, May 7, 2009, http://www.whitehouse.gov/files/documents/ostp/budget/doubling.pdf.

[19] EOP, OSTP, *The President's Plan for Science and Innovation: Doubling Funding for Key Basic Research Agencies in the 2011 Budget*, February 1, 2010, http://www.whitehouse.gov/sites/default/files/doubling%2011%20final.pdf.

In an effort to understand the potential consequence of the doubling effort, a 2009 National Bureau of Economic Research paper analyzed the effects of the NIH doubling (which took place from 1988 to 2003) and subsequent funding slowdown on the U.S. biomedical research enterprise. Among its conclusions, the authors found that "future increases in research spending should be seen in terms of increasing the stock of sustainable activity rather than in attaining some arbitrary target (i.e., doubling) in a short period."[20] Similar views were expressed by participants at a roundtable held by the House Committee on Energy and Commerce in 2014.[21]

Figure 1. Funding for Accounts Targeted for Doubling: Appropriations, Authorizations, and Requests versus Selected Doubling Rates



Sources: Prepared by CRS based on data from the Office of Management and Budget and agency budget justifications for FY2008 to FY2016 and agency authorization levels from the America COMPETES Act (P.L. 110-69) and the America COMPETES Reauthorization Act of 2010 (P.L. 111-358).

Notes: The 7-year doubling pace represents annual increases of 10.4%, the 10-year doubling pace represents annual increases of 7.2%, the 11-year doubling pace represents annual increases of 6.5%, the 15-year doubling pace represents annual increases of 4.7%, and the 20-year doubling pace represents annual increases of 3.3%. Through compounding, these rates would achieve the doubling of funding in the specified time period. The lines connecting aggregate appropriations, authorizations, and requests for the targeted accounts are for clarification purposes only.

[20] Richard Freeman and John Van Reenen, "What if Congress Doubled R&D Spending on the Physical," *Innovation Policy and the Economy*, vol. 9 (February 2009), p. 28.

[21] A video of the "21st Century Cures Roundtable," held on May 6, 2014, is available at http://energycommerce.house.gov/event/21st-century-cures-roundtable.

National Nanotechnology Initiative[22]

Launched by President Clinton in his FY2001 budget request, the National Nanotechnology Initiative (NNI) is a multiagency R&D initiative to advance understanding and control of matter at the nanoscale, where the physical, chemical, and biological properties of materials differ in fundamental and useful ways from the properties of individual atoms or bulk matter.[23] Federal nanotechnology efforts are coordinated by the National Science and Technology Council (NSTC) Subcommittee on Nanoscale Science, Engineering, and Technology (NSET).

The President's request for NNI R&D funding for FY2016 is $1.495 billion. This is $7.5 million (0.5%) above the FY2015 funding level of $1.495 billion. (See **Table 5**.)

Table 5. National Nanotechnology Initiative Funding, FY2014-FY2016

(budget authority, in millions of current dollars)

FY2014 Actual	FY2015 Estimate	FY2016 Request	Change, FY2015-FY2016	
			Dollar	Percent
$1,574.3	$1,487.8	$1,495.3	$7.5	0.5%

Source: Nanoscale Science, Engineering, and Technology Committee, National Science and Technology Council, The White House, *Supplement to the President's Budget for Fiscal Year 2016, The National Nanotechnology Initiative: Research and Development Leading to a Revolution in Technology and Industry*, March 11, 2015.

Networking and Information Technology Research and Development Program[24]

Established by the High-Performance Computing Act of 1991 (P.L. 102-194), the Networking and Information Technology Research and Development (NITRD) program is the primary mechanism by which the federal government coordinates its unclassified networking and information technology R&D investments in areas such as supercomputing, high-speed networking, cybersecurity, software engineering, and information management.

President Obama is requesting $4.091 billion in FY2016 for the NITRD program. (See **Table 6**.) This is $123.5 million (3.1%) above the FY2015 funding level. The largest agency increases in NITRD funding under the Administration's FY2016 request are for the DOE ($65.1 million, 10.3%) and NSF ($31.0 million, 2.6%). The President's budget would reduce NITRD funding at DOD by $10.0 million (1.4%), DHS by $6.1 million (7.7%), and the Agency for Healthcare Research and Quality (part of HHS) by $5.3 million (18.8%).[25]

[22] For additional information on the NNI, see CRS Report RL34401, *The National Nanotechnology Initiative: Overview, Reauthorization, and Appropriations Issues*, by John F. Sargent Jr.

[23] In the context of the NNI and nanotechnology, the nanoscale refers to lengths of 1 to 100 nanometers. A nanometer is one-billionth of a meter, or about the width of 10 hydrogen atoms arranged side by side in a line.

[24] For additional information on the NITRD program, see CRS Report RL33586, *The Federal Networking and Information Technology Research and Development Program: Background, Funding, and Activities*, by Patricia Moloney Figliola.

[25] EOP, NSTC, Committee on Technology, Subcommittee on Networking and Information Technology Research and (continued...)

Table 6. Networking and Information Technology Research and Development Program Funding, FY2014-FY2016

(budget authority, in millions of current dollars)

FY2014 Actual	FY2015 Estimate	FY2016 Request	Change, FY2015-FY2016	
			Dollar	Percent
$3,885.6	$3,967.1	$4,090.6	$123.5	3.1%

Source: EOP, NSTC, Committee on Technology, Subcommittee on Networking and Information Technology Research and Development, *Supplement to the President's FY2016 Budget for Fiscal Year 2016, The Networking and Information Technology Research and Development Program*, pp. 6-7, February 2015, https://www.nitrd.gov/pubs/2016supplement/FY2016NITRDSupplement.pdf.

U.S. Global Change Research Program[26]

The U.S. Global Change Research Program (USGCRP) coordinates and integrates federal research and applications to understand, assess, predict, and respond to human-induced and natural processes of global change. The program seeks to advance global climate change science and to "build a knowledge base that informs human responses to climate and global change through coordinated and integrated Federal programs of research, education, communication, and decision support."[27] Thirteen departments and agencies participate in the USGCRP.

The President's request for USGCRP funding for FY2016 and USGCRP funding data for FY2014 (actual) and FY2015 (estimate) were not available at the time of publication of this report.

BRAIN Initiative

In April 2013, President Obama launched the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, asserting that

> There is this enormous mystery waiting to be unlocked, and the BRAIN Initiative will change that by giving scientists the tools they need to get a dynamic picture of the brain in action and better understand how we think and how we learn and how we remember. And that knowledge could be—will be—transformative.[28]

Among the agencies participating in the BRAIN Initiative are the Defense Advanced Research Projects Agency (DARPA), NIH, NSF, and the Food and Drug Administration (FDA). The

(...continued)

Development, *Supplement to the President's FY2016 Budget for Fiscal Year 2016, The Networking and Information Technology Research and Development Program*, pp. 6-7, February 2015, https://www.nitrd.gov/pubs/2016supplement/FY2016NITRDSupplement.pdf.

[26] For additional information on the USGCRP, see CRS Report R43227, *Federal Climate Change Funding from FY2008 to FY2014*, by Jane A. Leggett, Richard K. Lattanzio, and Emily Bruner.

[27] U.S. Global Change Research Program website, http://www.globalchange.gov/about/mission-vision-strategic-plan.

[28] The White House, "Remarks by the President on the BRAIN Initiative and American Innovation," speech transcript, April 2013, http://www.whitehouse.gov/photos-and-video/video/2013/04/02/president-obama-speaks-brain-initiative-and-american-innovation#transcript.

research supported under this initiative seeks to facilitate a better understanding of "how the brain records, processes, uses, stores, and retrieves vast quantities of information, and shed light on the complex links between brain function and behavior,"[29] and to help improve the prevention, diagnosis, and treatment of brain diseases such as Parkinson's and Alzheimer's.

According to OSTP, federal investments in the BRAIN initiative totaled approximately $100 million in FY2014 and $200 million in FY2015. The President's FY2016 budget request includes more than $300 million for the effort, including $135 million in funding for NIH, $95 million from DARPA, and $72 million from NSF.[30] In addition, the Intelligence Advanced Research Projects Activity (IARPA) and the FDA are expected to make contributions to the BRAIN Initiative in FY2016.[31]

Precision Medicine Initiative

In his January 2015 State of the Union address, President Obama announced the Precision Medicine Initiative (PMI), a new undertaking among HHS agencies, proposing $215 million in FY2016 funding. The PMI seeks to build on research and discoveries that allow medical treatments to be tailored to an individual's unique characteristics (e.g., a patient's genes) or the genetic profile of an individual's tumor.

The President's FY2016 request for the PMI includes $130 million for NIH, $70 million for the National Cancer Institute (NCI), $10 million for FDA, and $5 million for the Office of the National Coordinator for Health Information Technology (ONC). NIH funding would support the development of a voluntary national research cohort of a million or more people to provide insights into health and disease. NCI funding would support the identification of genetic drivers in cancer and the application of that knowledge in the development of cancer treatments. FDA funding would support the development of databases to support the regulatory structure needed to advance innovation in precision medicine. ONC funding would support the development of interoperability standards and requirements to address privacy and enable secure exchange of data across systems. [32]

Materials Genome Initiative

Announced in June 2011 by President Obama, the Materials Genome Initiative (MGI) is a multi-agency initiative

> to create new knowledge, tools, and infrastructure with a goal of enabling U.S. industries to discover, manufacture, and deploy advanced materials twice as fast than is possible today. Agencies are currently developing implementation strategies for the Materials Genome

[29] The White House, "Fact Sheet: BRAIN Initiative," press release, April 2, 2013, http://www.whitehouse.gov/the-press-office/2013/04/02/fact-sheet-brain-initiative.

[30] EOP, OSTP, "Obama Administration Proposes Doubling Support for The Brain Initiative," press release, March 2014, http://www.whitehouse.gov/sites/default/files/microsites/ostp/FY%202015%20BRAIN.pdf.

[31] EOP, OSTP, "Obama Administration Proposes Over $300 Million in Funding for The BRAIN Initiative," fact sheet, February 2015, http://www.whitehouse.gov/sites/default/files/microsites/ostp/brain_initiative_fy16_fact_sheet_ostp.pdf.

[32] The White House, "Fact Sheet: President Obama's Precision Medicine Initiative," press release, January 30, 2015, http://www.whitehouse.gov/the-press-office/2015/01/30/fact-sheet-president-obama-s-precision-medicine-initiative.

> Initiative with a focus on: (1) the creation of a materials innovation infrastructure, (2) achieving national goals with advanced materials, and (3) equipping the next generation materials workforce.[33]

In congressional testimony, OSTP Director John Holdren stated that the purpose of the Materials Genome Initiative is to "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" in much the same way that the Human Genome Project accelerated a range of biological sciences by identifying and deciphering the human genetic code.[34] Such research may contribute to the identification of substitutes for critical minerals that are in short supply or have at-risk supply chains; the design, development, and use of materials that could reduce the number and severity of traumatic brain injuries resulting from blasts, impacts, and collisions incurred in military engagements, motor vehicle accidents, and athletics; and the development of new lightweight materials for vehicles that could enable new energy storage and propulsion systems and improve fuel efficiency.[35] The White House asserts that

> Since the launch of MGI in 2011, the Federal government has invested over $250 million in new R&D and innovation infrastructure to anchor the use of advanced materials in existing and emerging industrial sectors in the United States.[36]

Neither the President's FY2015 budget nor his FY2016 budget included a table of agency funding for the MGI. The NSTC Subcommittee on the Materials Genome Initiative (SMGI) coordinates the initiative's activities. Among the agencies participating in MGI R&D are DOE, DOD, U.S. Geological Survey, NSF, NIST, NASA, NIH, and NSF. MGI also coordinates its efforts with two other multiagency initiatives, the NNI and NITRD. [37]

Advanced Manufacturing Partnership

In June 2011, President Obama launched the Advanced Manufacturing Partnership (AMP), an effort to bring together "industry, universities, and the Federal government to invest in emerging technologies that will create high-quality manufacturing jobs and enhance our global competitiveness."[38] Two R&D-focused components of the AMP are the National Robotics Initiative (NRI) and the National Network for Manufacturing Innovation (NNMI).

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[33] Email correspondence between OSTP and CRS, March 14, 2012.

[34] John P. Holdren, Director, OSTP, EOP, testimony before the Senate Committee on Commerce, Science, and Transportation, Subcommittee on Science and Space, hearing on "Keeping America Competitive Through Investments in R&D," March 6, 2012, http://commerce.senate.gov/public/?a=Files.Serve&File_id=fed566eb-e2c8-49da-aec5-f84e4045890b.

[35] The White House, Materials Genome Initiative, "Examples of Materials Applications," accessed May 2014, http://www.whitehouse.gov/mgi/examples.

[36] The White House, Materials Genome Initiative, accessed February 27, 2015, http://www.whitehouse.gov/mgi.

[37] NSTC, Committee on Technology, SMGI, "Materials Genome Initiative Strategic Plan," December 2014, http://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/mgi_strategic_plan_-_dec_2014.pdf.

[38] John P. Holdren, Director, OSTP, EOP, testimony before the Senate Committee on Commerce, Science, and Transportation, Subcommittee on Science and Space, hearing on "Keeping America Competitive Through Investments in R&D," March 6, 2012, http://commerce.senate.gov/public/?a=Files.Serve&File_id=fed566eb-e2c8-49da-aec5-f84e4045890b.

National Robotics Initiative

The National Robotics Initiative seeks to "develop robots that work with or beside people to extend or augment human capabilities."[39] Among the goals of the program are increasing labor productivity in the manufacturing sector, assisting with dangerous and expensive missions in space, accelerating the discovery of new drugs, and improving food safety by rapidly sensing microbial contamination.[40]

In January 2015, several agencies—NSF, NIH, NASA, USDA, and DOD—announced a new round of funding for NRI efforts.[41] Neither the President's FY2015 nor his FY2016 budget included a table of agency funding for the NRI, but the *Analytical Perspectives* supplement to the President's FY2016 budget indicates support for initiative funding.[42]

National Network for Manufacturing Innovation[43]

President Obama first proposed the establishment of a National Network for Manufacturing Innovation in his FY2013 budget, which requested $1 billion to support the establishment of up to 15 institutes. The President also included proposals for establishing the NNMI in his FY2014, FY2015 and FY2016 budgets.

As originally conceived, the NNMI would consist of

> a network of institutes where researchers, companies, and entrepreneurs can come together to develop new manufacturing technologies with broad applications. Each institute would have a unique technology focus. These institutes will help support an ecosystem of manufacturing activity in local areas. The Manufacturing Innovation Institutes would support manufacturing technology commercialization by helping to bridge the gap from the laboratory to the market and address core gaps in scaling manufacturing process technologies.[44]

In the absence of explicit congressional authorization and appropriations for the NNMI, the Obama Administration competed and/or awarded eight institutes for manufacturing innovation using the broad agency authorities and appropriations of the DOD and DOE. The Administration has committed to establishing a ninth institute, but the focus area has not been identified.

In December 2014, Congress passed the Revitalize American Manufacturing and Innovation Act of 2014 (RAMIA), as Title VII of Division B of the Consolidated and Further Continuing Appropriations Act, 2015 (P.L. 113-235). President Obama signed the bill into law on December

[39] Ibid.

[40] EOP, OSTP, website, August 3, 2011, http://www.whitehouse.gov/blog/2011/08/03/supporting-president-s-national-robotics-initiative.

[41] National Science Foundation, "National Robotics Initiative (NRI): The realization of co-robots acting in direct support of individuals and groups," Program Solicitation NSF 15-505, January 2, 2015, http://www.nsf.gov/pubs/2015/nsf15505/nsf15505.htm.

[42] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2016*, pp. 293-294.

[43] For additional information on the NNMI, see CRS Report R42625, *The Obama Administration's Proposal to Establish a National Network for Manufacturing Innovation*, by John F. Sargent Jr., and CRS Report R43857, *The Network for Manufacturing Innovation*, by John F. Sargent Jr.

[44] DOC, *FY2014 Budget in Brief*, February 2012, p. 123, http://www.osec.doc.gov/bmi/budget/FY13BIB/fy2013bib_final.pdf.

16, 2014. RAMIA directs the Secretary of Commerce to establish a Network for Manufacturing Innovation (NMI) program within the Commerce Department's NIST.

The President's FY2016 budget proposes discretionary funding for seven additional centers—two each to be supported by USDA, DOE, and NIST, and one to be supported by DOD. In addition, the President's FY2016 budget includes a request for $1.9 billion in mandatory funding for NIST for the establishment of 29 additional centers between FY2017 and FY2024, which would bring the total number of centers to 45.

Reorganization of STEM Education Programs[45]

In FY2014, the Obama Administration proposed a major overhaul of the federal science, technology, engineering, and mathematics (STEM) education portfolio. That plan would have affected about 50% of the federal STEM education effort and involved the transfer of STEM education budget authority between federal agencies.

Although many legislators expressed conceptual support for reorganization as a means to improve the portfolio, the joint explanatory statement that accompanied the Consolidated Appropriations Act, 2014 (P.L. 113-76) rejected the proposal overall. It stated that the proposal "contained no clearly defined implementation plan, had no buy-in from the education community, and failed to sufficiently recognize or support a number of proven, successful programs." Some FY2014 House and Senate appropriations reports accepted some changes on a case-by-case basis. In a March 2014 progress report the Administration stated that the number of federal STEM education programs had been reduced by 40% between FY2012 (228 programs) and FY2014 (138 programs).

For FY2015, the Obama Administration proposed what it described as a "fresh" reorganization of the federal STEM education portfolio. Unlike the FY2014 proposal, which sought to transfer funding between agencies, the FY2015 proposal sought to consolidate funding within agencies. According to the Office of Management and Budget, the FY2015 reorganization would have consolidated or eliminated 31 programs at 9 agencies, affecting $145 million in FY2014 budget authority. The FY2015 budget request aimed to further reduce STEM education programs to 111 from their FY2014 level of 138.

The OSTP asserts that the President's FY2016 budget continues to reduce fragmentation.[46] Further government-wide details were not available at the time of publication of this report.

[45] For additional information on the reorganization of federal STEM education programs, see CRS Report R43880, *The America COMPETES Acts: An Overview* , by Heather B. Gonzalez; CRS In Focus IF00013, *The President's FY2015 Budget and STEM Education* (In Focus), by Heather B. Gonzalez; and CRS Report R42642, *Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer*, by Heather B. Gonzalez and Jeffrey J. Kuenzi.

[46] EOP, OMB, *Budget of the United States Government, Fiscal Year 2016, "*Cuts Consolidations, and Savings," p. 87, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/ccs.pdf.

FY2016 Appropriations Status

The remainder of this report provides a more in-depth analysis of R&D in 12 federal departments and agencies that, in aggregate, receive more than 98% of total federal R&D funding. Annual appropriations for these agencies are provided through 9 of the 12 regular appropriations bills. For each agency covered in this report, **Table 7** shows the corresponding regular appropriations bill that provides primary funding for the agency, including its R&D activities.

Because of the way that agencies report budget data to Congress, it can be difficult to identify the portion that is R&D. Consequently, R&D data presented in the agency analyses in this report may differ from R&D data provided by OMB.

Funding for R&D is often included in appropriations line items that also include non-R&D activities; therefore, it is not possible to identify precisely how much of the funding provided in appropriations laws is allocated to R&D specifically. In general, R&D funding levels are known only after departments and agencies allocate their appropriations to specific activities and report those figures.

In addition to this report, CRS produces individual reports on each of the appropriations bills. These reports can be accessed via the CRS website at http://crs.gov/Pages/clis.aspx?cliid=73. Also, the status of each appropriations bill is available on the CRS webpage, *Status Table of Appropriations*, available at http://crs.gov/Pages/AppropriationsStatusTable.aspx.

Table 7. Alignment of Agency R&D Funding and Regular Appropriations Bills

Department/Agency	Regular Appropriations Bill
Department of Defense	Department of Defense Appropriations Act
Department of Homeland Security	Department of Homeland Security Appropriations Act
Department of Health and Human Services - National Institutes of Health	Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriations Act
Department of Energy	Energy and Water Development and Related Agencies Appropriations Act
National Science Foundation	Commerce, Justice, Science, and Related Agencies Appropriations Act
Department of Commerce - National Institute of Standards and Technology - National Oceanic and Atmospheric Administration	Commerce, Justice, Science, and Related Agencies Appropriations Act
National Aeronautics and Space Administration	Commerce, Justice, Science, and Related Agencies Appropriations Act
Department of Agriculture	Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act
Department of the Interior	Department of the Interior, Environment, and Related Agencies Appropriations Act
Environmental Protection Agency	Department of the Interior, Environment, and Related Agencies Appropriations Act
Department of Transportation	Transportation, Housing and Urban Development, and Related Agencies Appropriations Act
Department of Veterans Affairs	Military Construction and Veterans Affairs, and Related Agencies Appropriations Act

Source: CRS website, FY2016 Status Table of Appropriations, available at http://crs.gov/Pages/AppropriationsStatusTable.aspx.

Department of Defense[47]

Congress supports R&D in the Department of Defense (DOD) primarily through its Research, Development, Test, and Evaluation (RDT&E) appropriation. The appropriation supports the development of the nation's future military hardware and software and the technology base upon which those products rely.

Nearly all of what DOD spends on RDT&E is appropriated in Title IV of the defense appropriation bill. (See **Table 8**.) However, RDT&E funds are also appropriated in other parts of the bill. For example, RDT&E funds are appropriated as part of the Defense Health Program, Chemical Agents and Munitions Destruction Program, and the National Defense Sealift Fund. The Defense Health Program (DHP) supports the delivery of health care to DOD personnel and their families. DHP funds (including the RDT&E funds) are requested through the Defensewide Operations and Maintenance appropriations request. The program's RDT&E funds support congressionally directed research in such areas as breast, prostate, and ovarian cancer and other medical conditions. Congress appropriates funds for this program in Title VI (Other Department of Defense Programs) of the defense appropriations bill. The Chemical Agents and Munitions Destruction Program supports activities to destroy the U.S. inventory of lethal chemical agents and munitions to avoid future risks and costs associated with storage. Funds for this program are requested through the Defensewide Procurement appropriations request. Congress appropriates funds for this program also in Title VI. The National Defense Sealift Fund supports the procurement, operation and maintenance, and research and development of the nation's naval reserve fleet and supports a U.S. flagged merchant fleet that can serve in time of need. The RDT&E funding for this effort is in the Navy's Procurement request and appropriated in Title V, Revolving and Management Funds, of the appropriation bill.

The Joint Improvised Explosive Device Defeat Fund (JIEDDF) also contains RDT&E monies. In contrast to the programs mentioned above, the fund does not contain an RDT&E line item. The Joint Improvised Explosive Device Defeat Office, which administers the fund, tracks (but does not report) the amount of funding allocated to RDT&E. The JIEDDF funding is not included in **Table 8**.

RDT&E funds also have been requested and appropriated as part of DOD's separate funding to support efforts in what the Bush Administration had termed the Global War on Terror (GWOT), and what the Obama Administration refers to as Overseas Contingency Operations (OCO). Typically, RDT&E funds appropriated for GWOT/OCO activities go to specified Program Elements (PEs) in Title IV. However, they are requested and accounted for separately. The Bush Administration made separate GWOT emergency supplemental requests. The Obama Administration, while continuing to identify these funds uniquely as OCO requests, has included these funds as part of the regular budget, not in emergency supplementals. However, the Obama Administration asks for additional OCO funds in supplemental requests, if the initial OCO funding is not enough to get through the fiscal year. The OCO budget is declining as operations in Iraq and Afghanistan are reduced. As the U.S. steps up its battle with the Islamic State of Iraq and Syria (ISIS), OCO funding will likely continue.

[47] This section was written by John Moteff, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

In addition, GWOT/OCO-related requests/appropriations often include money for a number of transfer funds. These have included in the past the Iraqi Freedom Fund (IFF), the Iraqi Security Forces Fund, the Afghanistan Security Forces Fund, and the Pakistan Counterinsurgency Capability Fund. Another transfer fund is the Mine Resistant and Ambush Protected Vehicle Fund (MRAPVF). Congress typically makes a single appropriation into each of these funds, and authorizes the Secretary to make transfers to other accounts, including RDT&E, at his discretion. These transfers are eventually reflected in Title IV prior year funding figures.

For FY2016, the Obama Administration is requesting $69.785 billion for DOD's baseline Title IV RDT&E. This is $6.101 billion above what was enacted for FY2015. It should be noted that the overall President's budget request does not stay within the caps of the Budget Control Act of 2011 (P.L. 112-25) as modified by the American Taxpayer Relief Act of 2012 (P.L. 112-240) and the Bipartisan Budget Act of 2012 (P.L. 113-67).

In addition to the baseline Title IV RDT&E request, the Administration is requesting $980 million in RDT&E through the Defense Health Program and $579 million in RDT&E through the Chemical Agents and Munitions Destruction program for FY2016. The Administration is requesting $25 million in RDT&E funding through the National Defense Sealift Fund for FY2016.

RDT&E funding can be analyzed by policymakers in different ways. Each of the military departments request and receive their own RDT&E funding. So, too, do various DOD agencies (e.g., the Missile Defense Agency and the Defense Advanced Research Projects Agency), collectively aggregated within the Defensewide account. RDT&E funding also can be characterized by budget activity (i.e., the type of RDT&E supported). Those budget activities designated as 6.1, 6.2, and 6.3 (basic research, applied research, and advanced technology development, respectively) constitute what is called DOD's Science and Technology Program (S&T) and represent the more research-oriented part of the RDT&E program. Budget activities 6.4 and 6.5 focus on the development of specific weapon systems or components (e.g., the Joint Strike Fighter or missile defense systems), for which an operational need has been determined and an acquisition program established. Budget activity 6.6 provides management support, including support for test and evaluation facilities. Budget activity 6.7 supports the development of system improvements in existing operational systems.

Many congressional policymakers are particularly interested in S&T funding since these funds support the development of new technologies and the underlying science. Some in the defense community see ensuring adequate support for S&T activities as imperative to maintaining U.S. military superiority into the future. The knowledge generated at this stage of development can also contribute to advances in commercial technologies.

The FY2016 Title IV baseline S&T funding request is $12.266 billion, $81 million more than what was enacted in FY2015.

Within the S&T program, basic research (6.1) receives special attention, particularly by the nation's universities. DOD is not a large supporter of basic research, when compared to NIH or NSF. However, over half of DOD's basic research budget is spent at universities and represents the major contribution of funds in some areas of science and technology (such as electrical engineering and material science). The Administration is requesting $2.089 billion for basic research for FY2016. This is $189 million less than what was enacted for FY2015.

Table 8. Department of Defense RDT&E

(in millions of dollars)

Budget Account	FY2015 Enacted		FY2016 Request		FY2016 House		FY2016 Senate		FY2016 Final	
	Base	OCO	Base	OCO	Base	OCO	Base	OCO	Base	OCO
Army	6,673	2	6,925	2						
Navy	15,955	36	17,886	36						
Air Force	23,630	15	26,474	17						
Defensewide	17,217	270[a]	18,330	137						
Dir. Test & Eval.	209		171							
Total Title IV—By Account[b]	**63,684**	**322**	**69,785**	**191**						
Budget Activity										
6.1 Basic Research	2,278		2,089							
6.2 Applied Research	4,603	45	4,713							
6.3 Advanced Tech. Dev.	5,304	23	5,464							
6.4 Advanced Component Dev. and Prototypes	12,472	19	14,402	2						
6.5 Systems Development and Demonstration	11,101	10	12,771							
6.6 Management Support[c]	4,396		4,185							
6.7 Op. Systems Dev.[d]	23,530	225	26,161	190						
Total Title IV—by Budget Activity[b]	**63,684**	**322**	**69,785**	**191**						
Title V—Revolving and Management Funds										
National Defense Sealift Fund	24		25							
Title VI—Other Defense Programs										
Defense Health Program	1,731		980							
Chemical Agents and Munitions Destruction	596		579							
Inspector General	1		5							
Grand Total[b]	**66,036**	**322**	**71,374**	**191**						

Source: CRS, adapted from the Department of Defense Budget, Fiscal Year 2016 RDT&E Programs (R-1), February 2015.

a. This figure includes $95 million for Ebola Response and Preparedness.

b. Numbers may not add due to rounding.

c. Includes funding for Director of Test and Evaluation.

d. Includes funding for Classified Programs.

Department of Homeland Security[48]

The Department of Homeland Security (DHS) has identified five core missions: to prevent terrorism and enhance security, to secure and manage the borders, to enforce and administer immigration laws, to safeguard and secure cyberspace, and to ensure resilience to disasters. New technology resulting from research and development can contribute to all these goals. The Directorate of Science and Technology (S&T) has primary responsibility for establishing, administering, and coordinating DHS R&D activities. The Domestic Nuclear Detection Office (DNDO) is responsible for R&D relating to nuclear and radiological threats. Other components, such as the U.S. Coast Guard, conduct R&D relating to their specific missions.

The President is requesting $1.154 billion in FY2016 for R&D and related programs in DHS. This is a 19.2% decrease from $1.430 billion in FY2015. The total includes $779 million for the S&T Directorate, $357 million for DNDO, and $18 million for Research, Development, Test, and Evaluation (RDT&E) in the U.S. Coast Guard. (See **Table 9**.)

The S&T Directorate is the primary DHS R&D organization.[49] Led by the Under Secretary for Science and Technology, it performs R&D in several laboratories of its own and funds R&D performed by the DOE national laboratories, industry, universities, and others. It also conducts testing and other technology-related activities in support of acquisitions by other DHS components. The Administration's request of $779 million for the S&T Directorate in FY2016 is 29.4% less than the FY2015 appropriation of $1.104 billion. Most of the difference results from a lower request for Laboratory Facilities, which received $300 million in FY2015 for construction of the National Bio and Agro-Defense Facility (NBAF). No further funds for NBAF construction are requested in FY2016. Within the request for Research, Development, and Innovation (RD&I), support for Apex projects would increase to $78 million in FY2016.[50] Apex projects are multidisciplinary projects agreed to between the S&T Directorate and the head of another DHS component. The FY2016 request would support six Apex projects in addition to the previous two. It would also establish a crosscutting "technology engines" activity within the Apex program.

DNDO is the DHS organization responsible for nuclear detection research, development, testing, evaluation, acquisition, and operational support. The Administration is requesting $357 million for DNDO in FY2016, an increase of 16.1% from the FY2015 appropriation of $308 million. In the Systems Acquisition account, the Administration proposes to merge the Radiation Portal Monitors program ($5 million in FY2015) and the Human Portable Radiation Detection Systems program ($49 million in FY2015) into a single, expanded Radiological and Nuclear Detection Equipment Acquisition program ($101 million requested for FY2016). The increase in funding for the merged program would support recapitalization of DHS radiation detection equipment that is at or past its life expectancy.

[48] This section was written by Daniel Morgan, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[49] For more information, see CRS Report R43064, *The DHS S&T Directorate: Selected Issues for Congress*, by Dana A. Shea.

[50] The FY2015 act and explanatory statement did not specify the allocation of funding to Apex projects within the total provided for RD&I. Apex funding was $15 million in FY2014 and in the FY2015 request.

In September 2012, the Government Accountability Office (GAO) reported that although the S&T Directorate, DNDO, and the Coast Guard are the only DHS components that report R&D activities to the Office of Management and Budget, several other DHS components also fund R&D and activities related to R&D.[51] The GAO report found that DHS lacks department-wide policies to define R&D and guide reporting of R&D activities, and, as a result, DHS does not know the total amount its components invest in R&D. The report recommended that DHS develop policies and guidance for defining, reporting, and coordinating R&D activities across the department, and that DHS establish a mechanism to track R&D projects. In March 2013, the explanatory statement for the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6), directed the Secretary of Homeland Security, through the Under Secretary for Science and Technology, to establish a review process for all R&D and related work within DHS.[52] In April 2013, citing its September 2012 report, GAO listed DHS R&D as an area of concern in its annual report on fragmented, overlapping, or duplicative federal programs.[53] In January 2014, the joint explanatory statement for the Consolidated Appropriations Act, 2014 (P.L. 113-76), directed DHS to implement and report on new policies for R&D prioritization, and to review and, in accordance with GAO's recommendations, to implement policies and guidance for defining and overseeing R&D department-wide.[54] In September 2014, GAO testified that DHS had updated its guidance to include a definition of R&D, but that efforts to develop a process for coordinating R&D across the department were ongoing but not yet complete.[55]

[51] U.S. Government Accountability Office, *Department of Homeland Security: Oversight and Coordination of Research and Development Should Be Strengthened*, GAO-12-837, September 12, 2012.

[52] *Congressional Record*, March 11, 2013, p. S1547.

[53] U.S. Government Accountability Office, *2013 Annual Report: Actions Needed to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits*, GAO-13-279SP, April 2013.

[54] *Congressional Record*, January 15, 2014, p. H927.

[55] U.S. Government Accountability Office, *Department of Homeland Security: Actions Needed to Strengthen Management of Research and Development*, GAO-14-865T, September 9, 2014.

Table 9. Department of Homeland Security R&D and Related Programs

(budget authority in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Directorate of Science and Technology	**$1,104**	**$779**			
Management and Administration	130[a]	132			
R&D, Acquisition, and Operations	974[b]	647			
Research, Development, and Innovation	457	435			
Laboratory Facilities	435	134			
Acquisition and Operations Support	42	47			
University Programs	40	31			
Domestic Nuclear Detection Office	**308**	**357**			
Management and Administration	37	38			
Research, Development, and Operations	198	196			
Systems Architecture	17	17			
Systems Development	21	22			
Transformational R&D	70	68			
Assessments	38	38			
Operations Support	31	31			
National Technical Nuclear Forensics Center	21	20			
Systems Acquisition	73	123			
Radiological//Nuclear Detection Equipment Acquisition	—	101			
Radiation Portal Monitors Program	5	—			
Human Portable Radiation Detection Systems	49	—			
Securing the Cities	19	22			
U.S. Coast Guard RDT&E	**18**	**18**			
DHS, Total R&D and Related Programs	**1,430**	**1,154**			

Sources: FY2014 actual and FY2016 request from DHS FY2016 congressional budget justification. FY2015 enacted from H.R. 240 and explanatory statement, *Congressional Record*, January 13, 2015.

Note: Totals may differ from sum of components due to rounding.

a. Does not reflect a rescission of $0.5 million from unobligated prior-year balances.

b. Does not reflect a rescission of $16.6 million from unobligated prior-year balances.

Department of Health and Human Services

The Department of Health and Human Services (HHS) is the federal government's "principal agency for protecting the health of all Americans and providing essential human services, especially for those who are least able to help themselves."[56]

The President is requesting $31.0 billion in R&D funding for HHS, an increase of $565 million (1.9%) from its FY2015 level of $30.5 billion. Several components of HHS provide funding for R&D. This report focuses on HHS R&D funded through NIH, an HHS agency which provides more than 95% of total HHS R&D funding.[57]

The President's FY2016 request for R&D at other HHS agencies includes:

- Centers for Disease Control and Prevention: $398 million, equal to the amount it received in FY2015.
- Food and Drug Administration: $410 million, equal to the amount it received in FY2015.
- Agency for Healthcare Research and Quality: $385 million, an increase of $1 million (0.3%) from its FY2015 level.
- Health Resources and Services Administration: $22 million, equal to the amount it received in FY2015.
- Administration for Children and Families: $17 million, an increase of $6 million (54.5%) from its FY2015 level.[58]

In addition, the President's budget would eliminate R&D funding for the Centers for Medicare and Medicaid Services, which received $64 million in FY2015, and provide $163 million for departmental management related to R&D, an increase of $6 million (3.8%) above its FY2015 level.[59]

National Institutes of Health[60]

The National Institutes of Health (NIH) is the primary agency of the federal government charged with performing and supporting biomedical and behavioral research. It also has major roles in training biomedical researchers and disseminating health information. The NIH mission is "to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce the burdens of illness and

[56] HHS, "About," http://www.hhs.gov/about.

[57] Email correspondence between OMB and CRS, February 9, 2015.

[58] Ibid.

[59] Ibid.

[60] This section was written by Judith A. Johnson, Specialist in Biomedical Policy, CRS Domestic Social Policy Division. For background information on NIH, see CRS Report R41705, *The National Institutes of Health (NIH): Background and Congressional Issues*, by Judith A. Johnson and CRS Report R43341, *NIH Funding: FY1994-FY2016*, by Judith A. Johnson.

disability."[61] The agency's organization consists of the Office of the NIH Director and 27 institutes and centers.

NIH supports and conducts a wide range of basic and clinical research, research training, and health information dissemination across all fields of biomedical and behavioral sciences. About 83% of NIH's budget goes out to the extramural research community in the form of grants, contracts, and other awards. This funding supports research performed by more than 300,000 non-federal scientists and technical personnel who work at more than 2,500 universities, hospitals, medical schools, and other research institutions.[62] The NIH Office of the Director (OD) sets overall policy for NIH and coordinates the programs and activities of all NIH components, particularly in areas of research that involve multiple institutes. The institutes and centers (collectively called ICs) focus on particular diseases, areas of human health and development, or aspects of research support. Each IC plans and manages its own research programs in coordination with OD. As shown in **Table 10**, Congress provides separate appropriations to 24 of the 27 ICs, to OD, and to an intramural Buildings and Facilities account. The other three centers, which perform centralized support services, are funded through assessments on the IC appropriations.

Funding for NIH comes primarily from the Labor, HHS, and Education appropriations bill, with an additional amount for Superfund-related activities from the Interior/Environment appropriations bill. Those two bills provide NIH's discretionary budget authority. In addition, NIH receives $150 million in mandatory funding annually. The Public Health Service (PHS) Act provides this funding for a special program on type 1 diabetes research and funding from a PHS Act transfer. The total funding available for NIH activities, taking account of transfers, is known as the NIH program level.

The President's FY2016 budget requests an NIH program level total of $31.311 billion, an increase of $1 billion (3.3%) over the FY2015 level of $30.311 billion (see **Table 10**). The FY2016 program level request for NIH includes $150 million in mandatory funding for research on type 1 diabetes which is proposed for reauthorization in FY2016.[63] The FY2016 program level amount also proposes $847 million in funding transferred to NIH by the PHS Program Evaluation Set-Aside, also called the evaluation tap. NIH and other HHS agencies and programs authorized under the PHS Act are subject to a budget assessment found in Section 241 of the PHS Act (42 U.S.C. §238j). It authorizes the Secretary to use a portion of eligible appropriations to study the effectiveness of federal health programs and to identify improvements. Although the PHS Act limits the evaluation tap to no more than 1% of eligible appropriations, in recent years the annual Labor, HHS, and Education appropriations act has specified a higher amount (2.5% in FY2015) and also typically directs specific amounts of funding from the evaluation tap for transfer to a number of HHS programs. The set-aside has the effect of redistributing appropriated funds for specific purposes among PHS and other HHS agencies. NIH, with the largest budget among the PHS agencies, has traditionally been the largest "donor" of program evaluation funds and, until recently, a relatively minor recipient.[64]

[61] National Institutes of Health, "About the National Institutes of Health," http://www.nih.gov/about/mission.htm.

[62] Department of Health and Human Services, *Fiscal Year 2016 Budget in Brief*, Washington, DC, February 2, 2015, p. 45, http://www.hhs.gov/budget/fy2016/fy-2016-budget-in-brief.pdf.

[63] Mandatory funds for type 1 diabetes research under PHS Act §330B were provided by the American Taxpayer Relief Act of 2012 (P.L. 112-240) in FY2014 and the Protecting Access to Medicare Act of 2014 (P.L. 113-93) in FY2015.

[64] Section 205 of the FY2012 Labor/HHS and Education appropriations act capped the set-aside at 2.5%, which drew (continued...)

Except for the mandatory diabetes funding, Congress does not usually specify amounts for particular diseases or research areas. Congress generally appropriates specific amounts to each IC and leaves it to NIH and its scientific advisory panels to allocate funding to different research areas.[65] Some bills may propose authorizations for designated research purposes, but funding generally remains subject to discretionary appropriations and the NIH peer review process.

Under the President's FY2016 budget request, most of the NIH institutes and centers would receive a 2% to 4% increase compared to FY2015 with few exceptions, such as a $70 million (6%) increase for the National Institute on Aging and a $57 million (17%) increase for the National Library of Medicine (NLM). The increase for NLM would allow the National Center for Biotechnology Information to support PubMed Central, providing public access to papers emanating from NIH research, and enable ClinicalTrials.gov to accommodate the increased volume of clinical trial reporting due to a proposed expansion of NIH trial reporting policy and implementation of regulations related to the Food and Drug Administration Amendments Act of 2007 (FDAAA).[66] The overview below outlines research priorities in the FY2016 NIH budget.[67]

Basic Research. About 54% of the proposed NIH budget is targeted for basic biomedical and behavioral research. The Brain Research through Application of Innovative Neurotechnologies Initiative, a collaborative effort with the National Science Foundation and the Defense Advanced Research Projects Agency, develops and applies new tools for the study of complex brain functions. The NIH portion of about $135 million in FY2016 is an increase of $70 million over FY2015. Insights into brain circuitry and activity gained via the BRAIN initiative may help reveal the underlying problems in brain disorders and may provide therapeutic or prevention approaches for conditions such as Alzheimer's disease, autism, schizophrenia, depression, and addiction.

Translating Discovery into Health. To continue implementing the research components of the National Plan to Address Alzheimer's Disease (AD), NIH estimates it will spend $638 million on AD research in FY2016, an increase of $51 million over FY2015. Over 25 NIH-supported clinical trials are being conducted and more than 40 grants are testing compounds as possible prevention or treatment agents against AD and other forms of cognitive decline.

(...continued)

over $700 million from the NIH budget. The same percentage was assessed in FY2013 under the continuing appropriations act. The FY2014 President's Budget proposed increasing the PHS set-aside to 3.0%. The Senate committee rejected the increase, largely because of its effect on NIH, estimating that it would have taken an extra $147 million from NIH. (See S.Rept. 113-71 on S. 1284, p. 41 and p. 83.) The Consolidated Appropriations Act, 2014 (P.L. 113-76), set the assessment at 2.5%. The President's FY2015 Budget again proposed increasing the tap from 2.5% to 3.0%; P.L. 113-235 set the assessment at 2.5%. For FY2015, although NIH contributed an estimated $700 million to the tap, it received $715 million under P.L. 113-235, an increase over the $8.2 million the agency received in the past from the transfer. P.L. 113-235 allocates the entire $715 million to the National Institute of General Medical Sciences (NIGMS), offsetting the more than $700 million reduction in discretionary budget authority for NIGMS in the law compared with its FY2014 funding level. By convention, budget tables such as **Table 10** do not subtract the amount of the evaluation tap from the donor agencies' appropriations. For further information on the PHS Evaluation Set-Aside, see CRS Report R43304, *Public Health Service Agencies: Overview and Funding*, coordinated by C. Stephen Redhead.

[65] See NIH website, "Estimates of Funding for Various Research, Condition, and Disease Categories (RCDC)," http://report.nih.gov/categorical_spending.aspx.

[66] NIH, FY2016 Justification of Estimates for Appropriation Committees, Vol. V, National Library of Medicine, p. NLM-6, at http://www.nlm.nih.gov/about/2016CJ_NLM.pdf.

[67] The amounts discussed in the text below are based on the NIH section in *Fiscal Year 2016 Budget in Brief*, pp. 44-49, http://www.hhs.gov/budget/fy2016/fy-2016-budget-in-brief.pdf.

NIH would spend $23 million in FY2016, same level as FY2015, on the Accelerating Medicines Partnership (AMP), a venture with ten biopharmaceutical firms and several non-profit organizations. The partnership aims at promising biological targets in three disease areas: Alzheimer's; type 2 diabetes; and two autoimmune disorders, rheumatoid arthritis and lupus.

In addition, NIH would target $461 million in FY2016 to support the Administration's National Strategy to Combat Antimicrobial Resistance Bacteria, an increase of $100 million over FY2015.

Big Data. NIH would spend $102 million in FY2016 on the Big Data to Knowledge (BD2K) initiative, an increase of $20 million over FY2015, to facilitate sharing and protection of data as well as develop faster and more accurate analytical methods and software. Examples of large complex biomedical datasets of information include high-resolution medical images and DNA sequencing data from many individuals.

Precision Medicine Initiative. The FY2016 budget request proposes a total of $215 million for a multi-agency precision medicine initiative: $10 million to FDA to support the development of the necessary regulatory approaches, $5 million to the Office of the National Coordinator for Health Information Technology for developing relevant data privacy and sharing requirements, and $200 million to support biomedical research at NIH. Of the amount for NIH, it would use $130 million for the development of a national research cohort composed of one million or more volunteers. The cohort's health, genetic, environmental and other data would be collected and used in research studies to identify novel therapeutics and prevention strategies. The proposal would use existing smaller research cohorts rather than recruiting one million new participants. The National Cancer Institute would use the remaining $70 million of NIH funds to explore the genetics of tumor cells that are resistant to therapy, to determine the efficacy of combination therapies that target specific tumor mutations, and for research on non-invasive methods to track response to cancer treatment.

Biomedical Research Workforce. NIH estimates it will spend $785 million to support 15,735 individuals in its major research training program, the Ruth L. Kirschstein National Research Service Awards, with a 2% stipend increase in FY2016 for predoctoral and postdoctoral trainees. The request is $23 million above the FY2015 level. NIH will continue with programs to encourage exceptionally promising new investigators, such as the Pioneer Research Awards, the NIH Director's Early Independence Awards, Transformative Research Awards, New Innovator Awards, and the Pathway to Independence Awards. In addition, several ICs are conducting similar award programs which are expected to expand in FY2016. NIH asserts it will continue to implement steps to promote diversity and understand the barriers to career advancement of people traditionally underrepresented in the research workforce.

The following are other selected program changes and areas of emphasis in the FY2016 request.

HIV/AIDS. NIH estimates it will spend about $3.1 billion on HIV/AIDS research in FY2016, an increase of $100 million compared with FY2015.

Pediatric Research. NIH estimates it will spend over $3.6 billion on pediatric research in FY2016, an increase of $75 million over FY2015. The $13 million authorized for pediatric research by the Gabriella Miller Kids First Research Act of 2014 (P.L. 113-94) will continue in FY2016.

Research Project Grants. The main funding mechanism for supporting NIH extramural research is research project grants (RPGs), which are competitive, peer-reviewed, and largely investigator-initiated. The FY2016 budget requests total funding for RPGs of $17.2 billion, representing about 55% of NIH's proposed budget. The request would support an estimated 35,447 RPG awards. Within that total, 10,000 would be competing RPGs, an increase of over 1,200 grants compared with FY2015. (Competing awards are new grants plus competing renewals of existing grants.) NIH estimates the average amount of a competing RPG in FY2016 would be about $461,000, up from about $457,000 in FY2015.

Table 10. National Institutes of Health Funding

(budget authority, in millions of dollars)

	FY2015 Operating Level	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
National Cancer Institute (NCI)	$4,953	$5,098			
National Heart, Lung, & Blood Institute (NHLBI)	2,996	3,072			
Dental/Craniofacial Research (NIDCR)	398	407			
Diabetes/Digestive/Kidney (NIDDK)[a]	1,749	1,788			
Neurological Disorders/Stroke (NINDS)	1,605	1,660			
Allergy/Infectious Diseases (NIAID)	4,418	4,615			
General Medical Sciences (NIGMS)	1,657	1,587			
Child Health/Human Development (NICHD)	1,287	1,318			
National Eye Institute (NEI)	677	695			
Environmental Health Sciences (NIEHS)	667	682			
National Institute on Aging (NIA)	1,198	1,267			
Arthritis/Musculoskeletal/Skin Diseases (NIAMS)	522	533			
Deafness/Communication Disorders (NIDCD)	405	416			
National Institute of Mental Health (NIMH)	1,434	1,489			
National Institute on Drug Abuse (NIDA)	1,016	1,047			
Alcohol Abuse/Alcoholism (NIAAA)	447	460			
National Institute of Nursing Research (NINR)	141	145			
National Human Genome Research Institute (NHGRI)	499	515			
Biomedical Imaging/Bioengineering (NIBIB)	327	337			
Minority Health/Health Disparities (NIMHD)	271	282			
Complementary/Integrative Health (NCCIH)[b]	124	128			
Advancing Translational Sciences (NCATS)	633	660			
Fogarty International Center (FIC)	68	70			

	FY2015 Operating Level	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
National Library of Medicine (NLM)	337	394			
Office of Director (OD)	1,414	1,443			
Buildings & Facilities (B&F)	129	129			
Subtotal, Labor/HHS Appropriation	**29,369**	**30,237**			
PHS Evaluation Tap funding[c]	715	847			
Subtotal, NIH	**30,084**	**31,084**			
Superfund (Interior appropriation to NIEHS)[d]	77	77			
Pre-appropriated type 1 diabetes funds[e]	150	150			
Total, NIH program level	**30,311**	**31,311**			

Source: NIH, FY2016 Justification of Estimates for Appropriation Committees, Vol. I, Overview, table on "Budget Request by Institute and Center," p. 85, at http://officeofbudget.od.nih.gov/br.html.

Notes: Totals may differ from the sum of the components due to rounding. Amounts in table may differ from actuals in many cases. By convention, budget tables such as **Table 10** do not subtract the amount of transfers, such as the evaluation tap, from the agencies' appropriation. CRS estimated the NIH contribution to the evaluation tap to be over $700 million for FY2015. FY2015 amounts do not include $238,000,000 for NIAID for research on Ebola that was provided in P.L. 113-235 (Title VI of Division G).

a. Amounts for NIDDK do not include mandatory funding for type 1 diabetes research (see note e).

b. Reflects name change from National Center for Complementary and Alternative Medicine to National Center for Complementary and Integrative Health; provision included in P.L. 113-235.

c. Additional funds for NLM in FY2014 and for NIGMS in FY2015 Operating Level and FY2016 Request from PHS Evaluation Set-Aside (§241 of PHS Act).

d. This is a separate account in the Interior/Environment appropriations for NIEHS research activities related to Superfund.

e. Mandatory funds available to NIDDK for type 1 diabetes research under PHS Act §330B (provided by P.L. 112-240 in FY2014 and P.L. 113-93 in FY2015) are proposed for reauthorization in FY2016. Although not reflected in **Table 10**, the FY2015 amount was reduced by about $11 million (7.3%) due to the FY2015 sequestration.

Department of Energy[68]

The Department of Energy (DOE) was established in 1977 by the Department of Energy Organization Act (P.L. 95-91), which combined energy-related programs from a variety of other agencies with defense-related nuclear programs that dated back to the Manhattan Project. Today, DOE conducts basic scientific research in areas ranging from nuclear physics to the biological and environmental sciences, basic and applied R&D relating to energy production and use, and R&D on nuclear weapons, nuclear nonproliferation, and defense nuclear reactors. The department has a system of 17 national laboratories around the country, mostly operated by contractors, that together account for about 40% of all DOE expenditures.

[68] This section was written by Daniel Morgan, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

The Administration is requesting $14.178 billion in FY2016 for DOE R&D and related activities, including programs in three major categories: science, national security, and energy. This request is 12.2% more than the FY2015 appropriation of $12.640 billion. (See **Table 11** for details.)

The request for the DOE Office of Science is $5.340 billion, an increase of 5.4% from the FY2015 appropriation of $5.068 billion. There is no authorized funding level for the Office of Science for FY2016. The most recent authorization act (the America COMPETES Reauthorization Act of 2010, P.L. 111-358) authorized appropriations through FY2013. The FY2016 budget request does not mention the Obama Administration's previous goal of doubling the combined funding of the Office of Science and two other agencies. (For more information on the doubling goal and how it has evolved, see "Efforts to Double Certain R&D Accounts.") The original target, announced by the Bush Administration in 2006, was to achieve the doubling in the decade from FY2006 to FY2016. The FY2016 request for the Office of Science is 47% more than its FY2006 baseline.

The Office of Science includes six major research programs. The request for the largest program, Basic Energy Sciences (BES), is $1.849 billion, an increase of 6.7%. Within BES, a proposed increase of $62 million for continued construction of the Linac Coherent Light Source II (LCLS-II) is slightly less than was previously projected; however, the projected future cost of completing the project in FY2017 through FY2019 has increased. A proposed increase of $35 million for Scientific User Facilities would support increased operating hours at multiple BES research facilities. Energy Frontier Research Centers would increase by $10 million to support up to 10 new centers.

The request for High Energy Physics is $788 million, an increase of 2.9%. Within this program, a proposed increase of $15 million for continued construction of the Muon to Electron Conversion Experiment (Mu2e) is slightly less than was previously projected; however, the projected future cost of completing the project in FY2017 through FY2019 has increased. In the program's three major experimental areas, proposed increases for cosmic frontier physics and energy frontier physics are approximately offset by a proposed decrease for physics at the intensity frontier.

The request for Biological and Environmental Research is $612 million, an increase of 3.4%. This program consists of two roughly equal parts: Biological Systems Science and Climate and Environmental Sciences. Within Climate and Environmental Sciences, the request includes an increase of $31 million for climate and Earth system modeling.

The request for Advanced Scientific Computing Research is $621 million, an increase of 14.8%. Essentially the entire increase would be allocated to the Research and Evaluation Prototypes program. This activity supports R&D partnerships with vendors to influence and accelerate critical technologies for next-generation systems, system integration research, and development and engineering efforts.

The request for Fusion Energy Sciences is $420 million, a decrease of 10.2%. Construction funding for the International Thermonuclear Experimental Reactor (ITER) would be $150 million, the same as in FY2015. In 2008, the cost for the U.S. share of ITER, a multi-year international construction project, was estimated to be between $1.45 billion and $2.2 billion. Schedule delays, design and scope changes, and other factors have delayed formal approval of a revised cost estimate. According to DOE, the current best estimate of the total U.S. cost for ITER construction (which is 9.09% of the total international cost) is between $4 billion and $6.5 billion. In June 2014, the Government Accountability Office found that the cost of ITER has increased,

its schedule has slipped, the international project schedule is "not reliable," and DOE can "only partially" influence the international project's performance.[69] All other major program areas would decrease. The Alcator C-MOD facility would cease operations at the end of FY2016.

The request for DOE national security R&D is $4.488 billion, a 9.0% increase from $4.119 billion in FY2015. In the Weapons Activities account, Advanced Simulation and Computing would increase by $25 million, and Advanced Manufacturing Development would increase by $23 million. Funding for the Naval Reactors program would rise by 11.5%, including increases for technology development, systems development, and facility operations and maintenance. Defense Nuclear Nonproliferation R&D would increase by $26 million, but this would result largely from a transfer of funding for materials characterization research and diagnostic equipment development to this account from Weapons Activities.

The FY2016 request for DOE energy R&D is $4.350 billion, up 26.0% from $3.453 billion in FY2015. The request would increase funding for R&D in the Office of Energy Efficiency and Renewable Energy (EERE) by 43.9%, with increases requested for all major EERE programs. Within EERE, the largest increases would be for Advanced Manufacturing ($404 million, up from $200 million in FY2015), Vehicle Technologies ($444 million, up from $280 million), Solar Energy ($337 million, up from $233 million), and Building Technologies ($264 million, up from $172 million). The request for Advanced Manufacturing would support the establishment of two additional Clean Energy Manufacturing Innovation Institutes (see "National Network for Manufacturing Innovation"). The proposed increase for Nuclear Energy reflects a rescission of unobligated prior-year balances in FY2015; without this rescission, the FY2016 request for Nuclear Energy would be a $6 million decrease. The request for Electricity Delivery and Energy Reliability R&D includes an increase of $15 million for smart grid R&D and $10 million to establish a new program of R&D on transformer resilience and advanced components. Support for the Advanced Research Projects Agency–Energy (ARPA-E) would increase by 16.1%. The balance of ARPA-E project funding would shift from an equal distribution between Stationary Power Systems and Transportation Systems to approximately a 60:40 split.

Table 11. Department of Energy R&D and Related Activities

(budget authority in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Science	**$5,068**	**$5,340**			
Basic Energy Sciences	1,733	1,849			
High Energy Physics	766	788			
Biological and Environmental Research	592	612			
Nuclear Physics	596	625			
Advanced Scientific Computing Research	541	621			
Fusion Energy Sciences	468	420			
Other	373	425			

[69] U.S. Government Accountability Office, *Fusion Energy: Actions Needed to Finalize Cost and Schedule Estimates for U.S. Contributions to an International Experimental Reactor*, GAO-14-499, June 5, 2014.

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
National Security	**4,119**	**4,488**			
Weapons Activities[a]	2,478	2,676			
Naval Reactors	1,234	1,375			
Defense Nuclear Nonproliferation R&D	393	419			
Defense Environmental Cleanup Tech. Dev.	14	17			
Energy	**3,453**	**4,350**			
Energy Efficiency and Renewable Energy[b]	1,671	2,404			
Fossil Energy R&D	561	560			
Nuclear Energy	833	908			
Electricity Delivery & Energy Reliability R&D	108	153			
Advanced Research Projects Agency–Energy	280	325			
DOE, Total	**12,640**	**14,178**			

Source: FY2014 actual and FY2016 request from DOE FY2016 congressional budget justification, http://energy.gov/cfo/downloads/fy-2016-budget-justification. FY2015 enacted from P.L. 113-235 and explanatory statement, *Congressional Record*, December 11, 2014.

Notes: Totals may differ from the sum of the components due to rounding. Amounts include rescissions and use of prior-year unobligated balances. FY2014 amounts include transfers within and between accounts for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.

a. Including Stockpile Services R&D Support, Stockpile Services R&D Certification and Safety, Science, Engineering except Enhanced Surety and Enhanced Surveillance; Ignition and High Yield; Advanced Simulation and Computing; and a prorated share of Readiness in Technical Base and Facilities and Infrastructure and Safety. Additional R&D activities may take place in the subprograms of Directed Stockpile Work that are devoted to specific weapon systems. This table does not include these funds because detailed funding schedules for those subprograms are classified.

b. Excluding Weatherization and Intergovernmental Activities.

National Science Foundation[70]

The National Science Foundation (NSF) supports basic research and education in the non-medical sciences and engineering. Congress established the Foundation as an independent federal agency in 1950 and directed it to "promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes."[71] The NSF is a primary source of federal support for U.S. university research, especially in mathematics and computer science. It is also responsible for significant shares of the federal science, technology, engineering, and mathematics education program portfolio and federal STEM student aid and support.[72]

[70] This section was written by Heather B. Gonzalez, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[71] The National Science Foundation Act of 1950 (P.L. 81-507).

[72] For more information about the NSF, see CRS Report R43585, *The National Science Foundation: Background and Selected Policy Issues*, by Heather B. Gonzalez.

NSF has six major appropriations accounts: Research and Related Activities (RRA, the main research account), Education and Human Resources (EHR, the main education account), Major Research Equipment and Facilities Construction (MREFC), Agency Operations and Award Management (AOAM), the National Science Board (NSB), and the Office of Inspector General (OIG). FY2016 funding for these accounts is tracked in **Table 12**.

Overall, the Obama Administration seeks $7.724 billion for the NSF in FY2016, a $379 million (5%) increase over the FY2015 estimate of $7.344 billion. Under the request, RRA would increase by $253 million or 4%. EHR would grow by nearly $100 million (11%).

In its budget documents NSF indicates that its FY2016 priorities include four programs that have been foundation priorities since at least FY2013: Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS, $257 million requested, 11% increase); Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21, $143 million requested, 11% increase); Science, Engineering, and Education for Sustainability (SEES, $81 million requested, 42% reduction); and Secure and Trustworthy Cyberspace (SaTC, $124 million requested, 1% increase). New priorities in FY2016 include Clean Energy Technology ($377 million, 2% increase), Innovation Corps (I-Corps, $30 million, 14% increase), NSF Research Traineeships (NRT, $62 million, 1% increase), and Research at the Interface of Biological, Mathematical, and Physical Sciences (BioMaPS, $33 million, 12% increase). NSF added Cognitive Science and Neuroscience to its priority list in FY2015, but removed it in FY2016.[73]

As previously noted, the Administration seeks a $253 million (4%) increase in year-over-year funding for RRA. In FY2015, House report language (H.Rept. 113-448) directed NSF to apply any additional appropriations (over FY2015 RRA requested levels) to BIO, CISE, ENG and MPS. NSF received $126 million more than requested for RRA in FY2015. The additional funding was applied to the specified major subaccounts, which received 3%-4% increases over FY2015 requested levels. (Funding for GEO, SBE, IA/OISE, and USARC was at FY2015 requested levels.) Although the FY2016 budget request seeks increases ranging from 2% to 8% for all major RRA subaccounts, the request seeks slightly more (on average, as a percentage over prior year) for accounts that did not receive extra funding in FY2015 (i.e., GEO, SBE, IA/OISE, and USARC).[74] However, more than half of the $253 million total increase for RRA (54%) would still go to BIO, CISE, ENG, and MPS.

Policymakers actively debate congressional funding directives at the major subaccount level in RRA. Some analysts assert that legislators have a role in establishing funding priorities by scientific field within RRA, as part of the legislative oversight function and in order to assure accountability for taxpayer funds. Other analysts argue that the scientists who manage NSF ought to determine the distribution of funding by field, based on their deeper knowledge of research needs and scientific possibilities within each field, and of how these needs are best balanced across the NSF portfolio.

[73] In FY2016, NSF identifies cognitive science and neuroscience as elements of a cross-foundation investment called Understanding the Brain (UtB). The FY2016 request for UtB is $144 million, $38 million (35%) more than the FY2015 estimate of $106 million.

[74] The average requested percentage increase for BIO (2%), CISE (4%), ENG (6%), and MPS (2%) is 4%. The average requested percentage increase for GEO (5%), SBE (7%), IA/OISE (8%), and USARC (5%) is 6%.

RRA programs that are widely tracked by policymakers include the Experimental Program to Stimulate Competitive Research (EPSCoR) program. For FY2016, the Administration seeks $170 million for EPSCoR, a $10 million (6%) increase over the FY2015 estimate of $160 million.

The FY2016 request for EHR is $963 million, or $97 million more than the FY2015 estimated level of $866 million. Most of the requested increase ($81 million or 83%) would go to activities classified as R&D. This additional investment in R&D would further shift the balance between R&D and education and training within EHR.[75] If Congress adopts the FY2016 request, the portion of EHR dedicated to R&D activities would reach 49%. By comparison, in FY2008 (the earliest year for which comparable budget data are available), R&D activities constituted 11% of EHR funding. The character of EHR's R&D funding has also shifted, moving from about 91% basic research in FY2008 to about 34% basic research in the FY2016 request.

By program, the largest increase in the FY2016 EHR request is for Improving Undergraduate STEM Education (IUSE).[76] The Administration seeks $121 million in EHR funding for IUSE in FY2016, a $36 million (43%) increase over the FY2015 estimated level of $84 million. In addition, IUSE would receive $15 million in FY2016 RRA co-funding (from GEO, ENG, and BIO). The second-largest increase in the FY2016 EHR request is for EHR Core Research (ECR): STEM Learning, within the Division of Research on Learning in Formal and Informal Settings.[77] The FY2016 request for ECR:STEM Learning is $49 million, or $24 million (92%) more than the FY2015 estimate of $26 million.

Other widely tracked EHR programs include Advanced Technological Education (ATE, $66 million requested, no change); Robert Noyce Teacher Scholarship Program (Noyce, $61 million requested, no change); Cybercorps: Scholarships for Service (SFS, $45 million requested, no change); Advancing Informal STEM Learning (AISL, $60 million requested, 9% increase); and Science, Technology, Engineering, and Mathematics + Computing (STEM+C) Partnerships (formerly Mathematics and Science Partnerships, $52 million requested, 9% decrease).

The FY2016 NSF budget request would provide $338 million in combined funding for the Graduate Research Fellowship (GRF), which receives half of its funding from RRA and half from EHR, for a $4 million (1%) increase over the FY2015 estimate of $333 million. The NSF Research Traineeship (NRT, formerly the Integrative Graduate Education and Research Traineeship or IGERT), which is also co-funded by RRA and EHR (but not equally), would receive $62 million in FY2016. This amount is about 1% more than FY2015. However, the budget request seeks to reduce the RRA contribution by $7 million and increase the EHR contribution by a similar amount. EHR would provide the majority of NRT program funding for the first time in at least five fiscal years.

[75] According to Office of Management and Budget (OMB) character classification definitions, most EHR funding goes to R&D or to education and training. The education and training classification includes scholarships, as well as operating assistance for schools and colleges. For more information, see OMB Circular A-11, Section 84, "Character Classification (Schedule C)" at http://www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/s84.pdf.

[76] According to the July 23, 2014, IUSE program solicitation (NSF14588), two goals guide the IUSE program, "1) to promote the development, use, and testing of instructional practices and curricular innovations that engage and improve student learning and retention in STEM, and 2) to promote community and institutional transformation that will increase opportunities for the application of highly effective STEM teaching methods."

[77] Each EHR division has an ECR program. ECR:STEM Learning is in the Division of Research on Learning in Formal and Informal Settings (DRL). According to the October 24, 2014, ECR: STEM Learning program solicitation (NSF15509), DRL's "ECR projects are grounded in theory, ask well formulated research questions, employ relevant data and analytic techniques, and contribute to the growing body of literature on STEM education research."

The Administration seeks no changes for most of NSF's minority-serving institution programs, including Historically Black Colleges and Universities—Undergraduate Program (HBCU-UP, $32 million), Louis Stokes Alliances for Minority Participation (LSAMP, $46 million), and Tribal Colleges and Universities Program (TCUP, $13.5 million). The FY2016 NSF budget request does not seek funding for a Hispanic-Serving Institutions (HSIs) program. Some policymakers have encouraged NSF to seek such funding in the past. Rather, the budget request pledges to emphasize Hispanic-serving two-year colleges through existing programs, including ATE, IUSE, and LSAMP.

Other accounts that fund R&D at the NSF include the MREFC account, which supports large construction projects and scientific instruments. The Administration seeks just over $200 million for MREFC in FY2016, which is close to the FY2015 estimate of $201 million. In FY2016, MREFC funding would pay for the final year of National Ecological Observatory Network (NEON) construction, and would provide ongoing support for the Large Synoptic Survey Telescope (LSST) and Daniel K. Inouye Solar Telescope (DKIST).[78]

Historically, the MREFC account has typically supported between four and six projects at a time. The FY2015 and FY2016 requests for three projects was lower than the historical trend, which could indicate that some potentially scientifically valuable projects are being delayed or overlooked. On the other hand, when these large projects come online their operations costs must be shouldered by research accounts. This can be seen in the FY2016 BIO request, which states that "NEON operations will represent a major change to the BIO portfolio, with up to 5.9% of BIO's total funding dedicated to operations and maintenance of the facility."[79] In a constrained budget environment, this dynamic could precipitate difficult choices between funding for research and funding research facilities and equipment.

The Administration seeks $355 million, $4 million, and $15 million for AOAM, NSB, and OIG (respectively). Funding for AOAM would be $30 million or 9% greater in FY2016 than it was in FY2015 ($325 million, estimated). The increase for AOAM is part of a multi-year plan to relocate NSF headquarters. Previous disputes between NSF and its labor unions over headquarters interior space allocations have been resolved. Funding for NSB would not change significantly between FY2015 and FY2016 under the request; funding for OIG would increase by about three-quarters of a million (5%).

The FY2016 NSF budget request includes funding for three multi-agency initiatives: National Nanotechnology Initiative (NNI, $416 million), Networking and Information Technology Research and Development (NITRD, $1.217 billion), and U.S. Global Change Research Program (USGCRP, $341 million). The request for NNI is about the same as the FY2015 estimate, NITRD would increase by $31 million, and USGCRP would receive an additional $10 million in FY2016.

[78] The Advanced Technology Solar Telescope was renamed the Daniel K. Inouye Solar Telescope in December 2013.

[79] National Science Foundation, *FY2016 Budget Request to Congress*, February 2, 2015, p. BIO-2.

Table 12. NSF Funding by Major Account

(budget authority in millions of dollars)

Account	FY2015 Estimate	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Enacted
Research and Related Activities (RRA)					
Biological Sciences (BIO)	731.0	747.9			
Computer and Information Science and Engineering (CISE)	921.7	954.4			
Engineering (ENG)	892.3	949.2			
Geosciences (GEO)	1,304.4	1,365.4			
Mathematical and Physical Sciences (MPS)	1,336.7	1,366.2			
Social, Behavioral, and Economic Sciences (SBE)	272.2	291.5			
Office of International Science and Engineering (OISE)	48.5	51.0			
Integrative Activities (IA)	425.3	459.2			
U.S. Arctic Research Commission (USARC)	1.4	1.5			
RRA, Subtotal	**5,933.7**	**6,186.3**			
Education and Human Resources (EHR)	**866.0**	**962.6**			
Major Research Equipment and Facilities Construction (MREFC)	**200.8**	**200.3**			
Agency Operations and Award Management (AOAM)	**325.0**	**354.8**			
National Science Board (NSB)	**4.4**	**4.4**			
Office of the Inspector General (OIG)	**14.4**	**15.2**			
NSF, Total	**7,344.2**	**7,723.6**			

Source: Data in the columns titled, "FY2015 Estimate" and "FY2016 Request" are from the FY2016 NSF Budget Request to Congress.

Notes: Totals may differ from the sum of the components due to rounding. The account structure in **Table 12** reflects the realignment (in FY2015) of OISE and IA as separate budget activities.

National Aeronautics and Space Administration[80]

In 1958, the National Aeronautics and Space Act (P.L. 85-568) created the National Aeronautics and Space Administration to conduct civilian space and aeronautics activities. NASA has research programs in planetary science, Earth science, heliophysics, astrophysics, and aeronautics, as well as development programs for future human spacecraft and for multipurpose space technology

[80] This section was written by Daniel Morgan, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

such as advanced propulsion systems. In addition, NASA operates the International Space Station as a facility for R&D and other purposes.

The Administration is requesting $17.282 billion for NASA R&D in FY2016. This amount is 2.7% more than the $16.828 billion NASA received for R&D in FY2015.[81] For a breakdown of these amounts, see **Table 13**. There is no authorized level for NASA funding in FY2016. The most recent authorization act (the NASA Authorization Act of 2010, P.L. 111-267) authorized appropriations through FY2013. NASA R&D funding comes through five accounts: Science, Aeronautics, Space Technology, Exploration, and International Space Station.

The FY2016 request for Science is $5.289 billion, an increase of 0.8%. In Planetary Science, the request includes $30 million for formulation and development of a potential future mission to Jupiter's moon Europa. Congress provided $69.7 million in FY2013, $80 million in FY2014, and $100 million in FY2015 for formulation of a Europa mission, which was a high priority of the 2011 National Research Council (NRC) decadal survey of planetary science.[82] The NRC expressed reservations, however, at the mission's estimated cost of $4.7 billion, and in April 2014, NASA issued a request for information seeking Europa mission concepts costing less than $1 billion.[83] NASA expects to formulate cost and schedule range estimates for a Europa mission during FY2016; it notes that the "mission concept may require significant modification."[84]

Also in the Science account, an increase of 9.9% for Earth Science would support, among other initiatives, an expansion of the Sustainable Land Imaging program. Over several years, this program is to develop and launch the Landsat 9 land imaging satellite for the U.S. Geological Survey as a duplicate of the currently operational Landsat 8. The program is to also develop a lower-cost Thermal Infrared Free Flyer satellite to reduce the risk of a gap in data availability prior to the launch of Landsat 9. Finally, it is to initiate an ongoing program of technology development to inform the future design of Landsat 10.

In Astrophysics, also funded in the Science account, the request includes $85.2 million for the Stratospheric Observatory for Infrared Astronomy (SOFIA). In the FY2015 budget, NASA proposed placing the SOFIA aircraft in storage unless international partners could support the U.S. share of its operating costs. Rejecting this proposal, the 113th Congress provided $70 million for SOFIA in FY2015 and directed NASA to "continue to seek partners to restore SOFIA to its full operational level."

The FY2016 request for Aeronautics is $571 million, a decrease of 12.3%. This request follows an increase in FY2015 of nearly $100 million above the FY2015 request. NASA reorganized its aeronautics research in FY2015 to align with a new strategic vision announced in August 2013.[85] The proposed FY2016 budget for Aeronautics would support new activities aligned with the research thrust areas identified in the strategic vision.

[81] Based on a CRS estimate of $3.010 billion in R&D for the International Space Station in FY2015. See notes to **Table 13**.

[82] National Research Council, *Vision and Voyages for Planetary Science in the Decade 2013-2022* (National Academies Press, 2011). Available online at http://www.nap.edu/catalog.php?record_id=13117.

[83] National Aeronautics and Space Administration, "Europa Mission Concepts Costing Less than $1 Billion," solicitation NNH14ZDA008L, April 28, 2014. Available at https://nspires.nasaprs.com/external/solicitations/.

[84] NASA FY2016 congressional budget justification, p. PS-47.

[85] See National Aeronautics and Space Administration, "NASA Introduces New Blueprint for Transforming Global Aviation," August 14, 2013, http://www.nasa.gov/aero/strategic_vision/.

The FY2016 request for Space Technology is $725 million, an increase of 21.6%. Space Technology was first established as a separate account in FY2011. Each year since then, the Administration has proposed to increase Space Technology funding. Congress has provided increases each year except FY2014, but always less than the Administration's request. The request for FY2016 includes an increase of $44 million for in-space technology demonstrations and an increase of $48 million for maturation of early-stage transformational technologies.

The FY2016 request for Exploration is $4.506 billion, an increase of 3.4%. This account funds development of the Orion Multipurpose Crew Vehicle and the Space Launch System (SLS) heavy-lift rocket, which the 2010 authorization act mandated for human exploration beyond Earth orbit. The account also funds development of a commercial crew transportation capability for future U.S. astronaut access to the International Space Station. The request of $2.863 billion for Orion, the SLS, and related ground systems (known collectively as Exploration Systems Development) is a decrease of 11.8%, while the request of $1.244 billion for commercial crew is an increase of 54.5%. Other recent Administration budgets have similarly proposed to decrease Exploration Systems Development funding while increasing commercial crew funding. Many in Congress have seen these proposals as evidence of a difference in human spaceflight priorities between Congress and the Administration. Congress has generally appropriated less than the Administration's request for commercial crew and more for Exploration Systems Development. NASA argues that the requested amount for commercial crew is necessary to maintain the scheduled availability of commercial crew transportation to the International Space Station starting in 2017. It asserts that the schedule for initial operation of Orion and SLS (NASA plans a first crewed test flight for FY2021-FY2022) is dependent primarily on testing and development schedules and would be difficult to accelerate, even with additional funds. Some congressional supporters of Orion and SLS argue that those programs have not received the funds they need to stay on schedule.

The Administration's FY2016 request includes $3.106 billion for the International Space Station (ISS).[86] Funding for the ISS includes the cost of commercial cargo flights for ISS resupply, as well as the cost of Russian Soyuz flights for U.S. ISS astronauts.

Table 13. NASA R&D

(budget authority in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Science	**$5,244.7**	**$5,288.6**			
Earth Science	1,772.5	1,947.3			
Planetary Science	1,437.8	1,361.2			
Astrophysics	684.8	709.1			
James Webb Space Telescope	645.4	620.0			
Heliophysics	662.2	651.0			
Education	42.0[a]	—			

[86] Neither P.L. 113-235 nor the accompanying explanatory statement specified FY2015 funding for the ISS. They identified only the amount for Space Operations, which includes funding for other activities in addition to the ISS. The total FY2016 request for Space Operations is a 4.6% increase.

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Aeronautics	**651.0**	**571.4**			
Space Technology	**596.0**	**724.8**			
Exploration	**4,356.7**	**4,505.9**			
Exploration Systems Development	3,245.3	2,862.9			
Commercial Spaceflight	805.0	1,243.8			
Exploration R&D	306.4	399.2			
International Space Station	**—**[b]	**3,105.6**			
Subtotal R&D	**13,858.4**	**14,196.3**			
Non-R&D Programs[c]	973.8	1,024.4			
Safety, Security, and Mission Services[d]	2,758.9	2,843.1			
Associated with R&D[e]	*2,577.8*	*2,651.8*			
Construction & Environmental C&R	419.1	465.3			
Associated with R&D[e]	*391.6*	*434.0*			
NASA, Total (R&D)	**16,827.8**	**17,282.0**			
NASA, Total	**18,010.2**	**18,529.1**			

Sources: FY2014 actual and FY2016 request from NASA's FY2016 congressional budget justification, http://www.nasa.gov/news/budget/. FY2015 enacted from P.L. 113-235 and explanatory statement, *Congressional Record*, December 11, 2014, Book II, at pp. H9348-H9349.

Notes: Totals may differ from the sum of the components due to rounding.

a. Included in Astrophysics in other years. This item is separate from the Education account, which is included in Non-R&D Programs, lower in the table.

b. Not specified in P.L. 113-235 or the explanatory statement. The R&D totals shown in the table are calculated using a CRS estimate of $3,010.0 million for the International Space Station.

c. Space Operations other than International Space Station, Education, and Inspector General.

d. Formerly known as Cross-Agency Support.

e. CRS estimates the allocation between R&D and non-R&D in proportion to the underlying program amounts in order to allow calculation of a total for R&D. The Cross-Agency Support and Construction and Environmental Compliance and Remediation accounts consist mostly of indirect costs for other programs, assessed in proportion to their direct costs.

Department of Commerce

The Department of Commerce is a multi-faceted organization engaging in diverse policy and programmatic activities, including trade, technology, telecommunications, data collection and analysis, and the environment. The department's R&D activities are found primarily in the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration. This chapter addresses only DOC R&D funding at these organizations.

National Institute of Standards and Technology[87]

An agency of the Department of Commerce, NIST has a mandate to increase the competitiveness of U.S. companies through appropriate support for industrial development of precompetitive, generic technologies and the diffusion of government-developed technological advances to users in all segments of the American economy. NIST research also provides the measurement, calibration, and quality assurance methods and techniques that underpin U.S. commerce, technological progress, product reliability, manufacturing processes, and public safety. NIST is also responsible for developing, maintaining, and retaining custody of the national standards of measurement; providing the means and methods for making measurements consistent with those standards; and ensuring the compatibility of U.S. national measurement standards with those of other nations.

The President's budget request would provide $1.120 billion for NIST in FY2016, an increase of $255.8 million (29.6%) over the FY2015 enacted appropriation. (See **Table 14**.) NIST funding is provided through three accounts: Scientific and Technical Research and Services (STRS), Industrial Technology Services (ITS), and Construction of Research Facilities (CRF).

The President's request includes $754.7 million for R&D in the STRS account for FY2016, $79.2 million (11.7%) above FY2015 funding. According to NIST, activities with increased requested funding in this account for FY2016 include: advanced manufacturing, up $24 million; ensuring a world-class neutron research facility, up $11 million; disaster resilience, up $10 million; advanced communications, up $9 million; cybersecurity, up $7 million; Smart Cities/cyber-physical systems, up $5 million; quantum information science, up $5 million; and a lab-to-market/technology transfer initiative, up $4 million.[88]

The President is requesting $306.0 million for the ITS account for FY2016, including $141.0 million for the Manufacturing Extension Partnership (MEP) program (up $11.0 million, 8.5%, from FY2015), $15.0 million for the Advanced Manufacturing Technology Consortia (AMTech) (up $6.9 million, 85.2%, from FY2015), and $150.0 million for the Network for Manufacturing Innovation (NMI).[89] The Revitalize American Manufacturing and Innovation Act of 2014 (RAMIA, Title VII of Division B of the Consolidated and Further Continuing Appropriations Act, 2015 [P.L. 113-235]) authorized the NMI with provisions largely mirroring the National Network for Manufacturing Innovation (NNMI) first proposed by President Obama in his FY2013 budget request and renewed in his FY2014 and FY2015 requests. RAMIA authorizes NIST to carry out the NMI program using $5 million per year for FY2015-FY2024 from funds appropriated to the ITS account. The act also authorizes DOE to transfer to NIST up to $250 million over the FY2015-FY2024 period from funds appropriated for advanced manufacturing R&D in the DOE Energy Efficiency and Renewable Energy account. The President's FY2016 budget also includes a request for $1.9 billion in mandatory funding for NIST for the establishment of 29 additional centers between FY2017 and FY2024, bringing the total number of centers to 45.

[87] This section was written by John F. Sargent, Jr., Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[88] National Institute of Standards and Technology, "Programs with increased funding requests," press release, February 3, 2015, http://nist.gov/public_affairs/releases/budget-2016.cfm.

[89] For more information, see "National Network for Manufacturing Innovation."

The President is requesting $59.0 million for the NIST CRF account, up $8.7 million (17.3%) over FY2015.[90]

NIST's extramural programs (currently the MEP and AMTech), which are directed toward increased private-sector commercialization, have been a source of contention. Some Members of Congress have expressed skepticism about a technology policy based on providing federal funds to industry for the development of what are termed "pre-competitive generic technologies." This skepticism, coupled with pressures to balance the federal budget, previously led to proposals for the elimination of NIST extramural activities. In 2007, similar concerns led to the Advanced Technology Program being terminated and replaced by the Technology Innovation Program, which operated until Congress withdrew its funding in FY2012.

As part of the American Competitiveness Initiative, announced in 2006, the Bush Administration stated its intention to double funding over 10 years for "innovation-enabling research" done, in part, at NIST through its "core" programs (defined as the STRS and CRF accounts). In April 2009, President Obama indicated his decision to double the budget of key science agencies, including the NIST STRS and CRF accounts, over the next 10 years. In President Obama's FY2011 budget the time frame for doubling slipped to 11 years; his FY2012 budget was silent on a time frame for doubling. There is no mention of doubling or a time frame in the FY2016 budget request. For more information on the doubling effort, see "Efforts to Double Certain R&D Accounts."

Table 14. NIST Appropriations

(budget authority, in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Enacted
Base Budget					
Scientific and Technical Research and Services (STRS)	**$675.5**	**$754.7**			
Industrial Technology Services (ITS) [a]	**138.1**	**306.0**			
Manufacturing Extension Partnership (MEP)	130.0	141.0			
Adv. Mfg. Technology Consortia (AmTech)	8.1	15.0			
National Network for Mfg. Innovation (NNMI)	[b]	150.0			
Construction of Research Facilities (CRF)	**50.3**	**59.0**			
NIST, Total (Base Budget)	**863.9**	**1,119.7**			
Wireless Innovation (WIN) Fund	**$300.0**[c]				
Mandatory Funding					
National Network for Manufacturing Innovation (NNMI)		**1,930.0**			

Source: U.S. Department of Commerce, *Department of Commerce, Budget in Brief, Fiscal Year 2016,* http://www.osec.doc.gov/bmi/budget/FY16BIB/EntireDocument-WebVersionWithCharts.pdf; FY2016 Congressional Budget Justification for the National Institute of Standards and Technology/National Technical

[90] National Institute of Standards and Technology, "Programs with Increased Funding Requests," press release, February 3, 2015, http://nist.gov/public_affairs/releases/budget-2016.cfm.

Information Service, http://www.osec.doc.gov/bmi/budget/FY16CJ/NIST-NTIS_FY_2016_CJ_Final_508_Compliant.pdf.

Notes:

a. The Revitalize American Manufacturing and Innovation Act of 2014 authorizes NIST to use $5 million per year for FY2015-FY2024 from funds appropriated to its Industrial Technology Services account to carry out the NMI program. The act also authorizes the Department of Energy to transfer to NIST up to $250 million over the FY2015-FY2024 period from funds appropriated for advanced manufacturing R&D.

b. The President's FY2015 budget proposed the establishment of the NNMI to promote the development of manufacturing technologies with broad applications. This request was not part of the President's FY2015 base budget request, but rather a part of the adjunct $56 billion Opportunity, Growth, and Security Initiative (OGSI) proposal. The OGSI included $2.4 billion to establish up to 45 NNMI institutes. Both of the President's two previous budget requests sought mandatory appropriations to NIST of $1 billion in support of up to 15 NNMI manufacturing innovation institutes.

c. The spectrum auction authorized by the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96) provided $300.0 million for NIST; these funds will be used in FY2015 and future years.

National Oceanic and Atmospheric Administration[91]

The Commerce Department's National Oceanic and Atmospheric Administration (NOAA) conducts scientific research in areas such as ecosystems, climate, global climate change, weather, and oceans; supplies information on the oceans and atmosphere; and manages coastal and marine organisms and environments. NOAA was created in 1970 by Reorganization Plan No. 4.[92] The reorganization was intended to unify elements of the nation's environmental activities and to provide a systematic approach for monitoring, analyzing, and protecting the environment. One of the agency's main challenges is related to its diverse mission of science, service, and stewardship. A review of research undertaken by NOAA found, "The major challenge for NOAA is connecting the pieces of its research program and ensuring research is linked to the broader science needs of the agency."[93]

NOAA's Research Council has developed a five-year plan (2013-2017) to guide the agency's R&D efforts.[94] R&D efforts support the long-term goals and enterprise objectives of NOAA's *Next Generation Strategic Plan*.[95] The strategic plan is organized into four categories of long-term goals including (1) climate adaptation and mitigation, (2) a weather-ready nation,[96] (3) healthy oceans, and (4) resilient coastal communities and economies; and three groups of enterprise objectives including (1) stakeholder engagement, (2) data and observations, and (3)

[91] This section was written by Harold F. Upton, Analyst in Natural Resources Policy, CRS Resources, Science, and Industry Division.

[92] "Reorganization Plan No. 4 of 1970," 35 *Federal Register* 15627-15630, October 6, 1970; see also http://www.lib.noaa.gov/noaainfo/heritage/ReorganizationPlan4.html.

[93] Dr. Kathryn Sullivan, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator, *NOAA Response to the NOAA Science Advisory Board's Portfolio Review Task Force Report* , NOAA, April 15, 2014, http://www.sab.noaa.gov/Reports/2014/NOAA.Response.to.PRTF.Report_2014.04.15.pdf.

[94] NOAA, *Research and Development at NOAA*, Five-Year Research and Development Plan 2013-2017, Washington, DC, 2014, http://nrc.noaa.gov/CouncilProducts/ResearchPlans/5YearRDPlan/NOAA5YRPHome/Preface/Purpose.aspx.

[95] NOAA, *NOAA's Next-Generation Strategic Plan*, Silver Spring, MD, December 2010, http://www.ppi.noaa.gov/wp-content/uploads/NOAA_NGSP.pdf.

[96] According to NOAA a weather-ready nation is envisioned as a society that is prepared for and responds to weather-related events.

integrated environmental modeling. To achieve the strategic plan's goals and objectives, NOAA has identified gaps in knowledge and capabilities. NOAA's R&D plan attempts to address these gaps by asking key questions. Key questions are used in the plan to frame and organize R&D objectives and to identify tasks associated with achieving these objectives.

The R&D plan notes that it "contains many elements to pursue and efforts must be prioritized as funding will likely not be available for all topics at all times." The plan also describes how priorities are set during the annual planning season. Although the plan identifies many different NOAA R&D efforts, it does not consider the relative importance of these efforts and related funding needs. Another challenge identified in the NOAA R&D plan is the need to integrate the diverse perspectives and professional expertise required by the agency's mission. The plan states that "holistically understanding the earth system is not only understanding its individual components, but understanding and interpreting the way each of the components interact and behave as an integrated composite that is more than the sum of its parts."

For FY2016, President Obama is requesting $911.7 million in R&D funding for NOAA, an increase of $229.5 million (33.7%) above the FY2015 enacted level of $682.2 million. In the FY2016 request, R&D accounts for 15.3% of NOAA's total funding. The R&D request consists of $498.6 million for research (54.7% of total R&D funding), $97.8 million for development (10.7%), and $315.4 million for R&D equipment (34.6%).[97] Most of the $163.1 million increase for R&D equipment would be used for NOAA vessel construction and fleet improvements.

NOAA's administrative structure is organized by five line offices that reflect its diverse mission: the National Ocean Service (NOS); National Marine Fisheries Service (NMFS); National Environmental Satellite, Data, and Information Service (NESDIS); National Weather Service (NWS); and Office of Oceanic and Atmospheric Research (OAR). In addition to NOAA's five line offices, Program Support (PS), a cross-cutting budget activity, includes the Office of Marine and Aviation Operations (OMAO). **Table 15** provides R&D funding levels by line office for FY2015 and the FY2016 request.[98]

The Office of Oceanic and Atmospheric Research is the primary center for R&D within NOAA. In FY2015, OAR accounts for 60.3% of NOAA's total R&D funding. The President's FY2016 request would provide OAR with $471.1 million to fund R&D, an increase of $59.9 million (14.6%) above the FY2015 enacted funding level of $411.2 million.[99]

OAR conducts research in three major areas which include weather and air chemistry; climate; and oceans, coasts, and the Great Lakes. A significant portion of these efforts is implemented through partnerships between NOAA and cooperative research institutes and the National Sea Grant College Program. NOAA supports 16 cooperative research institutes that work with seven NOAA laboratories in all three of the main OAR research areas. The President's FY2016 request would fund the cooperative institutes with a total of $165.6 million, $8.6 million (5.5%) more than the FY2015 enacted funding level of $157.0 million.

The National Sea Grant College Program is composed of 33 university-based state programs. Sea Grant programs support scientific research and engage constituents to identify and solve problems

[97] Courtney Barry, NOAA Budget Office, email to CRS, February 3, 2015.

[98] Ibid.

[99] Ibid.

faced by coastal communities. The President's FY2016 request would provide the National Sea Grant College Program with a total of $68.5 million, $1.2 million (1.8%) more than the FY2015 enacted funding level of $67.3 million.

Table 15. NOAA R&D

(budget authority, in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
National Ocean Service (NOS)	$73.8	$77.9			
National Marine Fisheries Service (NMFS)	70.9	76.8			
National Weather Service (NWS)	19.0	26.1			
National Environmental Satellite, Data, and Information Service (NESDIS)	26.0	25.9			
Office of Marine and Aviation Operations[a] (OMAO)	81.2	233.9			
Office of Oceanic and Atmospheric Research (OAR)	411.2	471.1			
Total, R&D	**682.2**	**911.7**			
OAR Total, R&D and Non-R&D	**446.3**	**507.0**			
NOAA Total, R&D and Non-R&D	**5,441.0**	**5,976.9**			

Source: Courtney Barry, NOAA Budget Office, email to CRS concerning NOAA R&D, February 3, 2015

Note:

a. All Office of Marine and Aviation Operations funding is for equipment related to R&D.

Department of Agriculture[100]

The U.S. Department of Agriculture (USDA) was created in 1862 in part to support agricultural research in an expanding, agriculturally dependent country. USDA conducts intramural research at federal facilities with government-employed scientists, and supports external research at universities and other facilities through competitive grants and formula-based funding. The breadth of contemporary USDA research spans traditional agricultural production techniques, organic and sustainable agriculture, bioenergy, nutrition needs and composition, food safety, animal and plant health, pest and disease management, economic decision making, and other social sciences affecting consumers, farmers, and rural communities.

Four agencies carry out USDA's research and education activities, grouped together into the Research, Education, and Economics (REE) mission area. The agencies are the Agricultural Research Service (ARS), National Institute of Food and Agriculture (NIFA), National Agricultural Statistics Service (NASS), and Economic Research Service (ERS).[101]

For FY2016, the President's request[102] would provide a total of $3.167 billion for the USDA research mission area, $442 million (16%) more than the FY2015 enacted amount. Nearly half of the requested increase is for ARS (mostly for buildings and facilities), and most of the rest of the increase is for NIFA competitive grants. (See **Table 16.**)

Agricultural Research Service

The Agricultural Research Service is USDA's in-house basic and applied research agency. It operates approximately 90 laboratories nationwide with about 7,400 employees. ARS also operates the National Agricultural Library, one of the Department's primary information repositories for food, agriculture, and natural resource sciences. ARS laboratories focus on efficient food and fiber production, development of new products and uses for agricultural commodities, development of effective controls for pest management, and support of USDA regulatory and technical assistance programs.

For FY2016, the President's request would provide $1.397 billion for ARS, $220 million (19%) more than FY2015. The request is composed of $1.192 billion for ARS salaries and expenses, plus $206 million for ARS buildings and facilities construction. The salaries and expenses portion would be $59 million (5%) more than enacted in FY2015. The buildings and facilities portion would be $161 million (358%) more than FY2015; FY2015 was the first time in several years that this account received appropriations.

[100] This section was written by Jim Monke, Specialist in Agricultural Policy, CRS Resources, Science, and Industry Division.

[101] For more background on agricultural research, see CRS Report R40819, *USDA's Research, Education, and Economics (REE) Mission Area: Issues and Background*, by Dennis A. Shields. For background on FY2015 agricultural appropriations, see CRS Report R43669, *Agriculture and Related Agencies: FY2015 Appropriations*, coordinated by Jim Monke.

[102] USDA, *FY2016 USDA Budget Summary and Annual Performance Plan*, at http://www.obpa.usda.gov/budsum/fy16budsum.pdf; and USDA, *FY2016 USDA Budget Explanatory Notes for Committee on Appropriations*, at http://www.obpa.usda.gov/fy16explan_notes.html.

ARS proposes increases across several programmatic areas on prioritized research projects, coupled with reductions in funding for several existing programs. This is similar to prior-year appropriations requests for which Congress rejected many, if not most, of the reductions.

For buildings and facilities, which comprises most of the ARS budget increase, ARS has prioritized construction of a Biocontainment Laboratory and Consolidated Poultry Research Facility in Athens, GA. The FY2015 appropriation directed funding to "priorities identified in the USDA ARS Capital Investment Strategy."[103] Of the $206 million requested for ARS buildings and facilities in FY2016, $114 million would be to complete the Athens poultry facility. The rest would be for modernization of facilities in Beltsville, MD ($37 million); Houston, TX ($29 million); Ames, IA ($14 million); and Tucson, AZ ($12 million).

National Institute of Food and Agriculture

The National Institute of Food and Agriculture provides federal funding for research, education, and extension projects conducted in partnership with the State Agricultural Experiment Stations, the State Cooperative Extension System, land grant universities, colleges, and other research and education institutions, as well as individual researchers. These partnerships include the 1862 land-grant institutions, 1890 historically black colleges and universities (HBCUs), 1994 tribal land-grant colleges, and Hispanic-serving institutions.[104] Federal funds enhance capacity at universities and institutions by statutory formula funding, competitive awards, and grants.

For FY2016, the President's request would provide $1.503 billion for NIFA, $214 million (17%) more than the FY2015 appropriation. Administratively, USDA proposes to merge NIFA's three primary accounts (Research and Education, Extension, and Integrated Activities) into a single NIFA-wide account. Individual programs, as discussed below, largely would continue to be funded separately, albeit not identified within one of the former programmatic activities.

The Agriculture and Food Research Initiative (AFRI), USDA's flagship competitive grants program with potentially 30% of NIFA's total budget, would receive $450 million—an increase of $125 million over FY2015. Formula funded programs would increase more modestly. Under the President's FY2016 request, 1862 land-grant universities would receive Hatch Act authorized appropriations of $256 million, up $12 million (5%) over FY2015, and the Evans-Allen program that funds 1890 HBCUs, would receive $60 million, up $8 million (15%) to accommodate additional universities that became eligible in the 2014 farm bill. Extension funding would remain nearly constant.

The Administration proposes to establish two new "Innovation Institutes" as part of the Administration's multiagency National Network for Manufacturing Innovation. (For additional information, see "National Network for Manufacturing Innovation.") These centers would focus on emerging agricultural research challenges such as biomanufacturing and nanocellulosics. The public-private institutes would receive $80 million per year.

[103] USDA-ARS, *The USDA Agricultural Research Service Capital Investment Strategy*, April 2012, at http://www.ars.usda.gov/sp2UserFiles/Subsite/ARSLegisAffrs/USDA_ARS_Capital_Investment_Strategy_FINAL_eeo.pdf.

[104] The numbers 1862, 1890, and 1994 in this context refer to the years that laws were enacted creating these classifications of colleges and universities, not to the number of institutions.

The request for USDA also follows the Administration's federal STEM education funding consolidation. (For additional information, see "Reorganization of STEM Education Programs.") USDA would no longer fund Higher Education Challenge Grants, Graduate and Post-graduate Fellowship Grants, Higher Education Multicultural Scholars Program, Women and Minorities in STEM Program, Agriculture in the Classroom, and Secondary/Postsecondary Challenge Grants.

National Agricultural Statistics Service

The National Agricultural Statistics Service conducts the Census of Agriculture and provides official statistics on agricultural production and indicators of the economic and environmental status of the farm sector. For FY2016, the President's request would provide $180 million for NASS, an increase of $8 million (5%) over FY2015. NASS plans additional survey coverage of antimicrobial resistance, pollinator issues, fruit and vegetable estimates, and satellite-based agricultural statistics.

Economic Research Service

The Economic Research Service supports economic and social science information analysis on agriculture, rural development, food, commodity markets, and the environment. It collects and disseminates data concerning USDA programs and policies to various stakeholders. For FY2016, the President's request would provide $86 million for ERS, an increase of less than $1 million (0.8%) over FY2015.

Table 16. U.S. Department of Agriculture R&D

(budget authority in millions of dollars)

Agency or Major Program	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Agricultural Research Service (ARS)	1,132.6	1,191.5			
Buildings and Facilities	45.0	205.9			
Subtotal, ARS	**1,177.6**	**1,397.4**			
National Institute of Food and Agriculture (NIFA)					
Research and Education					
AFRI (competitive grants)	*325.0*	*450.0*			
Hatch Act (1862 institutions)	*243.7*	*256.2*			
Evans-Allen (1890s institutions)	*52.5*	*60.5*			
McIntire-Stennis (forestry)	*34.0*	*34.0*			
Innovation Institutes		*80.0*			
Other	*131.7*	*ns*			
Subtotal	786.9	ns			
Extension					
Smith-Lever (b) & (c)	*300.0*	*304.0*			
Smith-Lever (d)	*85.5*	*86.0*			

Agency or Major Program	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Other	*86.2*	*ns*			
Subtotal	471.7	ns			
Integrated Activities	30.9	ns			
Subtotal, NIFA	**1,289.5**	**1,503.1**			
National Agricultural Statistics Service (NASS)	**172.4**	**180.3**			
Economic Research Service (ERS)	**85.4**	**86.0**			
Total, USDA Research Mission Area	**2,724.9**	**3,166.9**			

Source: CRS, compiled from tables in the joint explanatory statements for P.L. 113-235 and P.L. 113-76, the OMB *FY2016 Budget Appendix*, and the USDA *FY2016 Budget Explanatory Notes*.

Notes: "ns" indicates that the figure is "not specified" in the President's FY2016 budget request. Components may not add to subtotals.

Department of the Interior[105]

The Department of the Interior (DOI) was created to protect and manage the nation's natural resources and cultural heritage and provides scientific and other information about those resources. DOI's responsibilities include, among other things, mapping, geological, hydrological, and biological science; migratory bird and wildlife conservation; endangered species preservation; surface-mined lands protection and restoration; and historic preservation.[106]

The Administration is requesting $1.075 billion in DOI R&D funding for FY2016, $140.2 million (15.0%) above its FY2015 enacted level of $934.6 million.[107]

According to DOI,

> Activities supported by this [R&D] funding range from scientific observations of the Earth and its systems—including water, wildlife, and plants—to applied field research to better address specific problems such as sea level rise, invasive species, and drought. This research reflects and informs the expertise of Interior's land managers who are on the front lines of a changing climate and confronting the unpredictable nature of its impacts.[108]

[105] This section was written by John F. Sargent, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[106] Department of the Interior, *Strategic Plan for Fiscal Years 2014-2018*, http://www.doi.gov/pmb/ppp/upload/DOI-Strategic-Plan-for-FY-2014-2018-POSTED-ON-WEBSITE.pdf.

[107] Email correspondence between the DOI budget office and CRS.

[108] Department of the Interior, *Fiscal Year 2016: The Interior Budget in Brief*, February 2015, p. DH-50, http://www.doi.gov/budget/appropriations/2016/highlights/upload/2016_Highlights_Bookv3.pdfhttp://www.doi.gov/budget/appropriations/2015/highlights/upload/2015_Highlights_Book.pdf.

Of the R&D funding requested for FY2016, 5.6% is for basic research, 81.4% is for applied research, and 13.0% is for development. The U.S. Geological Survey (USGS) is the only DOI component that conducts basic research.[109]

Funding for DOI R&D is generally included in appropriations line items that also include non-R&D activities; therefore, it is not possible to identify precisely how much of the funding provided in appropriations laws is allocated to R&D specifically unless funding is provided at the precise level of the request. In general, R&D funding levels are known only after DOI components allocate their appropriations to specific activities and report those figures.

U.S. Geological Survey

A single account, Surveys, Investigations, and Research (SIR), provides all USGS funding. USGS R&D is conducted under seven SIR activity/program areas: Ecosystems; Climate and Land Use Change; Energy, Minerals, and Environmental Health; Natural Hazards; Water Resources; Core Science Systems; and Science Support.

The President's total FY2016 budget request for USGS (SIR account) is $1.104 billion. Requested SIR funding includes $761.1 million for R&D, an increase of $95.3 million (14.3%) over the FY2015 level of $665.8 million. This total includes $176.3 million for Ecosystems, up $19.3 million (12.3%); $140.1 million for Climate and Land Use Change, up $40.1 million (40.1%); $103.3 million for Energy, Minerals, and Environmental Health, up $11.0 million (12.0%); $116.9 million for Natural Hazards, up $5.6 million (5.1%); $128.2 million for Water Resources, up $6.5 million (5.4%); $95.9 million for Core Science Systems, up $12.7 million (15.2%); $0.4 million for Science Support, up $17,000 (4.0%).[110]

Other DOI Components

In addition to the USGS, the President's FY2016 request includes R&D funding for the following DOI components: [111]

- Bureau of Reclamation (BOR): $85.9 million in applied research and development funding for FY2016, up $9.9 million (13.1%) from FY2015.
- Bureau of Ocean Energy Management (BOEM): $69.3 million in applied research and development funding for FY2016, down $1.2 million (1.7%) from FY2015.
- Fish and Wildlife Service (FWS): $49.7 million in applied research for FY2016, up $17.2 million (53.1%) from FY2015.
- Bureau of Land Management (BLM): $31.0 million in applied research and development for FY2016, up $10.8 million (53.4%) from FY2015.
- National Park Service (NPS): $28.2 million in applied research and development for FY2016, up $1.2 million (4.4%) from FY2015.

[109] Email correspondence between the DOI budget office and CRS.

[110] Ibid.

[111] Email correspondence between the DOI budget office and CRS.

- Bureau of Safety and Environmental Enforcement (BSEE): $26.7 million in applied research for FY2016, down $0.4 million (1.4%) from FY2015.
- Bureau of Indian Affairs (BIA): $12.5 million in applied research for FY2016, up $3.0 million (31.6%) from FY2015.
- Wildland Fire Management (WFM): $6.0 million in applied research for FY2016, equal to the FY2015 level.
- Office of Surface Mining Reclamation and Enforcement (OSMRE): $4.4 million in applied research for FY2016; the office received no funding for R&D in FY2015.

Table 17 summarizes FY2015 R&D funding and the President's FY2016 R&D funding request for DOI components.

Table 17. Department of the Interior R&D

(budget authority, in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
U.S. Geological Survey (USGS)	$665.8	$761.1			
Bureau of Reclamation (BOR)	76.0	85.9			
Bureau of Ocean Energy Management (BOEM)	70.5	69.3			
Fish and Wildlife Service (FWS)	32.5	49.7			
Bureau of Land Management (BLM)	20.2	31.0			
National Park Service (NPS)	27.0	28.2			
Bureau of Safety and Environmental Enforcement (BSEE)	27.1	26.7			
Bureau of Indian Affairs (BIA)	9.5	12.5			
Wildland Fire Management (WFM)	6.0	6.0			
Office of Surface Mining Reclamation and Enforcement (OSMRE)	0.0	4.4			
Department of the Interior, Total	**$934.6**	**$1,074.8**			

Source: Department of the Interior, *Fiscal Year 2016: The Interior Budget in Brief*, February 2015, p. DH-51, http://www.doi.gov/budget/appropriations/2016/highlights/upload/2016_Highlights_Bookv3.pdf; email correspondence between the DOI budget office and CRS.

Note: Totals may differ from the sum of the components due to rounding.

Environmental Protection Agency[112]

The U.S. Environmental Protection Agency (EPA), the federal regulatory agency responsible for implementing a number of environmental pollution control laws, funds a broad range of R&D activities to provide scientific tools and knowledge that support decisions relating to preventing, regulating, and abating environmental pollution. Beginning in FY2006, Congress has funded EPA through the Interior, Environment, and Related Agencies appropriations. Funding for EPA R&D is generally included in line items that also include non-R&D activities; therefore, it is not possible to identify precisely how much of the funding provided in appropriations laws is allocated to R&D specifically unless funding is provided at the precise level of the request (see discussion later in this section). In general, R&D funding levels are known only after EPA allocates its appropriations to specific activities and reports those figures. The agency's Science and Technology (S&T) account funds much of EPA's scientific research activities. These activities include R&D conducted by the agency at its own laboratories and facilities, and R&D and other related scientific evaluations conducted by universities, foundations, and other non-federal entities that receive EPA grants. The S&T account receives a base appropriation and a transfer from the Hazardous Substance Superfund (Superfund) account.[113] The transferred funds are for research on more effective methods to clean up contaminated sites.

The President's FY2016 budget requests $785.3 million for EPA's S&T account, including transfers from the Hazardous Substance Superfund account ($16.2 million). This is $31.8 million (4.2%) above the $753.5 million (including the Superfund transfer) appropriated for FY2015.[114] As indicated in **Table 18** at the end of this section, the FY2016 requested total base (prior to transfers) for the S&T account is $769.1 million, $34.5 million (4.7%) above the FY2015 enacted level of $734.6 million. The $16.2 million FY2016 requested transfer from the Superfund account is less than the $18.8 million transferred in FY2015.

The requested base amount for the S&T account for FY2016 includes mostly increases for individual EPA program and activity line items below the account level compared to the FY2015 enacted levels.[115]

One of the largest percentage increases in the FY2016 request within the S&T account is for the Computational Toxicology activity in the Research: Chemical Safety and Sustainability program area. The $33.8 million requested for Computational Toxicology in FY2016 is $12.4 million

[112] This section was written by Robert Esworthy, Specialist in Environmental Policy, CRS Resources, Science, and Industry Division.

[113] The EPA S&T account incorporates elements of the former EPA Research and Development account, as well as portions of the former Salaries and Expenses and Program Operations accounts, which were in place until FY1996. Since 1996, EPA's annual appropriations have been requested, considered, and enacted according to eight statutory appropriations accounts established by Congress. A ninth account, Hazardous Waste Electronic Manifest System Fund, was added during the FY2014 budget process. Because of the differences in the scope of the activities included in these accounts, comparisons before and after FY1996 are not readily available.

[114] For an overview of the EPA FY2015 appropriations see CRS Report R43709, *Environmental Protection Agency (EPA): FY2015 Appropriations*, by Robert Esworthy.

[115] "Explanatory Statement" submitted by the Chairman of the House Committee on Appropriations in the House *Congressional Record*, vol. 160 No. 151-Book II (December 11, 2014), http://www.gpo.gov/fdsys/pkg/CREC-2014-12-11/content-detail.html. Under Division F, see discussion regarding EPA S&T account under "Title II—Environmental Protection Agency," p. H9766; and in the funding table, pp. H9801-H9802.

(57.9%) more than the FY2015 enacted level of $21.4 million. Within the S&T account, the FY2016 request includes $100.3 million for Air, Climate, and Energy (ACE) Research, an $8.4 million (9.1%) increase above the FY2015 enacted level, and $111.0 million for Safe and Sustainable Water (SSW) Resources, a $3.6 million (3.4%) increase compared to FY2015 enacted level. Contributing to these two requested increases are proposed $3.8 million and $3.7 million increases under ACE and SSW, respectively, as part of EPA's overall research efforts to address additional questions regarding the safety of hydraulic fracturing.[116] Concerns regarding potential drinking water impacts associated with hydraulic fracturing are likely to continue as an area of considerable interest during the 114th Congress.[117]

The largest proposed decrease in dollar terms in the S&T account is for Research: Sustainable and Healthy Communities. There, the $139.2 million requested is $10.8 million (7.2 %) less than the $150.0 million FY2015 enacted appropriation.[118] This decrease is attributable to the proposed $11.1 million reduction for EPA's Science to Achieve Results (STAR) and Greater Research Opportunities (GRO) fellowship programs as part of the Administration's proposal for reorganization and consolidation of STEM education programs.[119] (For additional information, see "Reorganization of STEM Education Programs" above.)

EPA's FY2016 congressional justification includes a proposal to eliminate $0.2 million within the S&T account appropriated in FY2015 to support radon testing.[120] The FY2014 and FY2015 budget requests also proposed eliminating this funding.[121] For FY2015, Congress rejected the proposed elimination of radon activities but did not specify a funding amount for these activities within the S&T account.[122] The FY2016 budget request proposes eliminating the indoor radon (categorical) state grants ($8.1 million) in the State and Tribal Assistance Grants (STAG) account,[123] the same as in the FY2015 request. In the explanatory statement the December 11, 2014 *Congressional Record*, Congress appropriated $8.1 million for the radon state grants FY2015,[124] rejecting the proposed elimination of funding in the FY2015 request. In addition to the proposed decreases for the radon program, the FY2016 request proposes increased funding within the Environmental Program and Management (EPM) account to support continuance of the EPA's Federal Radon Action plan to reduce radon risks and improve the public's understanding related to the risks associated with radon.[125]

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[116] U.S. EPA, *Fiscal Year 2016 Justification of Appropriations Estimates for the Committee on Appropriations: Science and Technology*, February 2015, pp. 39, 156-157, and 162-166, http://www2.epa.gov/sites/production/files/2015-02/documents/epa_fy_2016_congressional_justification.pdf.

[117] For more information, see CRS Report R41760, *Hydraulic Fracturing and Safe Drinking Water Act Regulatory Issues*, by Mary Tiemann and Adam Vann.

[118] See footnote 116, pp. 168-174, and footnote 115.

[119] See footnote 116, pp. 173.

[120] See footnote 116, pp. 107-108.

[121] See EPA's FY2014 Justification of Appropriation Estimates for Committee on Appropriations (FY2014 Congressional Justification), http://www2.epa.gov/planandbudget/archive, p. viii, p. 15, and pp. 99-100, and EPA's FY2015 Justification of Appropriation Estimates for Committee on Appropriations (FY2015 Congressional Justification), http://www2.epa.gov/planandbudget/fy2015, pp.101-102.

[122] See footnote 115, p. H9766.

[123] See footnote 116, pp. x, 794-795.

[124] See footnote 115, Table on p. H9808

[125] See footnote 116, pp. 555-556.

The FY2015 appropriations (P.L. 113-235) included $4.1 million for Research: National Priorities, a slight decrease compared to the $4.2 million FY2014 enacted level. The FY2015 funding, like FY2014 funding, was for competitively awarded research grants to fund "high-priority water quality and availability research by not-for-profit organizations."[126] As in previous requests, the President's FY2016 budget request did not include funding for Water Quality Research and Support Grants: Congressional Priorities.[127]

The EPA's Office of Research and Development (ORD) is the primary manager of R&D at EPA headquarters and laboratories around the country, as well as external R&D. A large portion of the S&T account funds EPA R&D activities managed by ORD, including the agency's research laboratories and research grants. Many of the programs implemented by other offices within EPA have a research component, but the research component is not necessarily the primary focus of the program.

Table 18. Environmental Protection Agency Science &Technology (S&T) Account

(millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Science and Technology Appropriations Account					
Clean Air and Climate	$116.5	$124.8			
Clean Air Allowance Trading Program	NR	7.8			
Climate Protection Program	8.0	8.1			
Federal Support for Air Quality Management	NR	8.5			
Federal Vehicle and Fuel Standards and Certification	NR	100.4			
Enforcement	13.7	14.4			
Homeland Security	37.1	38.1			
Indoor Air and Radiation	6.0	6.6			
Indoor Air: Radon	NR	0.0			
Radiation: Protection	NR	2.2			
Radiation: Response Preparedness	NR	4.0			
Reduce Risks from Indoor Air	NR	0.4			
IT/Data Management/Security	3.1	3.2			
Operations and Administration	68.3	79.2			
Pesticide Licensing	6.0	7.7			
Research: Air, Climate, and Energy	91.9	100.3			
Research: Chemical Safety and Sustainability	126.9	140.7			
Human Health Risk Assessment	NR	39.3			

[126] See footnote 115, pp. H9766, and H9802.

[127] See footnote 116, pp.193-194, and 1046.

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Research: Computational Toxicology	21.4	33.8			
Research: Endocrine Disruptor	16.3	15.4			
Research: Other Activities	NR	52.3			
Research: Safe and Sustainable Water Resources	107.4	111.0			
Research: Sustainable and Healthy Communities	150.0	139.2			
Water: Human Health Protection (Drinking Water Programs)	3.5	3.8			
Research: National [Congressional] Priorities (Water Quality and Availability)	4.1	0.0			
Subtotal S&T Account Base Appropriations	**734.6**	**769.1**			
Transfer in from Hazardous Substance Superfund Account	**18.8**	**16.2**			
EPA, Total (Science and Technology)	**753.5**	**785.3**			

Source: Prepared by CRS. FY2015 requested amounts are based on the EPA Fiscal Year 2016 Justification of Appropriation Estimates for the Committee on Appropriations, http://www2.epa.gov/sites/production/files/2015-02/documents/epa_fy_2016_congressional_justification.pdf. The FY2015 enacted amounts are as presented in the table in the House *Congressional Record*, vol. 160, No. 151-Book II (December 11, 2014), pp. H9801-H9802, http://www.lis.gov/crtext/113-datesection.shtml.

Notes: The NR (not reported) indicates those instances where the December 11, 2014, *Congressional Record*, did not specify funding amounts for these sub-program activities. Totals may differ from the sum of the components.

Department of Transportation[128]

The Department of Transportation (DOT) seeks to ensure a fast, safe, efficient, accessible, and convenient transportation system. DOT's goals include improving public health and safety by reducing transportation-related fatalities and injuries; ensuring the United States maintains critical transportation infrastructure in a state of good repair; promoting transportation policies and investments that bring lasting and equitable economic benefits; fostering livable communities by integrating transportation policies, plans, and investments with housing and economic development policies; and advancing environmentally sustainable policies and investments that reduce carbon and other harmful emissions from transportation sources.

President Obama is requesting $1.046 billion for Department of Transportation R&D and R&D facilities in FY2016, an increase of $244.6 million (30.5%) from the FY2015 enacted level. (See **Table 19**.) Two DOT agencies—the Federal Highway Administration (FHWA) and the Federal Aviation Administration (FAA)—account for more than three-fourths of the department's R&D funding (79.1% in the FY2016 request).[129]

[128] This section was written by John F. Sargent, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[129] Except as noted otherwise, the R&D funding figures in this section come from unpublished data provided by the DOT budget office to CRS by email on February 24, 2015.

Funding for DOT R&D is generally included in appropriations line items that also include non-R&D activities; therefore, it is not possible to identify precisely how much of the funding provided in appropriations laws will be allocated to R&D specifically unless funding is provided at the precise level of the request. In general, R&D funding levels are known only after DOT agencies allocate their appropriations to specific activities and report those figures.

Federal Highway Administration

Under the President's request, the Federal Highway Administration would receive $453.3 million in R&D funding in FY2016, an increase of $89.5 million (24.6%) from the FY2015 enacted level. The President's request would provide $130.0 million for highway R&D, up $22.0 million (20.4%); $139.5 million for Intelligent Transportation Systems R&D, up $64.1 million (84.8%); $167.1 million for State Planning and Research, up $3.2 million (1.9%); and $16.7 million for R&D-related administrative expenses.[130]

Federal Aviation Administration

Under the President's request, the Federal Aviation Administration would receive $374.2 million for R&D and R&D facilities in FY2015, an increase of $93.7 million (33.4%) from the FY2015 enacted level.[131] The FY2016 request includes $342.0 million for research and development, an increase of $86.7 million (34.0%),[132] and $32.3 million for R&D facilities, an increase of $7.0 million (27.7%).

Of this FY2016 request, $166.0 million are included in the FAA's Research, Engineering, and Development (RE&D) account (up $9.3 million, 5.9%). All RE&D account funding is for research and development. The RE&D account supports research in NextGen-specific areas such as wake turbulence, human factors, and clean aircraft technologies, as well as in fire safety, propulsion systems, advanced materials, aircraft icing, and continued airworthiness.

Other DOT Components

A number of other DOT components also fund research and development.

- The President's FY2016 request for National Highway Traffic Safety Administration (NHTSA) R&D and R&D facilities is $76.6 million, an increase of $14.1 million (22.5%) above the FY2015 level.
- The President's FY2016 request for Federal Railroad Administration (FRA) R&D and R&D facilities is $65.3 million, an increase of $22.5 million (52.6%) above the FY2015 level.

[130] FHWA, *Budget Estimates Fiscal Year 2016: Federal Highway Administration*, http://www.dot.gov/sites/dot.gov/files/docs/FY2016-BudgetEstimate-FHWA.pdf.

[131] The FAA notes that $74 million of this increase is due to a reclassification of certain NextGen FY2016 funding as applied R&D "to better align with OMB Circular A-11 Research Definitions."

[132] Ibid.

- The President's FY2016 request for Federal Transit Administration (FTA) R&D and R&D facilities is $28.2 million, an increase of $15.5 million (122.1%) above the FY2015 level.
- The President's FY2016 request for Pipeline and Hazardous Materials Safety Administration (PHMSA) R&D and R&D facilities is $22.0 million, an increase of $0.8 million (3.7%) above the FY2015 level.
- The President's FY2016 request for Federal Motor Carrier Safety Administration (FMCSA) R&D and R&D facilities is $10.6 million, an increase of $4.5 million (74.0%) above the FY2015 level.
- The President's FY2016 request for Office of the Secretary of Transportation (OST) R&D is $15.4 million, an increase of $4.0 million (35.4%) above the FY2015 level.

Table 19 summarizes R&D funding for the DOT components.

Table 19. Department of Transportation R&D and R&D Facilities

(budget authority, in millions of dollars)

	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Federal Highway Administration	$363.8	$453.3			
Federal Aviation Administration	280.5	374.2			
Research, Engineering, and Development	*156.8*	166.0			
National Highway Traffic Safety Administration	62.5	76.6			
Federal Railroad Administration	42.8	65.3			
Railroad Research and Development	*39.1*	*39.3*			
Federal Transit Administration	12.7	28.2			
Pipeline and Hazardous Materials Safety Administration	21.2	22.0			
Office of the Secretary	11.4	15.4			
Federal Motor Carrier Safety Administration	6.1	10.6			
DOT, R&D Total	**801.0**	**1,045.6**			

Source: DOT FY2016 department and agency budget justifications; email communication between CRS and the Department of Transportation, February 24, 2015.

Notes: Figures include R&D and R&D facilities. Totals may differ from the sum of the components due to rounding.

Department of Veterans Affairs[133]

The Department of Veterans Affairs (VA) was created to provide America's veterans with medical care, benefits, social support, and memorials, as well as other support. VA provides a broad range of primary care, specialized care, and related medical and social support services. VA seeks to advance medical R&D in areas that most directly address the diseases and conditions that affect veterans and eligible beneficiaries.

Funding for VA R&D is generally included in appropriations line items that also include non-R&D activities; therefore, it is not possible to know precisely how much of the funding provided for in appropriations laws will be allocated to R&D unless funding is provided at the precise level of the request. In general, R&D funding levels are known only after the VA allocates its appropriations to specific activities and reports those figures.

The President is requesting $1.147 billion for VA R&D in FY2016, up $57.3 million (5.0%) from FY2015. This total includes $621.8 million for the Medical and Prosthetic Research account, up $33.3 million (5.7%), and $525.0 million in funding for research supported by the Medical Care appropriation (up $24.0 million, 4.8%).[134]

The VA Office of Research and Development consists of four main research services:

- biomedical laboratory R&D, which supports preclinical research to understand life processes at the molecular, genomic, and physiological levels;
- clinical science R&D, which administers investigations, including human subject research, to determine the feasibility or effectiveness of new treatments such as drugs, therapy, or devices;
- health services R&D, which supports studies to identify and promote effective and efficient strategies to improve the organization, cost-effectiveness, and delivery of quality of health care; and
- rehabilitation R&D, which develops novel approaches to restore full and productive lives to veterans with traumatic amputation, central nervous system injuries, loss of sight or hearing, or other physical and cognitive impairments.[135]

Table 20 summarizes R&D funding for VA's Research account and Medical Care Support account.

[133] This section was written by John F. Sargent, Specialist in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[134] Department of Veterans Affairs, "Volume II Medical Programs and Information Technology Programs," *Department of Veterans Affairs Congressional Submission, FY2016*, p. VHA-280, http://www.va.gov/budget/docs/summary/Fy2016-VolumeII-MedicalProgramsAndInformationTechnology.pdf.

[135] Ibid., pp. VHA-282 to VHA-283.

Table 20. Department of Veterans Affairs R&D

(budget authority, in millions of dollars)

Account	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Enacted
Research	$588.5	$621.8			
Medical Care Support	501.0	525.0			
Veterans Affairs, Total	**1,089.5**	**1,146.8**			

Source: VA, *2016 Budget In Brief*, p.17, http://www.va.gov/budget/docs/summary/Fy2016-BudgetInBrief.pdf.

Table 21 provides amounts to be spent in Designated Research Areas (DRAs) which VA describe as "areas of particular importance to our veteran patient population."[136] Funding for research projects that span multiple areas may be included in several DRAs; thus, amounts in **Table 21** total to more than the appropriation or request for the VA Research account.

Table 21. Department of Veterans Affairs R&D by Designated Research Area

(in millions of dollars)

	FY2015 Estimate	FY2016 Request
Acute & Traumatic Injury	$20.3	$21.3
Aging	146.9	154.2
Autoimmune, Allergic & Hematopoietic Disorders	27.7	29.1
Cancer	55.0	57.8
CNS Injury & Associated Disorders	89.0	93.5
Degenerative Diseases of Bones & Joints	30.2	31.8
Dementia & Neuronal Degeneration	24.8	26.1
Diabetes & Major Complications	35.0	36.8
Digestive Diseases	20.7	21.7
Emerging Pathogens/Bio-Terrorism	1.0	1.0
Gulf War Veterans Illness	9.5	15.0
Health Systems	62.5	72.7
Heart Disease/Cardiovascular Health	62.3	65.4
Infectious Diseases	33.0	34.7
Kidney Disorders	20.9	22.0
Lung Disorders	27.0	28.3
Mental Illness	110.3	115.8
Military Occupations & Environ Exposures	14.0	16.6
Other Chronic Diseases	4.9	5.1
Prosthetics	15.1	15.8
Sensory Loss	17.1	17.9
Special Populations	19.6	20.6
Substance Abuse	29.4	30.9

Source: VA, "Volume II Medical Programs and Information Technology Programs," *Department of Veterans Affairs Congressional Submission, FY2016*, http://www.va.gov/budget/docs/summary/Fy2016-VolumeII-MedicalProgramsAndInformationTechnology.pdf.

Notes: Amounts in this table add to more than the totals in **Table 20** because projects that span multiple areas may be included in several DRAs.

[136] Ibid., p. VHA-308.

Appendix. Acronyms and Abbreviations

Glossary

ACE	Air, Climate, and Energy
ACI	American Competitiveness Initiative
AD	Alzheimer's Disease
AFRI	Agriculture and Food Research Initiative
AISL	Advancing Informal STEM Learning
AMP	Advanced Manufacturing Partnership – or – Accelerating Medicines Partnership
AMTech	Advanced Manufacturing Technology Consortia
AOAM	Agency Operations and Award Management
ARPA-E	Advanced Research Projects Agency–Energy
ARS	Agricultural Research Service
ATE	Advanced Technological Education
B&F	Buildings & Facilities
BD2K	Big Data to Knowledge
BES	Basic Energy Sciences
BIA	Bureau of Indian Affairs
BIO	Directorate for Biological Sciences
BioMaPS	Research at the Interface of Biological, Mathematical, and Physical Sciences
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BRAIN	Brain Research through Advancing Innovative Neurotechnologies
BSEE	Bureau of Safety and Environmental Enforcement
CAN	Cures Acceleration Network
CAUSE	Catalyzing and Advancing Undergraduate STEM Education
CEMMSS	Cyber-enabled Materials, Manufacturing, and Smart Systems
CIF21	Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education
CISE	Computer and Information Science and Engineering
CRF	Construction of Research Facilities
DARPA	Defense Advanced Projects Research Agency
DHP	Defense Health Program
DHS	Department of Homeland Security
DKIST	Daniel K. Inouye Solar Telescope
DNDO	Domestic Nuclear Detection Office
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
DRAs	Designated Research Areas
ECR	EHR Core Research
EERE	Office of Energy Efficiency and Renewable Energy

EHR	Education and Human Resources
ENG	Engineering
EPA	Environmental Protection Agency
EPM	Environmental Program and Management
EPSCoR	Experimental Program to Stimulate Competitive Research
ERS	Economic Research Service
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FDAAA	Food and Drug Administration Amendments Act of 2007
FHWA	Federal Highway Administration
FIC	Fogarty International Center
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FWS	Fish and Wildlife Service
GAO	Government Accountability Office
GDP	Gross Domestic Product
GEO	Directorate for Geosciences
GRF	Graduate Research Fellowship
GRO	Greater Research Opportunities
GWOT	Global War on Terror
HBCU	Historically Black Colleges and Universities
HBCU-UP	Historically Black Colleges and Universities—Undergraduate Program
HHS	Department of Health and Human Services
IARPA	Intelligence Advanced Research Projects Activity
ICER	Integrative and Collaborative Education and Research
I-Corps	Innovation Corps
ICs	Institutes and Centers
IFF	Iraqi Freedom Fund
IG	Inspector General
IGERT	Integrative Graduate Education and Research Traineeship
IA	Integrative Activities
ISS	International Space Station
ITER	International Thermonuclear Experimental Reactor
ITS	Industrial Technology Services
IUSE	Improving Undergraduate STEM Education
JIEDDF	Joint Improvised Explosive Device Defeat Fund
LBNE	Long Baseline Neutrino Experiment
LCLS-II	Linac Coherent Light Source II
LSAMP	Louis Stokes Alliances for Minority Participation
LSST	Large Synoptic Survey Telescope
MEP	Manufacturing Extension Partnership
MGI	Materials Genome Initiative
MPS	Mathematical and Physical Sciences

MRAPVF	Mine Resistant and Ambush Protected Vehicle Fund
MREFC	Major Research Equipment and Facilities Construction
Mu2e	Muon to Electron Conversion Experiment
NASA	National Aeronautics and Space Administration
NASS	National Agricultural Statistics Service
NBAF	National Bio and Agro-Defense Facility
NCATS	National Center for Advancing Translational Sciences
NCCAM	National Center for Complementary and Alternative Medicine
NCCIH	National Center for Complementary and Integrative Health
NCI	National Cancer Institute
NCSES	National Center for Science and Engineering Statistics
NEI	National Eye Institute
NEON	National Ecological Observatory Network
NESDIS	National Environmental Satellite, Data, and Information Service
NHGRI	National Human Genome Research Institute
NHLBI	National Heart, Lung, and Blood Institute
NHTSA	National Highway Traffic Safety Administration
NIA	National Institute on Aging
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIAID	National Institute of Allergy and Infectious Diseases
NIAMS	National Institute of Arthritis and Musculoskeletal and Skin Diseases
NIBIB	National Institute of Biomedical Imaging and Bioengineering
NICHD	National Institute of Child Health and Human Development
NIDA	National Institute on Drug Abuse
NIDCD	National Institute on Deafness and Other Communication Disorders
NIDCR	National Institute of Dental and Craniofacial Research
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
NIEHS	National Institute of Environmental Health Sciences
NIFA	National Institute of Food and Agriculture
NIGMS	National Institute of General Medical Sciences
NIH	National Institutes of Health
NIMH	National Institute of Mental Health
NIMHD	National Institute on Minority Health and Health Disparities
NINDS	National Institute of Neurological Disorders and Stroke
NINR	National Institute of Nursing Research
NIST	National Institute of Standards and Technology
NITRD	Networking and Information Technology Research and Development
NLM	National Library of Medicine
NMFS	National Marine Fisheries Service
NMI	Network for Manufacturing Innovation
NNI	National Nanotechnology Initiative
NNMI	National Network for Manufacturing Innovation
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service

NPS	National Park Service
NRC	National Research Council
NRI	National Robotics Initiative
NRT	NSF Research Traineeships
NSB	National Science Board
NSET	Nanoscale Science, Engineering, and Technology (NSTC Subcommittee)
NSF	National Science Foundation
NSLS-II	National Synchrotron Light Source II
NSTC	National Science and Technology Council
NWS	National Weather Service
OAR	Oceanic and Atmospheric Research
OCO	Overseas Contingency Operations
OCO-3	Orbiting Carbon Observatory 3
OD	NIH Office of the Director
OGSI	Opportunity, Growth, and Security Initiative
OIG	Office of the Inspector General
OISE	Office of International Science and Engineering
OMAO	Office of Marine and Aviation Operations
OMB	Office of Management and Budget
OOI	Ocean Observatories Initiative
ORD	Office of Research and Development
OST	Office of the Secretary of Transportation
OSTP	Office of Science and Technology Policy
PE	Program Element
PHMSA	Pipeline and Hazardous Materials Safety Administration
PHS	Public Health Service
PMI	Precision Medicine Initiative
PS	Program Support
R&D	Research and Development
R&E	Research and Experimentation
RAMIA	Revitalize American Manufacturing and Innovation Act of 2014
RDT&E	Research, Development, Test, and Evaluation
RE&D	Research, Engineering, and Development
REE	Research, Education, and Economics
REU	Research Experiences for Undergraduates
RIID	Radioisotope Identification Device
RITA	Research and Innovative Technology Administration
RPG	Research Project Grant
RRA	Research and Related Activities
S&T	Science and Technology
SaTC	Secure and Trustworthy Cyberspace
SBE	Social, Behavioral and Economic Sciences
SEES	Science, Engineering, and Education for Sustainability
SIR	Surveys, Investigations, and Research

SLS	Space Launch System
SMGI	Subcommittee on the Materials Genome Initiative (NSTC)
SOFIA	Stratospheric Observatory for Infrared Astronomy
SSW	Safe and Sustainable Water
STAG	State and Tribal Assistance Grants
STAR	Science to Achieve Results
STEM	Science, Technology, Engineering, and Mathematics
STEM+C	Science, Technology, Engineering, and Mathematics + Computing
STRS	Scientific and Technical Research and Services
TCUP	Tribal Colleges and Universities Program
USARC	U.S. Arctic Research Commission
USDA	Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VA	Veterans Administration
WFM	Wildland Fire Management
WIN Fund	Wireless Innovation Fund`

Author Contact Information

John F. Sargent Jr., Coordinator
Specialist in Science and Technology Policy
jsargent@crs.loc.gov, 7-9147

Robert Esworthy
Specialist in Environmental Policy
resworthy@crs.loc.gov, 7-7236

Heather B. Gonzalez
Specialist in Science and Technology Policy
hgonzalez@crs.loc.gov, 7-1895

Judith A. Johnson
Specialist in Biomedical Policy
jajohnson@crs.loc.gov, 7-7077

Jim Monke
Specialist in Agricultural Policy
jmonke@crs.loc.gov, 7-9664

Daniel Morgan
Specialist in Science and Technology Policy
dmorgan@crs.loc.gov, 7-5849

John D. Moteff
Specialist in Science and Technology Policy
jmoteff@crs.loc.gov, 7-1435

Harold F. Upton
Analyst in Natural Resources Policy
hupton@crs.loc.gov, 7-2264