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Federal Research and Development (R&D) Funding: FY2019

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SUMMARY

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Federal Research and Development (R&D) Funding: FY2019

President Trump's budget request for FY2019 includes approximately $131.0 billion for research and development (R&D), of which $118.056 billion is included in the President's budget and an estimated additional $12.9 billion in nondefense discretionary R&D is requested as part of an addendum to the President's budget. The additional funding requested in the addendum followed enactment of the Bipartisan Budget Act of 2018 (P.L. 115-123), which raised defense and nondefense discretionary spending caps for FY2018 and FY2019. In April 2018, the Administration issued amendments to the President's request, including language needed to clarify the funds requested in the addendum. Agencies appear to have included this proposed funding in their budget justifications, and this funding is included in the agency analyses in this report.

Final FY2018 funding had not been enacted at the time the President's FY2019 budget was prepared; therefore, the budget included the FY2017 actual funding levels, 2018 annualized continuing resolution (CR) levels, and the FY2019 request levels. Subsequent to the release of the President's budget, Congress enacted the Consolidated Appropriations Act, 2018 (P.L. 115-141), appropriating full-year funding for FY2018, rendering the CR levels identified in the budget no longer relevant. The analysis of government-wide R&D funding in this report preceding the individual agency analyses compares the President's request for FY2019 to the FY2017 level. As information about the agencies' FY2018 R&D levels becomes available, the agency sections of this report will be updated to reflect that information and to make comparisons to the President's FY2019 request; some agency sections have been updated. This report will also be updated to reflect House and Senate appropriations actions on the President's request.

In FY2018, OMB adopted a change to the definition of development, applying a more narrow treatment it describes as "experimental development." This approach was intended to better harmonize the reporting of U.S. R&D funding data with the approach used by other nations. The new definition is used in this report. Under the new definition of R&D (applied to both FY2017 and FY2019 figures), and including the estimated $12.9 billion included in the budget addendum, President Trump is requesting approximately $131.0 billion for R&D for FY2019, an increase of $5.7 billion (4.5%) above the FY2017 level. OMB notes that under the previous definition, total federal R&D would be $38.7 billion higher, or approximately $170 billion. Adjusted for inflation, the President's FY2019 R&D request represents an increase of 1.2% above the FY2017 level.

Funding for R&D is largely concentrated among a few departments and agencies. In FY2017, eight federal agencies received 96.3% of total federal R&D funding, with the Department of Defense (39.3%) and the Department of Health and Human Services (27.3%) combined accounting for more than two-thirds of all federal R&D funding.

President's Trump's FY2019 budget is largely silent on funding levels for a number of multiagency R&D initiatives. However, some activities supporting these initiatives are discussed in agency budget justifications and are reported in the agency analyses in this report.

The request represents the President's R&D priorities; Congress may opt to agree with none, part, or all of the request, and it may express different priorities through the appropriations process.

In recent years, Congress has completed the annual appropriations process after the start of the fiscal year. Failure to complete the process by the start of the fiscal year and the accompanying use of continuing resolutions can affect agencies' execution of their R&D budgets, including the delay or cancellation of planned R&D activities and the acquisition of R&D-related equipment.

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Introduction

The 115th Congress continues its interest in U.S. research and development (R&D) and in evaluating 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. In recent years, widespread concerns about the federal debt, recent and projected federal budget deficits, and federal budget caps have driven 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. While these factors continue to exist, increases in the budget caps for FY2018 and FY2019 may reduce some of the pressure affecting these decisions.

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 activities of these agencies. There is no single, centralized source of R&D funds. Agency R&D budgets are developed internally as part of each agency's overall budget development process. R&D funding may be included either in accounts that are entirely devoted to R&D or in accounts that include funding for non-R&D activities. Agency 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 activities 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 and for other purposes) in light of the federal deficit and debt. Other Members of Congress have expressed support for increased federal spending for R&D as an investment in the nation's future competitiveness. As Congress acts to complete the FY2019 appropriations process, it faces two overarching issues: the amount of the federal budget to be spent on federal R&D and the prioritization and allocation of the available funding.

This report begins with a discussion of the overall level of President Trump's FY2019 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 remainder of the report then provides discussion and analysis of the R&D budget requests of selected federal departments and agencies that, collectively, account for approximately 99% 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 A** 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 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 2017).[1] This document provides guidance to agencies in the preparation of the President's annual budget and instructions on budget execution. As reflected in the July 2017 update, OMB has adopted a refinement to the categories of R&D, replacing "development" with "experimental development," which more narrowly defines the set of activities to be included, resulting in lower reported R&D by some agencies, including the Department of Defense and the National Aeronautics and Space Administration. This definition is used in the President's FY2019 budget.

Conduct of R&D. Research and experimental development (R&D) activities are defined as creative and systematic work undertaken in order to increase the stock of knowledge—including knowledge of people, culture, and society—and to devise new applications using available knowledge.

Basic Research. Basic research is defined as experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts. Basic research may include activities with broad or general applications in mind, but should exclude research directed towards a specific application or requirement.

Applied Research. Applied research is defined as original investigation undertaken in order to acquire new knowledge. Applied research is, however, directed primarily towards a specific practical aim or objective.

Experimental Development. Experimental development is defined as creative and systematic work, drawing on knowledge gained from research and practical experience, which is directed at producing new products or processes or improving existing products or processes. Like research, experimental development will result in gaining additional knowledge.

R&D Equipment. R&D equipment includes amounts for major equipment for research and development. Includes acquisition, design, or production of major movable equipment, such as mass spectrometers, research vessels, DNA sequencers, and other major movable instruments for use in R&D activities. Includes programs of $1 million or more that are devoted to the purchase or construction of major R&D equipment

R&D Facilities. R&D facilities includes amounts for the construction of facilities that are necessary for the execution of an R&D program. This may include land, major fixed equipment, and supporting infrastructure such as a sewer line or housing at a remote location.

National Science Board/National Science Foundation. The National Science Board/National Science Foundation provides the following definitions of R&D-related terms in its *Science and Engineering Indicators: 2018* report.[2]

Research and Development (R&D): Research and experimental development comprise creative and systematic work undertaken to increase the stock of knowledge—including knowledge of humankind, culture, and society—and its use to devise new applications of available knowledge.

Basic Research: Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

Applied Research: Original investigation undertaken to acquire new knowledge; directed primarily, however, toward a specific, practical aim or objective.

Experimental Development: Systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

[1] The White House, Office of Management and Budget, Circular No. A-11, "Preparation, Submission, and Execution of the Budget," July 2017, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/assets/a11_current_year/a11_2017.pdf.

[2] National Science Board/National Science Foundation, *Science and Engineering Indicators 2018*, January 2018, https://www.nsf.gov/statistics/2018/nsb20181/.

The President's FY2019 Budget Request

On February 12, 2018, President Trump released his proposed FY2019 budget. In addition, on the same day, OMB issued an addendum that includes a request for an additional $12.9 billion in nondiscretionary R&D funding.[3] According to OMB, the request for these additional funds was made possible by changes to spending caps in the Budget Control Act (BCA; P.L. 112-25) that were enacted on February 9, 2018, in the Bipartisan Budget Act of 2018 (P.L. 115-123).

In FY2018, the Trump Administration began using a new definition for development in its R&D calculations ("experimental development"). The new definition excludes some development activities, primarily at the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA), that had been characterized as development in previous budgets. The new definition (experimental development) is used throughout this report for FY2017 and FY2019, except in the section "Department of Defense." According to OMB, the funds no longer included in the definition of development are, nevertheless, "requested in the FY 2019 budget request and support the development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate production funding in the current or subsequent fiscal year."[4] (See box below entitled "Caveats with Respect to Analysis of the FY2019 Budget Request" for additional information.)

Subsequent to the release of the President's budget, Congress enacted the Consolidated Appropriations Act, 2018 (P.L. 115-141), appropriating full-year funding for FY2018, rendering the CR levels identified in the budget no longer relevant. Therefore, the analysis of government-wide R&D funding in this report preceding the individual agency analyses compares the President's request for FY2019 to the FY2017 level. As information about the agencies' FY2018 R&D levels becomes available, the agency sections of this report will be updated to reflect that information and to make comparisons to the President's FY2019 request; some agency sections have been updated.

Under the new definition of R&D, and including the $12.9 billion proposed in the addendum, President Trump is proposing approximately $131.0 billion for R&D for FY2019, an increase of $5.7 billion above the FY2017 level (4.5%). Adjusted for inflation, the President's FY2019 R&D request represents a constant-dollar increase of 1.2% from the FY2017 actual level.[5]

The President's R&D request includes continued funding for existing single-agency and multiagency programs and activities, as well as new initiatives. This report provides government-wide, multiagency, and individual agency analyses of the President's FY2019 request as it relates to R&D and related activities. Additional information and analysis will be included as the House and Senate act on the President's budget request through appropriations bills.

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[3] According to OMB, the office only has this "very high-level estimate available at this time," and that the figure may be refined during summer 2018 as part of the regular budget process. Email communication between OMB and CRS, February 23, 2018. The addendum is available at https://www.whitehouse.gov/wp-content/uploads/2018/02/Addendum-to-the-FY-2019-Budget.pdf. On April 13, 2018, OMB issued amendments to the President's FY2019 request. In addition, the amendments include the appropriations language needed to formally reflect the funds included in the Addendum. The amendments are available at https://www.whitehouse.gov/omb/supplementals-amendments-and-releases/.

[4] Executive Office of the President (EOP), OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2019*, February 12, 2018, p. 240, https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

[5] As calculated by CRS using the Gross Domestic Product (GDP) (chained) price index for FY2017 and FY2019 in Table 10.1, "Gross Domestic Product and Deflators Used in the Historical Tables: 1940–2022," *Budget of the United States Government, Fiscal Year 2019*, https://www.whitehouse.gov/wp-content/uploads/2018/02/hist10z1-fy2019.xlsx.

Caveats for Analysis of the FY2019 Budget Request

Several factors complicate the analysis of changes in R&D funding for FY2019, both in aggregate and for selected agencies. For example:

- The President's FY2019 budget does not include FY2018 enacted budget authority levels because the FY2018 budget process had not been completed at the time the FY2019 budget was prepared. In the absence of final enacted FY2018 appropriations, the government-wide R&D analysis in this report (preceding the agency analyses) compares FY2019 request levels to FY2017 enacted levels. For each of the agency analyses, the FY2019 request levels will be updated to provide a comparison of FY2019 request levels to the FY2018 enacted levels as the FY2018 enacted R&D funding levels become available; some agencies have been updated accordingly.
- The analysis of the request, by agency, in the overview section of this report does not reflect the estimated $12.9 billion in additional nondefense discretionary R&D proposed in the President's budget addendum for FY2019. The additional funds requested in the addendum are included in the agency analyses, where noted. These funds could substantially affect the magnitude of some nondefense agencies' R&D budgets.
- Beginning in FY2018, OMB replaced the R&D category "development" with a subset referred to as "experimental development" in an effort that OMB asserts would better align its data with the survey data collected by the National Science Foundation, and to be consistent with international standards. Using the old definition of development, total requested funding for FY2019 would be approximately $170 billion, $39 billion more than under the new definition. Similarly, FY2017 (actual) funding would include an additional $30 billion in development, bringing that total to approximately $155 billion.

In addition, inconsistency among agencies in the reporting of R&D and the inclusion of R&D activities in accounts with non-R&D activities may result in different figures being reported by OMB and the White House Office of Science and Technology Policy (OSTP), including those shown in **Table 1**, and those in 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, and by a combination of these two perspectives.

Federal R&D by Agency

Congress makes decisions about R&D funding through the authorization and appropriations processes primarily from the perspective of individual agencies and programs. **Table 1** provides data on R&D funding by agency for FY2017 (actual) and FY2019 (request).[6] Funding data for FY2018 were not included in the Trump Administration's FY2019 budget because the FY2018 budget had not been completed at the time the FY2019 budget request was released.

Under President Trump's FY2019 budget request, eight federal agencies would receive more than 96% of total federal R&D funding: the Department of Defense, 48.4%; Department of Health and Human Services (HHS), primarily the National Institutes of Health (NIH), 20.9%; Department of Energy (DOE), 10.7%; National Aeronautics and Space Administration, 9.0%; National Science Foundation (NSF), 3.5%; Department of Agriculture (USDA), 1.6%; Department of Commerce (DOC), 1.2%; and Veterans Affairs (VA), 1.1%. This report provides an analysis of the R&D budget requests for these agencies, as well as for the Department of Homeland Security (DHS),

[6] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2019,* February 12, 2018, pp. 238-239, https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

Department of the Interior (DOI), Department of Transportation (DOT), and Environmental Protection Agency (EPA).

Excluding the $12.9 billion in R&D funding requested in the addendum, nearly every federal agency would see its R&D funding decrease under the President's FY2019 request compared to their FY2017 levels. The only agencies with increased R&D funding in FY2019 would be DOD (up $7.959 billion, 16.2%), the Patient-Centered Outcomes Research Institute,[7] (up $159 million, 34.3%), and the Smithsonian Institution (up $20 million, 8.0%).

The largest declines (as measured in dollars) would occur in the budgets of HHS (down $9.480 billion, 27.7%), DOE (down $2.211 billion, 14.8%), NSF (down $1.761 billion, 29.7%), USDA (down $671 million, 26.0%), and the DOC (down $433 million, 24.1%).

Table 1. Federal Research and Development Funding by Agency, FY2017 and FY2019

(budget authority, dollar amounts in millions)

			Change, FY2017-FY2019	
Department/Agency	**FY2017 Actual**	**FY2019 Request**	**Dollar**	**Percent, Total**
Department of Defense	49,197	57,156	7,959	16.2%
Department of Health and Human Services	34,222	24,742	-9,480	-27.7%
Department of Energy	14,896	12,685	-2,211	-14.8%
NASA	10,704	10,651	-53	-0.5%
National Science Foundation	5,938	4,177	-1,761	-29.7%
Department of Agriculture	2,585	1,914	-671	-26.0%
Department of Commerce	1,794	1,361	-433	-24.1%
Department of Veterans Affairs	1,346	1,345	-1	-0.1%
Department of Transportation	904	826	-78	-8.6%
Department of the Interior	953	759	-194	-20.4%
Patient-Centered Outcomes Research Institute[a]	463	622	159	34.3%
Department of Homeland Security	724	548	-176	-24.3%
Smithsonian Institution	251	271	20	8.0%
Environmental Protection Agency	497	269	-228	-45.9%
Department of Education	254	240	-14	-5.5%
Other	561	490	-71	-12.7%
Total, Base Budget	**$125,289**	**$118,056**	**-$7,233**	**-5.8%**
Addendum to the FY2019 Request (estimated)		~12,900	~12,900	n/a
Total, with Addendum	**$125,289**	**~$131,000**	**~$5,700**	**~4.5%**

Source: CRS analysis of data from Executive Office of the President (EOP), Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2019,* February 12, 2018, pp. 238-239,

[7] The Patient-Centered Outcomes Research Institute is funded through the Patient-Centered Outcomes Research Trust Fund, which was established by Congress under the Patient Protection and Affordable Care Act (P.L. 111-148). For more information, see https://www.pcori.org/.

https://www.whitehouse.gov/omb/budget/Analytical_Perspectives; *Addendum to the President's FY2019 Budget to Account for the Bipartisan Budget Act of 2018,* https://www.whitehouse.gov/wp-content/uploads/2018/02/Addendum-to-the-FY-2019-Budget.pdf; and email communication between OMB and CRS, February 23, 2018.

Notes: Components may not sum to totals due to rounding. FY2017 and FY2019 amounts exclude non-experimental development funding. n/a = not applicable.

a. The Patient-Centered Outcomes Research Institute is funded through the Patient-Centered Outcomes Research Trust Fund, which was established by Congress under the Patient Protection and Affordable Care Act (P.L. 111-148). For more information, see https://www.pcori.org/.

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 Trump's FY2019 request includes $27.341 billion for basic research, down $6.986 billion (20.4%) from FY2017; $31.648 billion for applied research, down $6.500 billion (17.0%); $56.696 billion for development, up $6.333 billion (12.6%); and $2.371 billion for facilities and equipment, down $80 million (3.3%).

Table 2. Federal R&D Funding by Character of Work and Facilities and Equipment, FY2017 and FY2019

(budget authority, dollar amounts in millions)

			Change, FY2017-FY2019	
Character of Work, Facilities, and Equipment	**FY2017 Actual**	**FY2019 Request**	**Dollar**	**Percent, Total**
Basic research	34,327	27,341	-6,986	-20.4%
Applied research	38,148	31,648	-6,500	-17.0%
Development	50,363	56,696	6,333	12.6%
Facilities and Equipment	2,451	2,371	-80	-3.3%
Total	**125,289**	**118,056**	**-7,233**	**-5.8%**

Source: CRS analysis of data from Executive Office of the President (EOP), Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2019,* February 12, 2018, pp. 238-240, https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

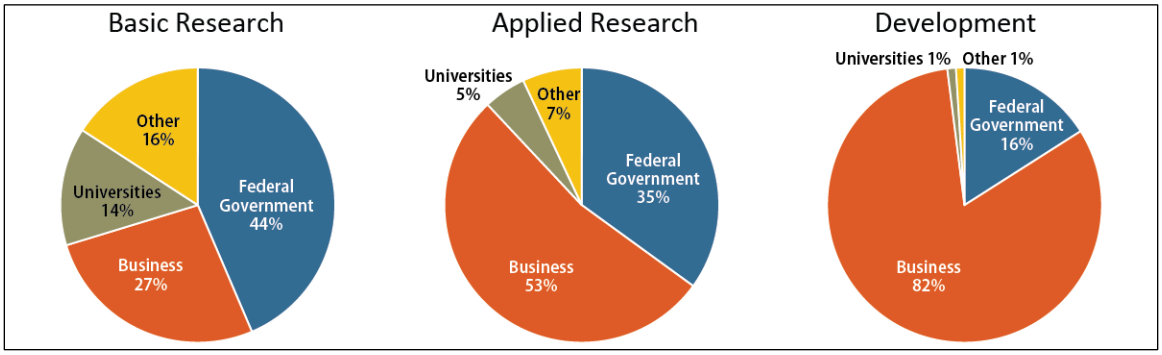
Notes: Components may not sum to totals due to rounding. Does not include estimated $12.9 billion in R&D funding included in the *Addendum to the President's FY2019 Budget to Account for the Bipartisan Budget Act of 2018.*

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

A primary policy justification 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 achieving 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 44% of U.S. basic research in 2016. Business funded 27% of U.S. basic research in 2016, with state governments, universities, and other nonprofit organizations funding the remaining 29%. For U.S. applied research, business is the primary funder, accounting for an estimated 53% in 2016, while the federal government accounted for an estimated 35%. State governments, universities, and other nonprofit organizations funded the remaining 12%. Business also provides the vast majority of U.S. funding for development. Business accounted for 82% of development funding in 2016, while the federal government provided 16%. State governments, universities, and other nonprofit organizations funded the remaining 2% (see **Figure 1**).[8]

Figure 1. Composition of U.S. Basic Research, Applied Research, and Development by Funding Sector, 2016



Source: CRS analysis of unpublished preliminary data from the National Science Foundation, *National Patterns of R&D Resources.*

Note: Components may not add to total due to rounding.

Federal R&D by Agency and Character of Work Combined

Federal R&D funding can also be viewed from the combined perspective of each agency's contribution to basic research, applied research, development, and facilities and equipment. (**Table 3** lists the three agencies with the most funding for each character of work classification.) 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 FY2019 budget request, the Department of Health and Human Services, primarily NIH, would account for nearly half (44.3%) of all federal funding for basic research. HHS would also be the largest federal funder of applied research, accounting for about 39.0% of all federally funded applied research in the President's FY2019 budget request. DOD would be the primary federal funder of development, accounting for 87.4% of total federal development funding in the President's FY2019 budget request.[9]

[8] CRS analysis of unpublished preliminary data for FY2016 from the National Science Foundation, *National Patterns of R&D Resources.* More recent data regarding business and other R&D funding are not yet available. Components may not add to total due to rounding.

[9] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2019,* February 12, 2018, pp. 238-240, https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

Table 3. Selected R&D Funding Agencies by Character of Work, Facilities, and Equipment, FY2017 and FY2019

(budget authority, dollar amounts in millions)

Character of Work/Agency	FY2017 Actual	FY2019 Request	Change, FY2017-FY2019	
			Dollars	Percent
Basic Research				
Dept. of Health and Human Services	$16,701	$12,114	-$4,587	-27.5%
NASA	3,607	4,150	+543	+15.1%
National Science Foundation	4,739	3,402	-1,337	-28.2%
Applied Research				
Dept. of Health and Human Services	17,356	12,348	-5,008	-28.9%
Dept. of Energy	6,491	5,885	-606	-9.3%
Dept. of Defense	5,276	5,239	-37	-0.7%
Development				
Dept. of Defense	41,545	49,579	+8,034	+19.3%
NASA	4,569	3,734	-835	-18.3%
Dept. of Energy	2,488	1865	-623	-25.0%
Facilities and Equipment				
Dept. of Energy	1,115	1,537	+422	+37.8%
Dept. of Health and Human Services	138	245	+107	+77.5%
Dept. of Commerce	278	240	-38	-13.7%

Source: CRS analysis of data from Executive Office of the President (EOP), Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2019,* February 12, 2018, pp. 238-240, https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

Notes: The top three funding agencies in each category, based on the FY2019 request, are listed. Components may not sum to totals due to rounding. Does not include estimated $12.9 billion in R&D funding included in the *Addendum to the President's FY2019 Budget to Account for the Bipartisan Budget Act of 2018.*

Multiagency R&D Initiatives

For many years, presidential budgets have reported on multiagency R&D initiatives and have often provided details of agency funding for these initiatives. Some of these efforts have a statutory basis—for example, the Networking and Information Technology Research and Development (NITRD) program, the National Nanotechnology Initiative (NNI), and the U.S. Global Change Research Program (USGCRP). These programs generally produce annual budget supplements identifying objectives, activities, funding levels, and other information, usually published shortly after the presidential budget release. Other multiagency R&D initiatives have operated at the discretion of the President without such a basis and may be eliminated at the discretion of the President. President Trump's FY2019 budget is largely silent on funding levels for these efforts and whether any or all of the nonstatutory initiatives will continue. Some

activities related to these initiatives are discussed in agency budget justifications and may be addressed in the agency analyses later in this report. This section provides available multiagency information on these initiatives and will be updated as additional information becomes available.

Networking and Information Technology Research and Development Program (NITRD)[10]

Established by the High-Performance Computing Act of 1991 (P.L. 102-194), the Networking and Information Technology Research and Development 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. In FY2018, 21 agencies are NITRD members; non-member agencies also participate in NITRD activities. NITRD efforts are coordinated by the National Science and Technology Council (NSTC)[11] Subcommittee on Networking and Information Technology Research and Development. The President's FY2018 budget request for the NITRD Program was $4.459 billion, a decrease of $0.33 billion compared to the $4.789 billion (enacted) in FY2017. The overall decrease was due to decreases of $234.7 million at NIH, $121.3 million at NSF, and smaller increases and decreases at other agencies. FY2018 appropriated amounts are not yet available.

P.L. 102-194, as reauthorized by the American Innovation and Competitiveness Act of 2017 (P.L. 114-329), requires the director of NITRD to prepare an annual report to be delivered to Congress along with the President's budget request. This annual report is to include, among other things, detailed information on the program's budget for the current fiscal year, previous fiscal year, and proposed for the next fiscal year. The FY2019 request level for the NITRD was not included in the President's FY2019 budget request. As of the date of this report, the NITRD supplement to the President's FY2019 budget, including FY2017 actual, FY2018 appropriated, and the FY2019 request levels, has not been published. This section will be updated when the NSTC publishes the appropriations information for FY2018 and the FY2019 request.

Additional NITRD information can be obtained at https://www.nitrd.gov.

[10] 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.

[11] The NSTC was established by Executive Order 12881 in 1993. According to the White House, "This Cabinet-level Council is the principal means within the Executive Branch to coordinate science and technology policy across the diverse entities that make up the Federal research and development enterprise. Chaired by the President, the membership of the NSTC is made up of the Vice President, Cabinet Secretaries and Agency Heads with significant science and technology responsibilities, and other White House officials. In practice, the Assistant to the President for Science and Technology Policy oversees the NSTC's ongoing activities." (Source: The White House, Office of Science and Technology Policy, "NSTC," https://www.whitehouse.gov/ostp/nstc/.) For more information on the NSTC, see CRS Report R43935, *Office of Science and Technology Policy (OSTP): History and Overview*, by John F. Sargent Jr. and Dana A. Shea; and https://www.whitehouse.gov/ostp/nstc/.

Table 4. Networking and Information Technology Research and Development Program Funding, FY2017-FY2019

(budget authority, in millions of current dollars)

FY2017 (estimate)	FY2018 (request)	FY2018 (enacted)	FY2019 (request)
$4.789	$4.459	n/a	n/a

Source: Subcommittee on Networking and Information Technology Research and Development, Committee on Technology, National Science and Technology Council, The White House, *Supplement to the President's Budget for Fiscal Year 2018, The Networking and Information Technology Research and Development Program*, October 2017.

Note: n/a = not available.

U.S. Global Change Research Program (USGCRP)[12]

The U.S. Global Change Research Program 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."[13] In FY2018, 13 departments and agencies participated in the USGCRP. USGCRP efforts are coordinated by the NSTC Subcommittee on Global Change Research.

The Global Change Research Act of 1990 (P.L. 101-606) requires annual reporting to Congress on federal budget and spending by agency on global change research.[14] In almost each of the past 17 years, language in appropriations laws has required the President to submit a comprehensive report to the appropriations committees "describing in detail all Federal agency funding, domestic and international, for climate change programs, projects, and activities … including an accounting of funding by agency…."[15] The most recent report was submitted in December 2016 for FY2017. This section will be updated when the USGCRP updates its budget information.

Additional USGCRP information can be obtained at http://www.globalchange.gov.

Table 5. U.S. Global Change Research Program Funding, FY2017-FY2019

(budget authority, in millions of current dollars)

FY2017 (request)	FY2018 (request)	FY2018 (enacted)	FY2019 (request)
$2.790	n/a	n/a	n/a

Source: U.S. Global Change Research Program, website, https://www.globalchange.gov/about/budget.

Note: n/a = not available.

[12] 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.

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

[14] Directives to report annually to Congress on budget requests and spending occur in several sections of P.L. 101-606, including Sections 105(b) and (c) on Budget Coordination, and Section 107, Annual Report.

[15] See, most recently, P.L. 115-31, Consolidated Appropriations Act, 2017, Section 416.

National Nanotechnology Initiative (NNI)[16]

Launched in FY2001, the National Nanotechnology Initiative 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.[17] In 2003, Congress enacted the 21st Century Nanotechnology Research and Development Act (P.L. 108-153), providing a legislative foundation for some of the activities of the NNI. In FY2018, the NNI included 16 federal departments and independent agencies and commissions with budgets dedicated to nanotechnology R&D, as well as other federal departments and independent agencies and commissions with responsibilities for health, safety, and environmental regulation; trade; education; training; intellectual property; international relations; and other areas that might affect or be affected by nanotechnology. NNI efforts are coordinated by the NSTC Subcommittee on Nanoscale Science, Engineering, and Technology (NSET). In FY2017, NNI funding was an estimated $1.470 billion.[18]

The 21st Century Nanotechnology Research and Development Act (P.L. 108-153) requires the NSTC to prepare an annual report to be delivered to Congress at the time the President's budget request is sent to Congress. This annual report is to include detailed information on the program's budget for the current fiscal year and the program's proposed budget for the next fiscal year, as well as additional information and data related to the performance of the program. The FY2019 request level for the NNI was not included in the President's FY2019 budget request. As of the date of this report, the NNI supplement to the President's FY2019 budget, including FY2018 appropriated amounts and the FY2019 request levels, has not been published. This section will be updated when the NSTC publishes the appropriations information for FY2018 and the FY2019 request.

Additional NNI information can be obtained at http://www.nano.gov.

Table 6. National Nanotechnology Initiative Funding, FY2017-FY2019

(budget authority, in millions of current dollars)

FY2017 (estimate)	FY2018 (request)	FY2018 (enacted)	FY2019 (request)
$1,469.7	$1,207.5	n/a	n/a

Source: Subcommittee on Nanoscale Science, Engineering, and Technology, Committee on Technology, National Science and Technology Council, The White House, *Supplement to President Obama's Budget for Fiscal Year 2018, The National Nanotechnology Initiative: Research and Development Leading to a Revolution in Technology and Industry*, November 2017.

Note: n/a = not available.

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

[17] 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.

[18] EOP, National Science and Technology Council, *Supplement to the President's Budget for Fiscal Year 2018: The Networking and Information Technology Research and Development Program*, November 2017.

Other Initiatives

Presidential initiatives without statutory foundations in operation at the end of the Obama Administration, but not explicitly addressed in President Trump's FY2018 or FY2019 budgets, include the Advanced Manufacturing Partnership (AMP, including the National Robotics Initiative [NRI] and the National Network for Manufacturing Innovation [NNMI]),[19] the Cancer Moonshot, the BRAIN Initiative, the Precision Medicine Initiative (PMI), the Materials Genome Initiative, and an effort to doubling federal funding for clean energy R&D. Some of the activities of these initiatives are discussed in agency budget justifications and the agency analyses later in this report.

FY2019 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 nearly 99% of total federal R&D funding. Agencies are presented in order of the size of their FY2019 R&D budget requests, with the largest presented first.

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 in the president's budget or otherwise provided by OMB.

Funding for R&D is often included in appropriations line items that also include non-R&D activities; therefore, in such cases, it may not be 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.

As of the date of this report, the House had completed action on 6 of the 12 regular appropriations bills; the Senate had completed action on 3. None of the 12 had yet been enacted as law. This report will be updated as Congress takes additional actions to complete the FY2019 appropriations process.

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://www.crs.gov/iap/appropriations. Also, the status of each appropriations bill is available on the CRS web page, *Status Table of Appropriations*, available at http://www.crs.gov/AppropriationsStatusTable/Index.

[19] The National Institute of Standards and Technology's FY2019 budget justification requests $5 million for the Manufacturing USA network (also known as the National Network for Manufacturing Innovation). In addition, DOD is requesting $92.3 million for FY2019 for the DOD-sponsored institutes that are part of the Manufacturing USA network as part of the request of the Office of the Secretary of Defense (see program element 0603680D8Z).

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 Health and Human Services - National Institutes of Health	(1) Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriations Act (2) Department of the Interior, Environment, and Related Agencies Appropriations Act
Department of Energy	Energy and Water Development and Related Agencies Appropriations Act
National Aeronautics and Space Administration	Commerce, Justice, Science, and Related Agencies Appropriations Act
National Science Foundation	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 Commerce - National Institute of Standards and Technology - National Oceanic and Atmospheric Administration	Commerce, Justice, Science, and Related Agencies Appropriations Act
Department of Veterans Affairs	Military Construction and Veterans Affairs, and Related Agencies Appropriations Act
Department of the Interior	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 Homeland Security	Department of Homeland Security Appropriations Act
Environmental Protection Agency	Department of the Interior, Environment, and Related Agencies Appropriations Act

Source: CRS Report R40858, *Locate an Agency or Program Within Appropriations Bills*, by Justin Murray.

Department of Defense[20]

The mission of the Department of Defense is "to provide the military forces needed to deter war and to protect the security of our country."[21] Congress supports research and development activities at DOD primarily through the department's Research, Development, Test, and Evaluation (RDT&E) funding. These funds support the development of the nation's future military hardware and software and the science and technology base upon which those products rely.

Nearly all of what DOD spends on RDT&E is appropriated in Title IV of the annual defense appropriations 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, the 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 Defense-wide Operations and Maintenance appropriations request. The program's RDT&E funds support congressionally directed research on breast, prostate, and ovarian cancer; traumatic brain injuries; orthotics and prosthetics; 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 Defense-wide 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 associated with the nation's naval reserve fleet and supports a U.S. flagged merchant fleet that can serve in time of need. In some fiscal years, RDT&E funding for this effort is requested in the Navy's Procurement request and appropriated in Title V (Revolving and Management Funds) of the appropriation bill.

RDT&E funds also have been requested and appropriated as part of DOD's separate funding to support efforts in what the George W. Bush Administration termed the Global War on Terror (GWOT), and what the Obama and Trump Administration have referred to as Overseas Contingency Operations (OCO). In appropriations bills, the term Overseas Contingency Operations/Global War on Terror (OCO/GWOT) has been used; President Trump's FY2019 budget uses the term Overseas Contingency Operations. Typically, the RDT&E funds appropriated for OCO/GWOT activities go to specified Program Elements (PEs) in Title IV.

In addition, OCO/GWOT-related requests/appropriations have included money for a number of transfer funds. In the past, these have included the Iraqi Freedom Fund (IFF), the Iraqi Security Forces Fund, the Afghanistan Security Forces Fund, and the Pakistan Counterinsurgency Capability Fund. Congress typically has made a single appropriation into each such fund and authorized 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.

It should be noted that the FY2018 enacted funding levels were not known at the time the President's FY2019 budget was prepared, as the budget process had not been completed.

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

[21] Department of Defense, https://www.defense.gov/.

For FY2019, the Trump Administration is requesting $92.365 billion for DOD's Title IV RDT&E PEs (base plus OCO/GWOT), $1.783 billion (2.0%) above the enacted FY2018 level. (See **Table 8**.) In addition, the request includes $710.6 million in RDT&E through the Defense Health Program (DHP; down $1.329 billion, 65.2% from FY2018), $886.7 million in RDT&E through the Chemical Agents and Munitions Destruction program (up $47.3 million, 5.6% from FY2018), and $1.6 million for the Inspector General for RDT&E-related activities (down $1.2 million, 42.9% from FY2018). The FY2019 budget included no RDT&E funding via the National Defense Sealift Fund, the same as the FY2018 enacted level.

On June 28, 2018, the House passed the Department of Defense Appropriations Act, 2019 (H.R. 6157). The bill includes $91.241 billion for Title IV base RDT&E funding and $1.181 billion in OCO/GWOT base RDT&E funding for a total of $92.422 billion.[22] This represents an increase of $1.840 billion (2.0%) over the FY2018 enacted Title IV RDT&E funding level (base and OCO/GWOT), and an increase of $57 million (0.1%) above the request level.

The House-passed bill would provide DHP with $1.466 billion in R&D funding for FY2019, $573 million (28.1%) below the FY2018 enacted level and $756 million (106.3%) above the FY2019 request; RDT&E for the Chemical Agents and Munitions Destruction program would be $887 million, up $47 million (5.6%) from the FY2018 level and equal to the request; RDT&E for the National Defense Sealift Fund would be zero, equal to the FY2018 enacted level and the FY2019 request; and RDT&E for the Inspector General would be $1.6 million, $1.2 million (42.9%) below the FY2018 enacted level and equal to the FY2019 request.

The military departments each request and receive their own RDT&E funding. So do various DOD agencies (e.g., the Missile Defense Agency and the Defense Advanced Research Projects Agency), through the Defense-wide account. The Director, Operational Test and Evaluation, receives a separate appropriation. RDT&E funding can also 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) constitute what is called DOD's Science and Technology (S&T) program. Budget activities 6.4 and 6.5 focus on the development of specific weapon systems or components 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.[23]

Many congressional policymakers are particularly interested in DOD S&T program 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 may also contribute to advances in commercial technologies. The FY2019 request for Title IV S&T funding (base plus OCO/GWOT) is $13.700 billion, $1.194 billion (8.0%) below the FY2018 enacted level. The House-passed bill would provide $14.648 billion in FY2019 level for Title IV S&T funding, $426 million (2.9%) below the FY2018 level and $768 million (5.6%) above the FY2019 request.

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

[22] OCO/GWOT is included in Title IX of the Department of Defense Appropriations Act, 2019, but supports the PEs in Title IV.

[23] For additional information on the structure of Defense RDT&E, see CRS Report R44711, *Department of Defense Research, Development, Test, and Evaluation (RDT&E): Appropriations Structure*, by John F. Sargent Jr.

NSF. However, over half of DOD's basic research budget is spent at universities, and it is among the largest sources of federal funds for university research in some areas of science and technology, such as electrical engineering and materials science.[24] The Trump Administration is requesting $2.269 billion for DOD basic research for FY2019, $74.0 million (3.2%) below the FY2018 enacted level. The House-passed bill would provide $2.298 billion in FY2019 for DOD basic research, $45 million (1.9%) below the FY2018 level and $29 million (1.3%) above the FY2019 request.

[24] CRS analysis of data from NSF, *Survey of Federal Funds for Research and Development, Fiscal Years 2015–17*, April 5, 2017, https://ncsesdata.nsf.gov/fedfunds/2015/.

Table 8. Department of Defense RDT&E

(obligational authority, in millions of dollars)

Budget Account	FY2018 Enacted	FY2019 Request			FY2019 House			FY2019 Senate	FY2019 Enacted
	Base + OCO + Emergency Enacted[d]	Base	OCO	Total	Base	OCO	Total		
Army	$10,903.5	$ 10,159.4	$ 325.1	$ 10,484.5	$10,113.1	$300.6	$10,413.7		
Navy	18,238.3	18,451.1	198.4	18,649.5	17,658.2	167.8	17,826.1		
Air Force	37,813.4	39,892.1	600.5	40,492.6	40,929.5	301.9	41,231.4		
Defense-wide	23,415.6	21,892.5	624.6	22,517.1	22,319.4	410.5	22,730.0		
Director, Operational Test & Evaluation	210.9	221.0	0.0	221.0	221.0	0.0	221.0		
Total Title IV—By Account	**$90,581.7**	**$90,616.1**	**$1,748.6**	**$92,364.7**	**$91,241.3**	**$1,180.8**	**$92,422.1**		
Budget Activity									
6.1 Basic Research	2,343.2	2,269.2	0.0	2,269.2	2,298.1	0.0	2,298.1		
6.2 Applied Research	5,681.8	5,100.4	0.0	5,100.4	5,571.2	0.0	5,571.2		
6.3 Advanced Technology Development	6,869.1	6,292.1	38.6	6,330.8	6,559.4	39.7	6,599.1		
6.4 Advanced Component Development and Prototypes	19,051.5	20,862.8	318.0	21,180.7	20,263.7	190.0	20,453.7		
6.5 Systems Dev. and Demonstration	14,689.3	15,338.5	238.0	15,576.5	15,316.6	238.0	15,554.6		
6.6 Management Support[a]	6,648.9	6,520.6	0	6,520.6	6,649.9	0.0	6,649.9		
6.7 Operational Systems Development[b]	33,947.0	34,232.5	1,154.0	35,386.5	34,609.4	713.2	35,322.6		

Budget Account	FY2018 Enacted	FY2019 Request			FY2019 House			FY2019 Senate	FY2019 Enacted
	Base + OCO + Emergency Enacted[d]	Base	OCO	Total	Base	OCO	Total		
Undistributed Additions*	1,346.7	n/a	n/a	n/a	65.4	n/a	65.4		
Undistributed Reductions	n/a	n/a	n/a	n/a	(42.4)	n/a	(42.2)		
Undistributed Reduction (DARPA)	(50.0)	n/a	n/a	n/a	(50.0)	n/a	(50.0)		
Undistributed Reduction (MDA)	(31.0)	n/a	n/a	n/a	n/a	n/a	n/a		
Undistributed Transfer (Air Force)	(83.0)	n/a	n/a	n/a	n/a	n/a	n/a		
Undistributed Transfer from JITDF	168.3	n/a	n/a	n/a	n/a	n/a	n/a		
Total Title IV—by Budget Activity	**$90,581.7**	**$90,616.1**	**$1,748.6**	**$92,364.7**	**$91,241.3**	**$1,180.8**	**$92,422.1**		
Title V—Revolving and Management Funds									
National Defense Sealift Fund	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Title VI—Other Defense Programs									
Defense Health Program	2,039.3	710.6	0.0	710.6	1,466.2	0.0	1,466.2		
Chemical Agents and Munitions Destruction	839.4	886.7	0.0	886.7	886.7	0.0	886.7		
Inspector General	2.8	1.6	0.0	1.6	1.6	0.0	1.6		
Grand Total	**$93,463.3**	**$92,215.1**	**$1,748.6**	**$93,963.6**	**$93,595.9**	**$1,180.8**	**$94,776.7**		

Source: The FY2018 enacted amounts were taken from the joint explanatory statement to accompany H.R. 1625, printed in the March 22, 2018, *Congressional Record* (pp. H2084-H2115), P.L. 115-141, and P.L. 115-96. FY2019 request amounts are based on CRS analysis of *Department of Defense Budget, Fiscal Year 2019, RDT&E Programs (R-1)*, February 2018.

Notes: Figures for the columns headed "FY2019 Senate" and "FY2019 Enacted" will be added, if available, as each action is completed. Totals may differ from the sum of the components due to rounding. "Undistributed" means undistributed among budget activity levels 6.1-6.7. n/a = not applicable.

a. Includes funding for Director of Test and Evaluation.

b. Includes funding for Classified Programs.

c. According to DOD, "Total Obligation Authority (TOA) is the sum of: 1) all budget authority (BA) granted (or requested) from the Congress in a given year, 2) amounts authorized to be credited to a specific fund, 3) BA transferred from another appropriation, and 4) Unobligated balances of BA from previous years which remain available for obligation. In practice, this term is used primarily in discussing the DoD budget, and most often refers to TOA as the 'direct program,' which equates to only (1) and (2) above." DOD defines "budget authority" as "the authority becoming available during the year to enter into obligations that result in immediate or future outlays of Government funds." See DoD 7000.14-R, "Department of Defense Financial Management Regulation," http://comptroller.defense.gov/fmr.aspx.

d. Includes supplemental emergency funding requested by President Trump in November 2017 and provided by the Department of Defense Missile Defeat and Defense Enhancements Appropriations Act, 2018 (included as Division B of P.L. 115-96).

Department of Health and Human Services

The mission of the Department of Health and Human Services is "to enhance and protect the health and well-being of all Americans ... by providing for effective health and human services and fostering advances in medicine, public health, and social services."[25] This section focuses on HHS research and development funded through the National Institutes of Health, an HHS agency that accounts for more than 95% of total HHS R&D funding.[26] Other HHS agencies that provide funding for R&D include the Centers for Disease Control and Prevention (CDC), the Centers for Medicare and Medicaid Services (CMS), the Food and Drug Administration (FDA), the Agency for Healthcare Research and Quality (AHRQ), Health Resources and Services Administration (HRSA), and the Administration for Children and Families (ACF).[27]

National Institutes of Health[28]

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 illness and disability."[29] The agency's organization consists of the NIH Office of the Director (OD) and 27 institutes and centers (ICs).

The 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 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 9**, separate appropriations are provided 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.

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 10% of the NIH budget supports intramural research projects conducted by the nearly 6,000 NIH scientists, most of whom are located on the NIH campus in Bethesda, MD. More than 80% 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 nonfederal scientists and technical personnel who work at more than 2,500 universities, hospitals, medical schools, and other research institutions.[30]

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[25] U.S. Department of Health and Human Services, "About," http://www.hhs.gov/about.

[26] CRS analysis of data from OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2018,* May 23, 2017, pp. 203-205, https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

[27] Ibid.

[28] This section was written by Judith A. Johnson, Specialist in Biomedical Policy, and Johnathan H. Duff, Analyst in Health 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.

[29] HHS, National Institutes of Health, "About NIH, What We Do, Mission and Goals," http://www.nih.gov/about-nih/what-we-do/mission-goals.

[30] HHS, *Fiscal Year 2018 Budget in Brief*, Washington, DC, May 2017, p. 38, https://www.hhs.gov/sites/default/files/Consolidated%20BIB_ONLINE_remediated.pdf.

Funding for NIH comes primarily from the annual Labor, HHS, and Education (LHHS) appropriations act, with an additional amount for Superfund-related activities from the Interior/Environment appropriations act. Those two appropriations acts provide NIH's discretionary budget authority. In addition, NIH has received mandatory funding of $150 million annually that is provided in the Public Health Service (PHS) Act 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 add-ons and transfers, is known as the NIH program level.

President Trump's FY2019 budget requests an NIH program level total of $34.767 billion, a decrease of $2.544 billion (6.8%) from the FY2018 enacted level of $37.311 billion (see **Table 9**).[31] Buildings and Facilities would receive a 55% increase in funding for FY2019 compared to FY2018, and OD would receive a smaller increase; all other ICs would receive a decrease compared to FY2018. (Readers should be aware that final FY2018 appropriations had not been enacted during the period in which the FY2019 President's request was being formulated. While the total request for NIH represents a decrease from FY2018 enacted levels, it represents an increase from FY2017 enacted levels and the FY2018 continuing resolution levels that were in place at the time FY2019 request levels were being determined.)

The FY2019 NIH budget request proposes the consolidation of other existing HHS research programs with NIH, establishing three new NIH Institutes.[32] The creation of three new NIH Institutes would require an amendment to the Public Health Service Act, considering that a provision in the NIH Reform Act of 2006 (P.L. 109-482; PHS Act §401[d]) states that the number of NIH ICs "may not exceed a total of 27."

As in the FY2018 proposal, the Trump budget again proposes the consolidation of the AHRQ with NIH, forming a new Institute called the National Institute for Research on Safety and Quality (NIRSQ). The FY2019 budget proposal includes $380 million in budget authority for NIRSQ "to coordinate and ensure a continued focus on research to improve health care quality and patient safety."[33] Of this, $256 million would be used "to continue selected unique, systemically-important activities formerly funded by AHRQ that have demonstrated effectiveness in improving healthcare quality."[34] NIRSQ would provide administrative support for the U.S. Preventive Services Task Force (USPSTF). In the FY2019 budget proposal, NIRSQ would provide $7.4 million in administrative support to USPSTF—a reduction of $4.2 million (-36%) below AHRQ's FY2017 level; FY2018 amount for administrative support to USPSTF was not available.[35] "A reduction of $4.2 million in FY2019 will reduce the number of recommendations the USPSTF will make from an average of 12 recommendations per year to 6 recommendations in FY2019."[36] Additionally, the President's FY2019 budget proposal states that NIRSQ is

[31] The FY2019 request level does not reflect the proposal to allocate an additional $750 million to NIH for opioid-related activities from the $10 billion in requested HHS-wide funding. The FY2019 request level is as shown in HHS, *Fiscal Year 2019 Budget in Brief*, Washington, DC, February 2018, p. 42, https://www.hhs.gov/sites/default/files/fy-2019-budget-in-brief.pdf. The FY2018 program level was calculated based on amounts shown in the Explanatory Statement on the Consolidated Appropriations Act, FY2018 (H.R. 1625, P.L. 115-141) in the March 22, 2018, *Congressional Record*, pp. H2681, H2733-H2735.

[32] Ibid., p. 41.

[33] HHS, *Fiscal Year 2019 Budget in Brief*, February 2018, p. 45.

[34] Ibid., p. 45.

[35] Ibid., p. 46; HHS, *FY2018 Justification of Estimates for Appropriations Committees, Vol. V, National Institutes of Health*, p. NIRSQ-11; and HHS, *FY2019 Justification of Estimates for Appropriations Committees, Vol. V, National Institutes of Health*, p. NIRSQ-7.

[36] HHS, *FY2019 Justification of Estimates for Appropriations Committees, Vol. V, National Institutes of Health*, p. NIRSQ-7.

projected to receive $124 million in mandatory resources from the Patient-Centered Outcomes Research Trust Fund "to disseminate findings from comparative clinical effectiveness studies and train researchers on how to conduct high-quality studies in this area of research."[37]

Under the President's FY2019 budget proposal, the National Institute for Occupational Safety and Health (NIOSH), currently housed within the Centers for Disease Control and Prevention, would be consolidated into the NIH. NIOSH targets "research needed to prevent the societal cost of work-related fatalities, injuries, and illnesses in the United States."[38] The FY2019 budget includes $200 million for this line of research, a reduction of $135 million (-40%) compared with the $335 million enacted for FY2018.[39] An additional $55 million in mandatory funding is also provided for the Energy Employees Occupational Illness Compensation Program Act. Through this program NIOSH conducts activities to assist claimants and "provides compensation and medical benefits to employees who worked at certain Department of Energy facilities."[40] The Department of Labor manages claims filed under the act.

The National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR), currently housed under the Administration for Community Living in HHS, would also be folded into NIH under the President's FY2019 budget. The mission of NIDILRR is "to generate new knowledge and promote its effective use to improve the abilities of people with disabilities to perform activities of their choice in the community, and to expand society's capacity to provide full opportunities and accommodations for its citizens with disabilities."[41] Under this arrangement, NIDILRR activities are designed to complement existing NIH research addressing disabilities and aging. The President's budget would provide $95 million for NIDILRR for FY2019, a $10 million reduction (-9.5%) from the $105 million enacted for FY2018.[42]

The main funding mechanism NIH uses to support extramural research is research project grants (RPGs), which are competitive, peer-reviewed, and largely investigator-initiated. Historically, over 50% of the NIH budget is used to support RPGs, which include salaries for investigators and research staff. The President's FY2019 budget proposal includes two initiatives designed to "stretch available grant dollars" by placing limits on salaries for investigators.[43] The FY2019 budget proposes to cap the percentage of an investigator's salary that can be paid with grant funds to 90%. It also proposes to cap investigator salaries at $152,000, a 19% reduction from the current $187,000 limit.

The FY2019 program level request for NIH includes $54 million for Superfund-related health research.[44] The FY2019 Trump budget proposes shifting the $150 million in mandatory funding

[37] Ibid., p. 46. The Affordable Care Act (ACA, P.L. 111-148) created the Patient-Centered Outcomes Research Trust Fund (PCORTF) to help build the national capacity and infrastructure needed to conduct patient-centered outcomes research (PCOR), and to enable PCOR findings to be integrated into clinical practice. See https://aspe.hhs.gov/patient-centered-outcomes-research-trust-fund.

[38] Ibid., p. 45.

[39] Ibid., p. 31, the Explanatory Statement on the Consolidated Appropriations Act, FY2018 (H.R. 1625, P.L. 115-141) in the March 22, 2018, *Congressional Record*, p. H2731.

[40] Ibid., p. 45.

[41] Ibid., p. 45.

[42] Ibid., p. 110, and the Explanatory Statement on the Consolidated Appropriations Act, FY2018 (H.R. 1625, P.L. 115-141) in the March 22, 2018 *Congressional Record*, p. H2749.

[43] Ibid., p. 44.

[44] The Superfund amount is provided in the Department of the Interior, Environment, and Related Agencies Appropriations Acts.

for research on type 1 diabetes authorized under the PHS Act §330B to discretionary funding within the budget of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).[45] The FY2019 program level request proposes $741 million in funding transferred to NIH by the PHS Program Evaluation Set-Aside, also called the evaluation tap. Discretionary funding programs at NIH and other HHS agencies that are authorized under the PHS Act are subject to an assessment under Section 241 of the PHS Act (42 U.S.C. §238j). This provision 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 tap to no more than 1% of eligible appropriations, in recent years, annual LHHS appropriations acts have specified a higher amount (2.5% in FY2018) and have also typically directed specific amounts of funding from the tap for transfer to a number of HHS programs. The assessment 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 historically been the largest "donor" of program evaluation funds; until recently, it had been a relatively minor recipient.[46] Provisions in recent LHHS appropriations acts have directed specific tap transfers to NIH, making NIH a net recipient of tap funds.

With the exception of the mandatory type 1 diabetes funding provided in previous years, Congress has not usually specified amounts for particular diseases or research areas. Generally specific amounts are appropriated to each IC; NIH and its scientific advisory panels allocate the funding to various research areas. This allows maximum flexibility for NIH to pursue scientific opportunities that are important to public health.[47] Some bills may propose authorizations for designated research purposes, but funding generally has remained subject to the NIH peer review process as well as the overall discretionary appropriation to the agency. This pattern has changed in recent years, most notably in FY2016 with Alzheimer's disease research[48] and in FY2017 with the NIH Innovation account established by the 21st Century Cures Act (P.L. 114-255, see text box below).

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[45] Mandatory funds of $150 million per fiscal year for type 1 diabetes research (under PHS Act §330B) provided by §50902 of P.L. 115-123 for FY2018 and FY2019. The President's FY2019 budget proposes to shift this from mandatory funding to discretionary funding. More information can be found in the addendum to the FY2019 President's Budget, Letter from Mick Mulvaney, Director, Office of Management and Budget, to Paul D. Ryan, Speaker of the House of Representatives, February 12, 2018, https://www.whitehouse.gov/wp-content/uploads/2018/02/Addendum-to-the-FY-2019-Budget.pdf.

[46] For more information, see the "PHS Evaluation Set-Aside" section of CRS Report R44505, *Public Health Service Agencies: Overview and Funding (FY2015-FY2017)*, coordinated by C. Stephen Redhead and Agata Dabrowska. By convention, budget tables such as **Table 9** do not subtract the amount of the evaluation tap from the donor agencies' appropriations.

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

[48] For example, in the year before this new pattern developed, the explanatory statement accompanying the FY2015 omnibus stated the following:

> In keeping with longstanding practice, the agreement does not recommend a specific amount of NIH funding for this purpose or for any other individual disease. Doing so would establish a dangerous precedent that could politicize the NIH peer review system. Nevertheless, in recognition that Alzheimer's disease poses a serious threat to the Nation's long-term health and economic stability, the agreement expects that a significant portion of the recommended increase for NIA [National Institute on Aging] should be directed to research on Alzheimer's. The exact amount should be determined by scientific opportunity of additional research on this disease and the quality of grant applications that are submitted for Alzheimer's relative to those submitted for other diseases.

See *Congressional Record*, daily edition, vol. 160, no. 151, Book II (December 11, 2014), p. H9832, https://www.gpo.gov/fdsys/pkg/CREC-2014-12-11/pdf/CREC-2014-12-11-pt2-PgH9307-2.pdf.

The 21st Century Cures Act and the NIH Innovation Account

The 21st Century Cures Act (P.L. 114-255) created the NIH Innovation account and specified that funds in the account must be appropriated in order to be available for expenditure. The first round of funding was provided by Section 194 of the Further Continuing and Security Assistance Appropriations Act, 2017 (CR, P.L. 114-254). The CR appropriated $352 million in the NIH Innovation account for necessary expenses to carry out the four NIH Innovation Projects as described in Section 1001(b)(4) of the Cures Act. The FY2019 total NIH budget request includes $711 million made available through the 21st Century Cures Act. The Cures Act authorizes four projects in the following amounts: Precision Medicine Initiative (FY2017, $40 million; FY2018, $100 million; FY2019, $186 million), the BRAIN Initiative (FY2017, $10 million; FY2018, $86 million; FY2019, $115 million), cancer research (FY2017, $300 million; FY2018, $300 million; FY2019 $400 million), and regenerative medicine using adult stem cells (FY2017, $2 million; FY2018, $10 million; FY2019, $10 million). Amounts, once appropriated, are to be available until expended. The NIH Director may transfer these amounts from the NIH Innovation account to other NIH accounts but only for the purposes specified in the Cures Act. If the NIH Director determines that the funds for any of the four Innovation Projects are not necessary, the amounts may be transferred back to the NIH Innovation account. This transfer authority is in addition to other transfer authorities provided by law.

For further information, see CRS Report R44720, *The 21st Century Cures Act (Division A of P.L. 114-255)*, coordinated by Amanda K. Sarata, and CRS Report R44723, *Overview of Further Continuing Appropriations for FY2017 (H.R. 2028)*, coordinated by James V. Saturno.

The FY2019 total NIH budget request includes $711 million in resources made available through the 21st Century Cures Act. This includes support for the Precision Medicine Initiative's *All of Us* Research Program. This research initiative includes a national resource of clinical, environmental, lifestyle, and genetic data from one million or more participants who will contribute health information over many years. National roll-out of this program begins in 2018 with the first stages of enrollment scheduled to begin in spring 2018.

The President's FY2019 budget identifies several research priorities for NIH in the coming year. The overview below outlines these priority themes in the budget request.

1. Tackling Complex Challenges by Leveraging Partnerships. NIH partners with other government agencies and private entities to collaborate on research. The President's budget proposal states that "public-private partnerships can create efficiencies of scale and facilitate development of innovative technologies or treatments, thereby increasing the pace of biomedical research."[49] For example, the Accelerating Medicines Partnership is a public-private partnership between NIH, FDA, and several biopharmaceutical companies and nonprofit organizations. With the goal of increasing the number of new diagnostics and therapies for patients, the Partnership aims to jointly identify promising biological targets for therapeutics.

Since 2014, the Partnership has been addressing Alzheimer's disease, type 2 diabetes, and two autoimmune disorders (rheumatoid arthritis and systemic lupus erythematosus); a new Parkinson's disease initiative was also recently inaugurated. NIH will also enhance existing research efforts using a similar public-partnership model to address the opioid crisis. The goal of this endeavor is to develop new formulations of medications to treat opioid misuse and accelerate the development of non-addictive pain therapies. The FY2019 budget proposal would provide NIH $350 million from the new $10 billion investment requested for opioids, serious mental illness, and pain related research at NIH.[50]

2. Supporting Basic Research to Drive New Understanding of Health and Disease in Living Systems. NIH is the largest funder of basic biomedical research in the United States. As mentioned previously, each year more than half of the NIH budget goes toward basic research,

[49] HHS, *Fiscal Year 2019 Budget in Brief*, February 2018, p. 42.

[50] Ibid., p. 43.

which provides "a critical research foundation for both the public and private sectors to build upon."[51] NIH funds a broad spectrum of basic science research. For example, addressing the opioid crisis requires understanding how pain is sensed and perceived, and how changes in neural circuits create a state of dependency. Basic research on neural pathways in the brain related to pain and substance use may provide an avenue for better treatments for pain, without the potential for addiction.

3. Investing in Translational and Clinical Research to Improve Health. NIH builds on the foundation of basic research by supporting translational and clinical research that seeks to convert this basic science knowledge into interventions. Translational research aims to "translate" findings from basic science into medical practice to produce meaningful health outcomes.[52] Likewise, clinical research, which uses human subjects, helps professionals find new and better ways to understand, detect, control, and treat illness. NIH is investing in large population studies to learn more about the similarities and differences among individuals and facilitate integrated understanding of health and disease at all levels, from the molecular to the social. For example, as previously mentioned, NIH would continue to establish a group of 1 million or more volunteers through the Precision Medicine Initiative's *All of Us* Research Program. This research project involves the collection of health, genetic, environmental, and other data from participants for use in research studies designed to identify novel therapeutics and prevention strategies.

In addition to the above three priorities, the President's budget also identifies the following as goals for FY2019:

- *Updating the infrastructure of NIH facilities*. An independent review is currently being conducted of the capital needs of the 281 facilities located on NIH's main campus, including its research hospital, laboratories, and offices.
- *Fostering a diverse and talented research workforce*. The FY2019 budget proposal includes $100 million in dedicated funding to the OD for the Next Generation Research Initiative to "address longstanding challenges faced by researchers trying to embark upon and sustain independent research careers."[53]
- *Advancing data science.* The FY2019 budget would continue to support the Big Data to Knowledge (BD2K) initiative established in 2012. The FY2019 budget includes $30 million for NIH to build on the progress of the BD2K as this initiative enters its final stages.
- *Encouraging innovation through prize competitions*. The FY2019 budget proposal would allocate $50 million for prize competitions to improve health outcomes, particularly for research for which there is potential for significant return on investment.

[51] HHS, *Fiscal Year 2018 Budget in Brief*, February 2018, p. 43.

[52] Griffin M. Weber, "Identifying Translational Science Within the Triangle of Biomedicine," *Journal of Translational Medicine*, vol. 11, no. 126 (2013), https://translational-medicine.biomedcentral.com/articles/10.1186/1479-5876-11-126.

[53] HHS, *Fiscal Year 2019 Budget in Brief*, February 2018, p. 44.

Table 9. National Institutes of Health Funding

(budget authority, in millions of dollars)

Institutes/Centers	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Cancer Institute (NCI)	5,665	5,626			
Heart, Lung, and Blood Institute (NHLBI)	3,383	3,112			
Dental/Craniofacial Research (NIDCR)	448	413			
Diabetes/Digestive/Kidney (NIDDK)[a]	1,971	1,965			
Neurological Disorders/Stroke (NINDS)	2,145	1,839			
Allergy/Infectious Diseases (NIAID)	5,260	4,762			
General Medical Sciences (NIGMS)[b]	1,863	1,832			
Child Health/Human Development (NICHD)	1,452	1,340			
National Eye Institute (NEI)	772	711			
Environmental Health Sciences (NIEHS)[c]	751	693			
National Institute on Aging (NIA)	2,574	1,988			
Arthritis/Musculoskeletal/Skin Diseases (NIAMS)	587	545			
Deafness/Communication Disorders (NIDCD)	460	424			
National Institute of Mental Health (NIMH)	1,712	1,612			
National Institute on Drug Abuse (NIDA)	1,384	1,137			
Alcohol Abuse/Alcoholism (NIAAA)	510	469			
Nursing Research (NINR)	158	146			
Human Genome Research Institute (NHGRI)	557	513			
Biomedical Imaging/Bioengineering (NIBIB)	378	347			
Minority Health/Health Disparities (NIMHD)	303	281			
Complementary/Integrative Health (NCCIH)	142	131			
Advancing Translational Sciences (NCATS)	742	685			
Fogarty International Center (FIC)	76	70			
National Library of Medicine (NLM)	429	395			
Office of Director (OD)	1,816	2,004			
NIH Innovation Account (non-add in FY2019 request)[d]	496	(711)			
Buildings and Facilities (B&F)	129	200			
Natl Institute for Research on Safety & Quality (NIRSQ)[e]	—	256			
Natl Institute for Occupational Safety and Health (NIOSH)[f]	—	200			
Natl Institute Disability/Independent Living/Rehabilitation Research (NIDILRR)	—	95			
Subtotal, NIH	**36,161**	**33,792**			
PHS Program Evaluation	923	741			

Institutes/Centers	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Superfund (Interior approp. to NIEHS)[g]	77	54			
Mandatory type 1 diabetes funds[h]	150	—			
Patient-Centered Outcomes Research Trust Fund	—	124			
Energy Employees Occupational Illness Compensation	—	55			
NIH Program Level	**37,311**	**34,767**			
Additional opioids allocation	—	750			
Total, NIH Program Level	**37,311**	**35,517**			

Source: FY2018 enacted amounts are from the Explanatory Statement on the Consolidated Appropriations Act, FY2018 (H.R. 1625, P.L. 115-141) in the March 22, 2018, *Congressional Record*, pp. H2681, H2733-H2735. FY2019 request amounts are from the Department of Health and Human Services, *Fiscal Year 2019 Budget in Brief*, February 2018, p. 40-41, https://www.hhs.gov/sites/default/files/fy-2019-budget-in-brief.pdf.

Notes: Figures for the columns headed "FY2019 House," "FY2019 Senate," and "FY2019 Enacted" will be added, if available, as each action is completed. 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 9** do not subtract the amount of transfers, such as the evaluation tap, from the agencies' appropriation.

a. Amounts for the FY2018 National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) do not include mandatory funding for type 1 diabetes research (see note g). Amounts for FY2019 NIDDK include funding for type 1 diabetes research. The President's FY2019 budget proposes to shift this from mandatory funding to discretionary funding. More information can be found in the addendum to the FY2019 President's Budget, Letter from Mick Mulvaney, Director, Office of Management and Budget, to Paul D. Ryan, Speaker of the House of Representatives, February 12, 2018, https://www.whitehouse.gov/wp-content/uploads/2018/02/Addendum-to-the-FY-2019-Budget.pdf.

b. Amounts for National Institute of General Medical Sciences (NIGMS) do not include funds from PHS Evaluation Set-Aside (§241 of the PHS Act) $923 million for FY2018 and $741 million for FY2019).

c. Amounts for National Institute of Environmental Health Sciences (NIEHS) do not include Interior Appropriation for Superfund research (see note f).

d. The FY2018 omnibus appropriated $496 million for this account. The FY2019 HHS Budget in Brief notes the total NIH request level includes $711 million for the activities supported by this account under the authorities of the 21st Century Cures Act. However, this amount is not shown as its own line-item.

e. Amount for NIRSQ does not include the Patient-Centered Outcomes Research Trust Fund (PCORTF).

f. Amount for NIOSH does not include the Energy Employees Occupational Illness Compensation funds.

g. This is a separate account in the Interior/Environment appropriations for National Institute of Environmental Health Sciences (NIEHS) research activities related to Superfund.

h. Mandatory funds available to NIDDK for type 1 diabetes research under PHS Act §330B (provided by §50902 P.L. 115-123 for FY2018 and FY2019). These funds are specified at $150 million annually. In the FY2019 budget proposal these funds are included as discretionary funds within the NIDDK budget, rather than mandatory funds.

Department of Energy[54]

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 agencies with defense-related nuclear programs that dated back to the Manhattan Project. Today, DOE conducts basic scientific research in fields 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.

The Administration's FY2019 budget request for DOE includes about $11.720 billion for R&D and related activities, including programs in three broad categories: science, national security, and energy. This request is 21.9% less than the enacted FY2018 amount of $15.011 billion. The House bill would provide $15.473 billion. The Senate bill would provide $15.362 billion. (See **Table 10** for details.)

The request for the DOE Office of Science is $5.391 billion, a decrease of 13.9% from the FY2018 appropriation of $6.260 billion. Within that total, funding for Advanced Scientific Computing Research would increase by $89 million (11.0%), largely to support the DOE-wide Exascale Computing Initiative. The office's other major research programs would all receive decreases. Funding for Fusion Energy Sciences would decrease by $192 million (36.1%), including a decrease to $75 million (from $122 million in FY2018) for the U.S. contribution to construction of the International Thermonuclear Experimental Reactor (ITER), a fusion energy demonstration and research facility in France. Funding for Biological and Environmental Research would decrease by $173 million (25.7%), with reductions concentrated in the Earth and Environmental Systems Sciences subprogram (relative to FY2017; the FY2018 appropriation did not specify an allocation between subprograms). Funding for Science Laboratories Infrastructure, which supports DOE laboratory facilities, infrastructure, and construction, would decrease by 50.7%, from $257 million in FY2018 to $127 million in the FY2019 request.

The House bill would provide $6.600 billion for the Office of Science, including $15 million more than the request for Advanced Scientific Computing Research; $250 million more than the request for Fusion Energy Sciences (including $163 million for ITER); $173 million more than the request for Biological and Environmental Research (but again no specified allocation by subprogram); and $290 million for Science Laboratories Infrastructure. The Senate bill would provide $6.650 billion, including $81 million more than the request for Advanced Scientific Computing Research; $85 million more than the request for Fusion Energy Sciences (including $122 million for ITER); $215 million more than the request for Biological and Environmental Research (including $39 million more than the FY2017 amount for Earth and Environmental Systems Sciences); and $302 million for Science Laboratories Infrastructure.

The request for DOE national security R&D is $4.268 billion, an increase of 0.5% from $4.249 billion in FY2018. Funding for the Naval Reactors program would increase (up $169 million, 10.4%). In the Weapons Activities account (down $39 million, 1.9%) requested increases for most programs would be offset by a decrease of $126 million (23.1%) for Inertial Confinement Fusion. Within Inertial Confinement Fusion, nearly half of the proposed decrease would be in the Ignition subprogram (down $57 million, 71.8%), and support for the Laboratory for Laser Energetics ($68

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

million in FY2017, not specified for FY2018, $45 million in the FY2019 request) would be phased out over three years.

The House bill would provide $4.371 billion for national security R&D, including the requested amount for Naval Reactors and $33 million more than the request for Weapons Activities. Within Weapons Activities, it would provide $91 million more than the request for Inertial Confinement Fusion, including $68 million for the Omega Laser Facility at the Laboratory for Laser Energetics. The Senate bill would provide $4.182 billion, including the FY2018 amount for Naval Reactors and $47 million more than the request for Weapons Activities. Within Weapons Activities, it would provide $126 million more than the request for Inertial Confinement Fusion, including $80 million for the Omega facility.

The request for DOE energy R&D is $2.061 billion, a decrease of 54.2% from $4.502 billion in FY2018. Funding for energy efficiency and renewable energy R&D would decrease by 65.5%, with reductions in all major research areas and a shift in emphasis toward early-stage R&D rather than later-stage development and deployment. Funding for fossil energy R&D would decrease by 30.9%, with reductions focused particularly on coal carbon capture and storage ($40 million, down from $198 million in FY2018) and natural gas technologies ($6 million, down from $50 million in FY2018). Funding for nuclear energy would decrease by 37.2%, with no funding requested for the Integrated University Program ($5 million in FY2018) or the Supercritical Transformational Electric Power (STEP) R&D initiative ($5 million in FY2018) and $60 million requested for fuel cycle R&D (down from $260 million in FY2018). The Advanced Research Projects Agency–Energy (ARPA-E), which is intended to advance high-impact energy technologies that have too much technical and financial uncertainty to attract near-term private-sector investment, would be terminated.

The House bill would provide $4.502 billion for energy R&D. This total would include $1.080 billion more than the request for energy efficiency and renewable energy R&D; $283 million more than the request for fossil energy R&D (including $192 million for coal carbon capture and storage and $50 million for natural gas technologies); $589 million more than the request for nuclear energy (including $5 million for the Integrated University Program, $5 million for STEP R&D, and $255 million for fuel cycle R&D); and $325 million for ARPA-E. The Senate bill would provide $4.531 billion, including the FY2018 amount ($1.321 billion more than the request) for energy efficiency and renewable energy R&D; the FY2018 amount ($225 million more than the request) for fossil energy R&D (including $207 million for coal carbon capture and storage and $53 million for natural gas technologies); approximately the FY2018 amount ($449 million more than the request) for nuclear energy (including $5 million for the Integrated University Program, no funding for STEP R&D, and $267 million for fuel cycle R&D); and $375 million for ARPA-E.

Table 10. Department of Energy R&D and Related Activities

(budget authority, in millions of dollars)

	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Science	**$6,260**	**$5,391**	**$6,600**	**$6,650**	
Basic Energy Sciences	2,090	1,850	2,129	2,193	
High Energy Physics	908	770	1,005	1,010	
Biological and Environmental Research	673	500	673	715	
Nuclear Physics	684	600	690	710	
Advanced Scientific Computing Research	810	899	915	980	
Fusion Energy Sciences	532	340	590	425	
Other	563	432	599	617	
National Security	**4,249**	**4,268**	**4,371**	**4,182**	
Weapons Activities RDT&E	2,034	1,995	2,028	2,042	
Naval Reactors	1,620	1,789	1,789	1,620	
Defense Nuclear Nonproliferation R&D	557	456	520	487	
Defense Environmental Cleanup Technol. Devel.	38	28	35	32	
Energy	**4,502**	**2,061**	**4,502**	**4,531**	
Energy Efficiency and Renewable Energy[a]	2,016	696	1,776	2,016	
Fossil Energy R&D	727	502	785	727	
Nuclear Energy	1,205	757	1,346	1,206	
Electricity Delivery R&D[b]	201	36	152	—	
Cybersec., En. Security, & Emerg. Response R&D	—	70	118	207	
Advanced Research Projects Agency–Energy	353	0	325	375	
DOE, Total	**15,011**	**11,720**	**15,473**	**15,362**	

Source: FY2018 enacted from P.L. 115-141 and explanatory statement, *Congressional Record*, March 22, 2018. FY2019 request from DOE FY2019 congressional budget justification, https://www.energy.gov/cfo/downloads/fy-2019-budget-justification. FY2019 House from H.R. 5895 as passed by the House and H.Rept. 115-697. FY2019 Senate from H.R. 5895 as passed by the Senate and S.Rept. 115-258 (on S. 2975).

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

a. Excluding Weatherization and Intergovernmental Activities.

b. Electricity Delivery and Energy Reliability R&D in FY2018. Includes Cybersecurity, Energy Security, and Emergency Response R&D in FY2018. Included in Cybersecurity, Energy Security, and Emergency Response R&D in FY2019 Senate.

National Aeronautics and Space Administration[55]

The National Aeronautics and Space Administration (NASA) was created in 1958 by the National Aeronautics and Space Act (P.L. 85-568) 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 such as advanced propulsion systems. In addition, NASA operates the International Space Station (ISS) as a facility for R&D and other purposes.

Because final FY2018 funding was not available at the time the FY2019 budget was prepared, requested R&D funding is compared to the FY2017 actual funding.

The Administration is requesting about $16.474 billion for NASA R&D in FY2019. This is 1.6% less than the FY2017 level of about $16.743 billion. For a breakdown of these amounts, see **Table 11**. NASA R&D funding comes through five accounts: Science; Aeronautics; Exploration Research and Technology (formerly Space Technology); Deep Space Exploration Systems (formerly Exploration); and the ISS, Commercial Crew, and Commercial Low Earth Orbit (LEO) Development portions of LEO and Spaceflight Operations (formerly Space Operations).

The FY2019 request for Science is $5.895 billion, an increase of 2.3% relative to FY2017. Within this total, funding for Earth Science would decrease by $124 million (6.5%); funding for Planetary Science would increase by $407 million (22.3%); and funding for Astrophysics would decrease by $167 million (12.3%). The request for Earth Science assumes the termination of three items in the Earth Systematic Missions program: the Pre-Aerosol, Clouds, and Ocean Ecosystem (PACE) mission; the Climate Absolute Radiance and Refractivity Observatory (CLARREO) Pathfinder mission; and the NASA-provided instruments on the Deep Space Climate Observatory (DSCOVR) mission. These were also proposed for termination in the FY2018 budget; Congress funded them for FY2018 in legislation enacted after the release of the FY2019 budget. The proposed increase for Planetary Science includes $90 million in new funding for the Double Asteroid Redirection Test (DART), a mission to demonstrate the redirection of an asteroid for the purpose of planetary defense; and an increase of $199 million to fund a new Lunar Discovery and Exploration program, including public-private partnerships for research using commercial lunar landers. In Astrophysics, a proposed decrease of $265 million for the James Webb Space Telescope (JWST, previously a separate budget item) is consistent with that mission's previous plans; a proposed decrease of $100 million for Exoplanet Exploration reflects the proposed cancellation of the Wide Field Infrared Space Telescope (WFIRST).

The FY2019 request for Aeronautics is $634 million, a decrease of 3.4% relative to FY2017. The request includes $88 million (up from $19 million in FY2017) for the Low Boom Flight Demonstrator, intended to demonstrate quiet supersonic flight. This increase would be offset by a decrease of $50 million for the Airspace Operations and Safety program and a $44 million decrease for the Advanced Air Vehicles program.

The FY2019 request for Exploration Research and Technology is $1.003 billion, an increase of 21.3% relative to FY2017. This account supports the Space Technology Mission Directorate, the Human Research Program, and certain activities previously in the Advanced Exploration Systems program. Funding for Technology Maturation would increase by $82 million. Funding for Technology Demonstration would increase by $70 million, but within Technology Demonstration, funding for the Restore-L mission and other in-space robotic satellite servicing

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

activities would decrease by $85 million. Funding for the Human Research Program would be the same as in FY2017.

The FY2019 request for Deep Space Exploration Systems is $4.559 billion, an increase of 9.0% relative to FY2017. This account funds development of the Orion Multipurpose Crew Vehicle and the Space Launch System (SLS) heavy-lift rocket, the capsule and launch vehicle mandated by the NASA Authorization Act of 2010 for future human exploration beyond Earth orbit. The first test flight of SLS carrying Orion but no crew (known as EM-1) is now expected no earlier than December 2019. The first flight of Orion and the SLS with a crew on board (known as EM-2) is now expected in late 2022 or early 2023. Funding for Orion, the SLS, and related ground systems (collectively known as Exploration Systems Development) would decrease by $259 million relative to FY2017. The account also funds Advanced Exploration Systems, which would increase by $791 million relative to FY2017. That increase would include $504 million in new funding for a platform in lunar orbit (known as the Gateway) to serve as a test bed for deep space human exploration capabilities.

In the LEO and Spaceflight Operations account, the request for Commercial Crew is $173 million, a decrease of 85.4% relative to FY2017; the request for the ISS is $1.462 billion, an increase of 0.8%; and the request for Commercial LEO Development, a new program, is $150 million. The reduction in Commercial Crew funding reflects the expected transition of commercial crew activities from development to operations. Boeing and SpaceX are both expected to begin postcertification crewed flights to the ISS in the first half of 2019. The Commercial LEO Development program is intended to stimulate a commercial space economy in low Earth orbit, including the commercial provision of NASA's requirements for research and technology demonstration after the proposed end of direct ISS funding in 2025.

Table 11. National Aeronautics and Space Administration R&D

(budget authority, in millions of dollars)

	FY2017	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Science	**5,762**	**5,895**			
Earth Science	1,908	1,784			
Planetary Science	1,828	2,235			
Astrophysics	1,352	1,185			
Heliophysics	675	691			
Aeronautics	**656**	**634**			
Exploration Research and Technology	**827**	**1,003**			
Deep Space Exploration Systems	**4,184**	**4,559**			
Exploration Systems Development	3,929	3,670			
Advanced Exploration Systems	98	889			
Exploration R&D	157	—			
LEO and Spaceflight Operations[a]	**2,636**[a]	**1,785**[a]			
International Space Station	1,451	1,462			
Commercial Crew	1,185	173			
Commercial LEO Development	—	150			
Subtotal R&D	**14,064**	**13,876**			

	FY2017	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Non-R&D Programs[b]	2,445	2,879			
Safety, Security, and Mission Services	2,769	2,750			
Associated with R&D[c]	*2,359*	*2,277*			
Construction & Environmental C&R	376[d]	388			
Associated with R&D[c]	*320*	*322*			
NASA, Total (R&D)	**16,743**	**16,474**			
NASA, Total	**19,653[d]**	**19,892**			

Sources: NASA FY2019 congressional budget justification, http://www.nasa.gov/news/budget/. The FY2019 House, Senate, and Enacted columns will be completed as Congress acts on appropriations legislation.

Notes: FY2017 amounts reflect NASA's operating plan as of the release of the FY2019 budget. In some cases they are not directly comparable to enacted FY2017 appropriations because of changes in account structure. Totals may differ from the sum of the components due to rounding. LEO = Low Earth Orbit. C&R = Compliance and Remediation.

a. Excluding non-R&D activities: Space and Flight Support and Space Transportation other than Commercial Crew.

b. Non-R&D activities in LEO and Spaceflight Operations (see note a); Education; and Inspector General.

c. 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 Safety, Security, and Mission Services account and the Construction and Environmental Compliance and Remediation account consist mostly of indirect costs for other programs, assessed in proportion to their direct costs.

d. Does not include $109 million in emergency appropriations for natural disaster repairs.

National Science Foundation[56]

The National Science Foundation 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."[57] 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 (STEM) education program portfolio and federal STEM student aid and support.[58]

NSF has six 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). Appropriations are generally provided at the account level, while program-specific direction may

[56] This section was written by Laurie Harris, Analyst in Science and Technology Policy, CRS Resources, Science, and Industry Division.

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

[58] For more information about NSF and the agency's funding history, see CRS Report R45009, *The National Science Foundation: FY2018 Appropriations and Funding History*, by Laurie A. Harris.

be included in appropriations acts, or accompanying conference reports or explanatory statements.

Because final FY2018 funding was not available at the time the FY2019 budget request was prepared, requested R&D funding is compared to the FY2017 actual funding. FY2018 funding levels, enacted March 23, 2018, are included for reference.[59] These amounts are available only at the account level; FY2018 R&D breakouts and subaccount funding amounts are not yet available for comparison.

Funding for R&D is included in the RRA, EHR, and MREFC accounts. (The RRA and EHR accounts also include non-R&D funding.) Together, these three accounts comprise 95% of the total requested funding for NSF. Actual R&D obligations for each account are known after NSF allocates funding appropriations to specific activities and reports those figures.[60] The budget request specifies R&D funding for the conduct of research, including basic and applied research, and for physical assets, including R&D facilities and major equipment. Funding amounts for FY2017 actual and FY2019 requested levels are reported by account, including amounts for R&D conduct and physical assets where applicable, in **Table 12**.

Overall. The Administration is requesting $7.47 billion for the NSF in FY2019, $295.4 million (3.8%) less than the FY2018 enacted amount, and equal to the FY2017 actual amount. The requested amount reflects an additional $2.20 billion provided for NSF in the *Addendum to the President's FY19 Budget to Account for the Bipartisan Budget Act of 2018*.[61] The request would decrease budget authority in two accounts relative to the FY2017 enacted level: MREFC by $128.1 million (57.5%) and AOAM by $48.4 million (12.7%). The request would provide slight increases to the RRA (2.4%, $144.1 million), OIG (1.6%, $0.25 million), and NSB (1.2%, $0.05 million) accounts, and no change for the EHR account. Overall, NSF estimates that, under the FY2019 request, agency-wide funding rates (i.e., the percentage of submitted proposals that are successfully awarded funding) would decrease slightly from 23% to 22%, resulting in 300 fewer grants awarded, compared to FY2017.

As a proportion of NSF's total funding, R&D activities account for approximately 82%. For FY2019, $6.12 billion is requested for R&D activities, a 3% increase from FY2017 actual funding for R&D of $5.95 billion. The total request includes $5.68 billion (93%) for the conduct of R&D, and $441 million (7%) for R&D facilities and major equipment. Of funding requested for the conduct of R&D, 87% is requested for basic research, and 13% for applied research. Overall funding for R&D facilities and major equipment supports not only the construction and acquisition phases, funded through MREFC ($94.7 million requested), but also the planning, design, and post-construction operations and maintenance, funded through RRA ($346.3 million requested).

Research. The Administration seeks $6.151 billion for RRA in FY2019, a $183.8 (2.9%) decrease compared to the FY2018 enacted funding, and a $144.2 million (2.4%) increase compared to FY2017 actual funding. Compared to the FY2017 actual levels, the FY2019 request includes decreases for 7 of the 10 RRA subaccounts. The largest percentage increase would go to Integrative Activities (27%, $116 million increase). The largest percentage decrease would go to

[59] The Consolidated Appropriations Act, 2018 (P.L. 115-141); and Explanatory Statement, Consolidated Appropriations Act, 2018, Division B (Commerce, Justice, Science, and Related Agencies Appropriations Act, 2018), *Congressional Record*, vol. 164, no. 50—Book II (March 22, 2018), p. H2084.

[60] R&D actual (FY2017) and requested (FY2019) amounts are reported in the "Quantitative Data Tables" section of the FY2019 *NSF Budget Request to Congress*, February 28, 2018, pp. QDT-1–QDT-7.

[61] Released by OMB on February 12, 2018, and available at https://www.whitehouse.gov/wp-content/uploads/2018/02/Addendum-to-the-FY-2019-Budget.pdf.

Social, Behavioral, and Economic Sciences (SBE, 9.1%, $24.7 million decrease) The FY2019 request also includes $160 million for the RRA Established Program to Stimulate Competitive Research (EPSCoR) program, equal to the $160 million directed in the explanatory statement for FY2017 enacted funding.

Within the RRA account, the FY2019 request includes $5.617 billion for R&D, an increase of $162.5 million (3.2%) compared to the FY2017 actual amount. Of this amount, the majority ($5.270 billion, 94%) is requested for the conduct of research, including $4.79 billion for basic research and $483 million for applied research.

Education. The FY2019 request for the EHR account is $28.6 million (3.2%) less than the FY2018 amount and equal to the FY2017 actual level of $873.37 million. By program division, the Division of Human Resource Development would receive an increase of $37.7 million (25.5%) over the FY2017 actual level. The divisions of research on learning in formal and informal settings, graduate education, and undergraduate education would receive decreases of 8.8% ($203.0 million requested), 5.0% ($187.2 million requested), and 2.0% ($224.6 million requested), respectively.

EHR programs of particular interest to congressional policymakers include the Graduate Research Fellowship (GRF) and National Research Traineeship (NRT) programs. The FY2019 request for GRF is $270.7 million, a reduction of $48.8 million (15.3%) from the FY2017 actual level. The FY2019 request for NRT is $52.1 million, a $0.7 million (1.4%) decrease from FY2017.

Within EHR, requested funding for R&D is $410 million, which is nearly equal to the FY2017 actual funding amount and accounts for approximately 6.7% of the agency's total R&D request. All of the requested funding would support the conduct of R&D, including $131 million for basic research and $279 million for applied research.

Construction. The MREFC account supports large construction projects and scientific instruments, with all of the funding supporting R&D facilities. The Administration is seeking $94.6 million for MREFC in FY2019, $88.2 million (48.2%) less than the FY2018 enacted amount, and $128.1 million (57.5%) less than the FY2017 actual amount.

Requested MREFC funding would support three main projects, including continued construction of the Large Synoptic Survey Telescope (LSST, $48.8 million requested, 18.9% decrease from FY2017) and the Daniel K. Inouye Solar Telescope (DKIST, $16.1 million requested, 19.4% decrease from FY2017). The request includes $28.7 million for the Regional Class Research Vessels (RCRV) program to build ships to support science in U.S. coastal waters, a decrease of $93.2 million (76.4%) from FY2017, about which NSF notes the following:

> In FY 2017, P.L. 115-31 appropriated $121.88 million in funding to facilitate the planning and construction of three vessels. In the context of the President's overall fiscal goals intended to maintain spending restraint, this Budget Request supports construction of two vessels.[62]

Other initiatives. The FY2019 NSF budget request includes funding for three multiagency initiatives. This funding is included in multiple NSF appropriations accounts and R&D amounts are not separately provided. The National Nanotechnology Initiative would receive $385 million, $78 million (17%) less than in FY2017. The Networking and Information Technology Research and Development program would receive $1.152 billion, a decrease of $85.7 million (6.9%). The

[62] NSF, *FY2019 NSF Budget Request to Congress*, February 28, 2018, p. MREFC-21.

U.S. Global Change Research Program would receive $238 million, $4.6 million (1.9%) less than in FY2017.[63]

Table 12. National Science Foundation Funding

(budget authority in millions of dollars)

Account	FY2017 Actual	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Research and Related Activities (RRA)	**6,006.5**	**6,334.5**	**6,150.7**			
R&D, RRA Total	5,313.1	n/a	5,616.7			
Conduct of R&D	*5,107.9*	*n/a*	*5,270.4*			
R&D Facilities and Major Equipment	*205.2*	*n/a*	*346.3*			
Education and Human Resources (EHR)	**873.4**	**902.0**	**873.4**			
R&D, EHR Total	409.8	n/a	410.0			
Conduct of R&D	*409.7*	*n/a*	*410.0*			
R&D Facilities and Major Equipment	*0.1*	*n/a*	*0.0*			
Major Research Equipment and Facilities Construction (MREFC)	**222.8**	**182.8**	**94.7**			
R&D, MREFC Total	222.8	n/a	94.7			
Conduct of R&D	*0.0*	*n/a*	*0.0*			
R&D Facilities and Major Equipment	*222.8*	*n/a*	*94.7*			
Agency Operations and Award Management (AOAM)[a]	**382.1**	**328.5**	**333.6**			
National Science Board (NSB)[a]	**4.3**	**4.4**	**4.3**			
Office of the Inspector General (OIG)[a]	**15.1**	**15.2**	**15.4**			
NSF, Total	**7,504.1**	**7,767.4**	**7,472.0**			
R&D, NSF Total	5,945.7	n/a	6,121.4			
Total, Conduct of R&D	*5,517.6*	*n/a*	*5,680.4*			
Total, R&D Facilities & Major Equipment	*428.1*	*n/a*	*441.0*			

Source: Data in the columns titled, "FY2017 Actual" and "FY2019 Request" are from the FY2019 *NSF Budget Request to Congress*. Data in the "FY2018 Enacted" column are from P.L. 115-141.

Notes: Appropriations accounts are in bold. NSF total may differ from the sum of the accounts due to rounding. Non-bold R&D funding amounts are a subset of funding for the specified accounts. The term "n/a" means not available. Figures for the columns headed "FY2019 House," "FY2019 Senate," and "FY2019 Enacted" will be added, if available, as each action is completed.

a. The AOAM, NSB, and OIG accounts have no reported R&D funding.

[63] For additional information on these initiatives, see "Multiagency R&D Initiatives."

Department of Agriculture[64]

The U.S. Department of Agriculture (USDA) was created in 1862, in part to support agricultural research in an expanding, agriculturally dependent country. Today, 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 decisionmaking, 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 involved are the Agricultural Research Service (ARS), National Institute of Food and Agriculture (NIFA), National Agricultural Statistics Service (NASS), and Economic Research Service (ERS).

The FY2018 Omnibus Appropriations Act (P.L. 115-141) provides a total of $3.09.7 billion in discretionary funding for the four research agencies, an increase of $139.0 million (4.8%) from the enacted FY2017 appropriation (P.L. 115-31). The Administration is requesting a total of $2,486.5 billion for FY2019, a $543.2 million (18.0%) reduction (see **Table 1**).

In addition to discretionary appropriations, agricultural research is also funded by state matching contributions and private donations or grants, as well as mandatory funding from the farm bill.[65] USDA's FY2018 discretionary appropriations for the four research agencies are profiled below.

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 6,600 employees. 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. ARS also operates the National Agricultural Library, one of the department's primary information repositories for food, agriculture, and natural resource sciences. In FY2019, ARS will also assume ownership of the National Bio and Agro-Defense Facility (NBAF) from the Department of Homeland Security. The enacted bill provides $4.0 million for NBAF in FY2018, and the Administration is requesting $53 million for the facility in FY2019.

For FY2018, the enacted bill provides $1,202.8 billion for ARS salaries and expenses, $183.9 million (15.2%) less than the FY2019 budget request. The enacted bill also provides $140.6 million for buildings and facilities. The budget request for FY2019 is no new funding for ARS buildings and facilities; however, a $192 million proposed rescission was restored to this account by an Office of Management and Budget amendment on April 13, 2018 (**Table 13**).

The enacted bill directs ARS to work with the Animal and Plant Health Inspection Service to develop an integrated management program for control of the scale insect pest infestation in the Mississippi River Delta region along the Gulf Coast. The bill also provides $1.25 million for

[64] This section was written by Tadlock Cowan, Analyst in Natural Resources and Rural Development, CRS Resources, Science, and Industry Division.

[65] For background on agricultural research, see CRS Report R40819, *Agricultural Research: Background and Issues*, by Jim Monke. For background on agricultural appropriations, CRS Report R44588, *Agriculture and Related Agencies: FY2017 Appropriations*, coordinated by Jim Monke.

whitefly research and directs NIFA in cooperation with the land-grant universities to develop and submit a plan of action to address the whitefly problem.

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), established by the Morrill Acts, the 1994 tribal land-grant colleges, and Hispanic-serving institutions.[66] Federal funds enhance capacity at universities and institutions through statutory formula funding, competitive awards, and grants.[67]

For FY2018, the enacted bill provides $1,407.8 billion in discretionary spending for NIFA. The Administration's FY2019 request for NIFA is $1,257.6 billion, a reduction of $150.2 million (10.6%) (**Table 13**). Hatch Act funding for FY2018 is $243.7 million, the same as requested for FY2019. For McIntire-Stennis forestry research support, the enacted bill provides $34.0 million, while the FY2019 request is for a $5.1 million reduction, to $28.9 million. Evans-Allen research support for the 1890 land grant colleges is $53.8 million for FY2018, about $400,000 more than the FY2019 request.

The enacted bill provides $400.0 million for the Agriculture and Food Research Initiative (AFRI)—USDA's flagship competitive grants program. The Administration is requesting $25 million less ($375.0 million) for AFRI in FY2019.This budget line currently represents about 28% of the NIFA discretionary budget.

Cooperative Extension support for FY2018 under Smith-Lever formula funding is $300 million. The FY2019 request is for a reduction of $600,000. Support for other Smith-Lever extension activities (Section (d)) for FY2018 is $85.5 million. For FY2019, the Administration requests a 22% reduction to $66.4 million of the Section (d) extension activities.

National Agricultural Statistics Service

The National Agricultural Statistics Service conducts the quinquennial Census of Agriculture and provides official statistics on agricultural production and indicators of the economic and environmental status of the farm sector.

For FY2018, the Consolidated Appropriations Act for 2018 provides $191.7 million to NASS, of which $63.3 million is reserved to support data collection for the 2017 Census of Agriculture. For FY2019, the Administration is requesting $165.0 million.

Economic Research Service

The Economic Research Service supports economic and social science analysis about agriculture, rural development, food, commodity markets, and the environment. It collects and disseminates data concerning USDA programs and policies.

[66] 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.

[67] The National Agricultural Research, Extension, and Teaching Policy Act of 1977 designated USDA as the lead federal agency for higher education in the food and agricultural sciences.

For FY2018, the enacted bill provides $86.8 million. The Administration is requesting $45.0 million for ERS in FY2019, a 48% decrease.

Table 13. U.S. Department of Agriculture R&D

(budget authority, in millions of dollars)

Agency or Major Program	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Agricultural Research Service (ARS)	1,202.8	1,018.9			
Buildings and Facilities	140.6	0.0			
Subtotal, ARS	**1,343.4**	**1,018.9**			
National Institute of Food and Agriculture (NIFA)					
Research and Education					
AFRI (competitive grants)	400.0	375.0			
Hatch Act (1862 institutions)	243.7	243.2			
Evans-Allen (1890 institutions)	54.2	53.8			
McIntire-Stennis (forestry)	34.0	28.9			
Other	155.3	93.6			
Subtotal	**887.2**	**794.5**			
Extension					
Smith-Lever (b) and (c)	300.0	299.4			
Smith-Lever (d)	85.5	66.4			
Other	98.1	84.3			
Subtotal	**483.6**	**450.1**			
Integrated Activities	**37.0**	**13.0**			
Subtotal, NIFA	**1,407.8**	**1,257.6**			
National Agricultural Statistics Service (NASS)	**191.7**	**165.0**			
Economic Research Service (ERS)	**86.8**	**45.0**			
Total, USDA Research Mission Area	**3,029.7**	**2,486.5**			

Source: CRS, compiled P.L. 115-31 (including tables in the joint explanatory statement); *2018 Omnibus Appropriation Explanatory Statement, Division A*; *2019 USDA Budget Explanatory Notes.*

Notes: Figures for "FY2019 House," "FY 2019 Senate," and "FY2019 Enacted" will be added as Congress completes each action.

Department of Commerce

Two agencies of the Department of Commerce have major R&D programs: the National Institute of Standards and Technology (NIST) and the National Oceanic and Atmospheric Administration (NOAA).

National Institute of Standards and Technology[68]

The mission of the National Institute of Standards and Technology is "to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life."[69] NIST research provides measurement, calibration, and quality assurance methods and techniques that support U.S. commerce, technological progress, product reliability, manufacturing processes, and public safety. NIST's responsibilities include the development, maintenance, and custodial retention 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.[70]

It should be noted that the FY2018 enacted funding levels were not known at the time the President's FY2019 budget was prepared, as the budget process had not been completed.

The President is requesting $629.1 billion in funding for NIST in FY2019, a decrease of $569.4 million (47.5%) from the FY2018 enacted appropriation of $1,198.5 million. (See **Table 14**.) NIST discretionary 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 FY2019 request includes $573.4 million for R&D, standards coordination, and related services in the STRS account, a decrease of $151.1 million (20.9%) from the FY2018 enacted level.[71]

The FY2019 request would provide $15.1 million for the Industrial Technology Services (ITS) account, down $139.9 million (90.3%) from the FY2018 enacted level. Within the ITS account, the request would provide no funding for the Manufacturing Extension Partnership (MEP) program, a reduction of $140.0 million from the FY2018 enacted level; MEP centers in each state would be required to become entirely self-supporting. The request provides $15.1 million provided for Manufacturing USA (also referred to as the National Network for Manufacturing Innovation or NNMI), essentially unchanged from the FY2018 enacted level. Of these funds, $10.0 million would be for continued support of the NIST-sponsored National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) manufacturing institute, with the balance ($5.1 million) to be used for coordination of the Manufacturing USA network.[72]

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

[69] NIST website, "General Information," http://nist.gov/public_affairs/general_information.cfm.

[70] 15 U.S.C. 272.

[71] CRS analysis of data from U.S. Department of Commerce, *National Institute of Standards and Technology Fiscal Year 2019 Budget Submission to Congress*, February 2018; and P.L. 115-31.

[72] Ibid.

The President is requesting $40.5 million for FY2019 for the NIST CRF account, down $278.5 million (87.3%) from the FY2018 enacted level.[73]

Table 14. National Institute of Standards and Technology Funding

(budget authority, in millions of dollars)

Account	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Scientific and Technical Research and Services	724.5	573.4			
Industrial Technology Services	155.0	15.1[a]			
Manufacturing Extension Partnership	*140.0*	*0.0*			
Manufacturing USA/ National Network for Manufacturing Innovation	*15.0*	*15.1*			
Construction of Research Facilities	319.0	40.5			
NIST, Total[b]	1,198.5	629.1			

Source: The FY2018 enacted amounts were taken from the joint explanatory statement to accompany P.L. 115-141, printed in the March 22, 2018, *Congressional Record* (pp. H2084-H2115). FY2019 amounts from U.S. Department of Commerce, *Department of Commerce, Budget in Brief, Fiscal Year 2019,* https://www.commerce.gov/sites/commerce.gov/files/us_department_of_commerce_budget_in_brief_fiscal_year_2019.pdf.

Notes: Figures for the columns headed "FY2019 House," "FY2018 Senate" and "FY2018 Enacted" will be added, if available, as Congress completes each action. Totals may differ from the sum of the components due to rounding.

a. According to NIST, a rescission of $2 million in carryover balances from the discontinued Technology Innovation Program (TIP) adjusts the ITS budget authority to $13.1 million.

b. NIST stated that it would continue to execute mandatory resources in FY2019 (not included in the table figures) provided through the NIST Public Safety Communications Research Fund to help develop wireless technologies for public safety users, as part of the National Wireless Initiative included in the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96). This act provides mandatory funds for NIST from spectrum auction proceeds to help industry and public safety organizations conduct research and develop new standards, technologies and applications to advance public safety communications in support of the initiative's efforts to build an interoperable nationwide broadband network for first responders. The act provided NIST a total of $300 million, though rescissions have reduced this amount to $285 million.

National Oceanic and Atmospheric Administration[74]

The National Oceanic and Atmospheric Administration conducts scientific research in areas such as ecosystems, climate, global climate change, weather, and oceans; collects and provides data on the oceans and atmosphere; and manages coastal and marine organisms and environments. NOAA was created in 1970 by Reorganization Plan No. 4.[75] The reorganization was intended to unify elements of the nation's environmental programs and to provide a systematic approach for monitoring, analyzing, and protecting the environment.

[73] Ibid.

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

[75] "Reorganization Plan No. 4 of 1970," 35 *Federal Register* 15627-15630, October 6, 1970.

NOAA's Research Council[76] developed a five-year plan (2013-2017) to guide the agency's R&D efforts.[77] R&D efforts support the long-term goals and enterprise objectives of NOAA's *Next Generation Strategic Plan*.[78] The strategic plan is organized into four categories of long-term goals including (1) climate adaptation and mitigation, (2) a weather-ready nation,[79] (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) 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.

One of the main challenges 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."[80]

Because final FY2018 funding was not available at the time the FY2019 budget was prepared, requested R&D funding is compared to the FY2017 actual funding.

For FY2019, President Trump requested $623.6 million in R&D funding for NOAA, a decrease of $188.3 million (23.2%) below the FY2017 enacted level of $811.9 million. R&D funding for FY2017 consisted of $547.4 million for research (67.4% of total R&D funding), $120.8 million for development (14.9%), and $143.7 million for R&D equipment (17.7%).[81] In FY2017, R&D was 14.3% of NOAA's total discretionary budget of $5.675 billion. The FY2019 request for R&D funding includes $367.1 million for research (58.9% of total R&D funding), $83.2 million for development (13.3%), and $173.3 million for R&D equipment (27.8%). The President's request for R&D is 13.7% of NOAA's total discretionary budget request of $4.563 billion.

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, two major funding categories include Mission Support (formerly Program Support) and the Office of Marine and Aviation Operations (OMAO). Mission support is a cross-cutting budget activity, which provides administrative functions related to planning, information

[76] According to NOAA, "The NOAA Research Council is an internal body composed of senior scientific personnel from every line office in the agency who provide corporate oversight to ensure NOAA's research and development activities are of the highest quality, meet near- to long-term mission requirements and societal needs, take advantage of emerging scientific and technological opportunities, shape a forward-looking research agenda, and are accomplished in an efficient and cost-effective manner." Source: NOAA website, "NOAA Research Council," http://nrc.noaa.gov.

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

[78] NOAA, *NOAA's Next-Generation Strategic Plan*, Silver Spring, MD, December 2010.

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

[80] NOAA, *Research and Development at NOAA, Five-Year Research and Development Plan 2013-2017*, 2014.

[81] NOAA Budget Office, email to CRS, February 14, 2018.

technology, human resources, and infrastructure. OMAO is responsible for the agency's ships and aircraft that collect data in support of NOAA's environmental and scientific missions.[82]

Table 15 provides R&D funding levels for FY2017 enacted and the Administration's FY2019 request for each NOAA office.[83] Most of NOAA's R&D activities are conducted by OAR, and in most years OAR accounts for over half of NOAA's R&D funding. The FY2019 request would provide OAR with $321.7 million for R&D, a decrease of $178.8 million (35.7%) below the FY2017 enacted funding level of $500.5 million.[84]

OAR conducts research in three major areas: 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. NOAA supports 16 cooperative research institutes that work with seven NOAA laboratories in all three of the main OAR research areas. The President's FY2019 request would fund the cooperative institutes at $167.4 million, $2.6 million (1.5%) less than the FY2017 enacted funding level of $170.0 million.

The President's FY2019 request would also reduce OAR R&D funding for the National Sea Grant Program and Climate Research. 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 faced by coastal communities. The President's FY2019 request would terminate federal support of the National Sea Grant College Program and Sea Grant Marine Aquaculture Research. In FY2017, the National Sea Grant College Program was funded at $62.8 million and marine aquaculture research was funded at $9.5 million. Climate research includes funding for laboratories and cooperative institutes, regional climate data and information, and competitive research. The President's FY2019 request would provide climate research with $98.6 million, $58.6 million (37.3%) less than the FY2017 enacted funding level of $157.2 million.[85]

[82] Most of NOAA's discretionary funding for the five offices, OMAO, and Mission Support is from the Operations, Research and Facilities and the Procurement, Acquisition, and Construction accounts.

[83] Ibid.

[84] Ibid.

[85] Approximately one-third of climate research funding is provided for laboratories and cooperative institutes (e.g., $60.0 million in FY2017).

Table 15. National Oceanic and Atmospheric Administration R&D

(budget authority in millions of dollars)

	FY2017 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
National Ocean Service (NOS)	82.2	75.2			
National Marine Fisheries Service (NMFS)	70.4	54.9			
National Weather Service (NWS)	23.1	13.2			
National Environmental Satellite, Data, and Information Service (NESDIS)	29.9	29.4			
Office of Marine and Aviation Operations (OMAO)[a]	100.1	129.2			
Office of Oceanic and Atmospheric Research (OAR)	500.5	321.7			
Other	5.7	0			
Total R&D	**811.9**	**623.6**			
OAR, Total R&D and Non-R&D	510.1	321.7			
NOAA, Total R&D and Non-R&D	5,675.4	4,562.7			

Source: NOAA Budget Office, email to CRS concerning NOAA R&D, February 14, 2018.

Notes: Figures for the columns headed "FY2019 House," "FY2018 Senate" and "FY2018 Enacted" will be added, if available, as Congress completes each action. Totals may differ from the sum of the components due to rounding.

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

Department of the Interior[86]

The Department of the Interior was created to protect and manage the nation's natural resources and cultural heritage and to provide scientific and other information about those resources. DOI has a wide range of responsibilities including, among other things, mapping, geological, hydrological, and biological science; migratory bird, wildlife, and endangered species conservation; surface-mined lands protection and restoration; and historic preservation.[87]

Because final FY2018 funding was not available at the time the FY2019 budget was prepared, requested R&D funding is compared to the FY2017 actual funding.

The Administration is requesting $11.7 billion in net discretionary funding for DOI in FY2019.[88] Of that amount, $758.9 million is requested for R&D funding, $235.5 million below (23.7%) the

[86] This section was written by Laurie Harris, Analyst in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[87] Department of the Interior, *Strategic Plan for Fiscal Years 2014-2018*, https://www.doi.gov/pmb/ppp/upload/DOI-Strategic-Plan-for-FY-2014-2018-POSTED-ON-WEBSITE-4.pdf. A final version of DOI's strategic plan for 2018-2022 was not available at the time of the publishing of this report.

[88] Department of the Interior, *Fiscal Year 2019: The Interior Budget in Brief*, February 2018, p. DH-6. This amount reflects an additional $367.1 million provided for DOI in the *Addendum to the President's FY19 Budget to Account for the Bipartisan Budget Act of 2018* released by OMB on February 12, 2018. DOI also proposes transferring $111 million from the Department of Defense to the DOI for commitments to the Republic of Palau, for a total 2019 budget of $11.8 billion in current authority.

FY2017 enacted level of $994.3 million.[89] Of the President's FY2019 DOI R&D funding request, 5.3% is for basic research, 76.4% is for applied research, and 18.3% is for development. The U.S. Geological Survey (USGS) is the only DOI component that conducts basic research.[90]

Funding for DOI R&D is generally included in appropriations line items that also include non-R&D activities. How much of the funding provided in appropriations legislation is allocated to R&D specifically is unclear 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.

As passed by the House on July 19, 2018, the Interior, Environment, Financial Services, and General Government Appropriations Act, 2019 (H.R. 6147) would provide $13.0 billion for DOI, a $1.3 billion (11.1%) increase over the FY2019 budget request and approximately equal to the FY2018 enacted amount. These amounts includes both R&D and non-R&D funding.

U.S. Geological Survey

The USGS accounts for more than two-thirds of all DOI R&D funding. A single appropriations 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 FY2019 budget request for USGS is $859.7 million. Of this amount, $502.6 million would be for R&D, a decrease of $184.9 million (26.9%) over the FY2017 enacted level of $687.6 million.[91]

As passed by the House, H.R. 6147 would provide $1.167 billion for USGS, a $19 million (1.7%) increase over the FY2018 enacted amount and $307 million (35.7%) more than the FY2019 request. These amounts includes both R&D and non-R&D funding.

Other DOI Components

The President's FY2019 request also includes R&D funding for the following DOI components:[92]

- Bureau of Reclamation (BOR): $82.5 million in applied research and development funding for FY2019, down $24.5 million (22.9%) from FY2017.
- Bureau of Ocean Energy Management (BOEM): $84.6 million in applied research and development funding for FY2019, up $12.6 million (17.4%) from FY2017.
- Fish and Wildlife Service (FWS): $15.4 million in applied research for FY2019, down $17.0 million (52.5%) from FY2017.
- Bureau of Land Management (BLM): $24.2 million in applied research and development for FY2019, down $2.0 million (7.5%) from FY2017.
- National Park Service (NPS): $24.0 million in applied research and development for FY2019, down $3.0 million (11.0%) from FY2017.

[89] Email correspondence between the DOI and CRS on February 26, 2018.

[90] Email correspondence between the DOI and CRS on February 26, 2018.

[91] Email correspondence between the DOI and CRS on February 26, 2018.

[92] Ibid.

- Bureau of Safety and Environmental Enforcement (BSEE): $20.5 million in applied research for FY2019, down $6.2 million (23.1%) from FY2017.
- Bureau of Indian Affairs (BIA): $5.0 million in applied research for FY2019, down $4.5 million (47.4%) from FY2017.
- Wildland Fire Management (WFM): No funding requested for R&D for FY2019, down $6.0 million (100.0%) from FY2017.[93]
- Office of Surface Mining Reclamation and Enforcement (OSMRE): $5.0 million in applied research was requested in FY2017, though no funding was enacted; the office has not requested any R&D funding in FY2019.[94]

Table 16 summarizes FY2017 enacted R&D funding and the President's FY2019 R&D funding request for DOI components.

Table 16. Department of the Interior R&D

(budget authority in millions of dollars)

	FY2017 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
U.S. Geological Survey (USGS)	$687.6	$502.6	n/s		
Bureau of Reclamation (BOR)	106.9	82.5	n/s		
Bureau of Ocean Energy Management (BOEM)	72.0	84.6	n/s		
Fish and Wildlife Service (FWS)	32.5	15.4	n/s		
Bureau of Land Management (BLM)	26.1	24.2	n/s		
National Park Service (NPS)	27.0	24.0	n/s		
Bureau of Safety and Environmental Enforcement (BSEE)	26.7	20.5	n/s		
Bureau of Indian Affairs (BIA)	9.5	5.0	n/s		
Wildland Fire Management (WFM)	6.0	—	n/s		
Office of Surface Mining Reclamation and Enforcement (OSMRE)	—	—	n/s		
Department of the Interior, Total	**$994.3**	**$758.9**	**n/s**		

Source: Email correspondence between the DOI and CRS on February 26, 2018.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns headed "FY2019 Senate" and "FY2019 Enacted" will be added, if available, as each action is completed. The term "n/s" means "not specified." It is not possible to determine the level of budget authority specifically for R&D from the bill or report language; see the text for additional information.

[93] The FY2019 budget request for the Wildland Fire Management Program is $870.4 million (non-R&D funding).

[94] The FY2019 budget request for OSMRE is $121.7 million (non-R&D funding).

Department of Veterans Affairs[95]

The Department of Veterans Affairs operates and maintains a national health care delivery system to provide eligible veterans with medical care, benefits, and social support. As part of the agency's mission, it seeks to advance medical R&D in areas most relevant to the diseases and conditions that affect the health care needs of veterans.

Because final FY2018 funding was not available at the time the FY2019 budget was prepared, requested R&D funding is compared to the FY2017 actual funding.

The President is proposing $1.346 billion for VA R&D in FY2019, an increase of $137.1 million (11.3%) from FY2017. (See **Table 17**.) VA R&D represents 0.68% of the agency's overall FY2019 budget request and is funded through two accounts—the Medical and Prosthetic Research account and the Medical Care Support account. As the Medical Care Support account also includes non-R&D funding, the amount of funding that will be allocated to R&D through appropriations legislation is unclear unless funding is provided at the precise level of the request. In general, R&D funding levels from the Medical Care Support account are only known after the VA allocates its appropriations to specific activities and reports those figures. The FY2019 request includes $727.4 million for VA's Medical and Prosthetic Research account, an increase of $54 million (8.0%), and $618.3 million in funding for research supported by the agency's Medical Care Support account, an increase of $83.1 million (15.5%).

According to the President's request, VA R&D priorities for FY2019 include efforts to treat veterans at risk of suicide; research to address pain management, opioid addiction, and Gulf War Veterans Illness; an expansion of efforts focused on women veterans' health issues; and the use of the Million Veteran Program—a genomic research program that is collecting genetic samples and detailed health information from one million veterans—to advance precision medicine.

The Medical and Prosthetics R&D program is an intramural program managed by the Veteran Health Administration's Office of Research and Development (ORD) and conducted at VA Medical Centers and VA-approved sites nationwide. According to ORD, the mission of VA R&D is "to improve Veterans' health and well-being via basic, translational, clinical, health services, and rehabilitative research and to apply scientific knowledge to develop effective individualized care solutions for Veterans."[96] ORD consists of four main research services each headed by a director:

- Biomedical Laboratory R&D conducts preclinical and clinical research to understand life processes at the molecular, genomic, and physiological levels.
- Clinical Science R&D supports research, including human subjects research, to determine the feasibility and effectiveness of new treatments such as drugs, therapies, or devices.
- Health Services R&D conducts studies to identify and promote effective and efficient strategies to improve the quality and accessibility of the VA health system and patient outcomes, and to minimize health care costs.
- Rehabilitation R&D develops novel approaches to improving the quality of life of impaired and disabled veterans suffering from traumatic amputation, central

[95] This section was written by Marcy E. Gallo, Analyst in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[96] Department of Veterans Affairs, website, "Office of Research & Development," https://www.research.va.gov/about/default.cfm.

nervous system injuries, loss of sight or hearing, or other physical and cognitive impairments.

In addition to intramural support, VA researchers are eligible to obtain funding for their research from extramural sources, including other federal agencies, private foundations and health organizations, and commercial entities. According to the President's FY2019 budget request, these additional R&D resources are estimated at $570 million in FY2019. However, unlike federal agencies, such as the National Institutes of Health and the Department of Defense, VA does not have the authority to support extramural R&D by providing research grants to colleges, universities, or other non-VA entities.

On June 8, 2018, the House passed H.R. 5895, the Energy and Water, Legislative Branch, and Military Construction and Veterans Affairs Appropriations Act, 2019. H.R. 5895 would provide $732.3 million in funding for the Medical and Prosthetic Research account, an increase of $4.9 million, or 0.7% above the FY2019 request.

On June 25, 2018, the Senate passed H.R. 5895 providing the Medical and Prosthetic Research account $779 million, an increase of $51.6 million, or 7.1% above the FY2019 request

Table 17 summarizes R&D program funding for VA in the Medical and Prosthetic Research and the Medical Care Support accounts. **Table 18** details amounts to be spent in Designated Research Areas (DRAs) which VA describes as "areas of particular importance to our veteran patient population." Funding for research projects that span multiple areas may be included in several DRAs; thus, the amounts in **Table 18** total to more than the appropriation or request for VA R&D.

Table 17. Department of Veterans Affairs R&D

(budget authority, in millions of dollars)

Account	FY2017	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Medical and Prosthetic Research	$673.4	$727.4	$732.3	$779.0	
Medical Care Support	535.2	618.3	a	a	
Veterans Affairs, Total R&D	**$1,208.5**	**$1,345.6**	a	a	

Source: Department of Veterans Affairs, *Volume II: Medical Programs and Information Technology Programs, Congressional Submission, FY2019 Funding and FY2020 Advance Appropriations*, p. VHA-436, https://www.va.gov/budget/docs/summary/fy2019VAbudgetVolumeIImedicalProgramsAndInformationTechnology.pdf.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns headed "FY2019 House," "FY2019 Senate," and "FY2019 Enacted" will be added, if available, as each action is completed. VA researchers also receive grants from other federal and nonfederal resources including, the National Institutes of Health, the Department of Defense, and the Centers for Disease Control and Prevention. According to VA, these resources are estimated at $595 million in FY2017 and $570 million in FY2019 increasing the total amount of R&D performed at VA to $1.85 billion in FY2017 and $1.97 billion in the FY2019 request.

a. Cannot be determined as R&D is included in accounts with non-R&D funding.

Table 18. Department of Veterans Affairs Amounts by Designated Research Areas

(in millions of dollars)

Designated Research Area	FY2017	FY2019 Request
Acute and Traumatic Injury	$23.1	$26.5
Aging	149.0	159.5
Autoimmune, Allergic, and Hematopoietic Disorders	31.2	29.4
Cancer	55.9	61.6
Central Nervous System Injury and Associated Disorders	100.6	107.3
Degenerative Diseases of Bones and Joints	39.4	40.2
Dementia and Neuronal Degeneration	31.4	30.0
Diabetes and Major Complications	37.0	35.7
Digestive Diseases	22.2	18.8
Emerging Pathogens/Bio-Terrorism	1.8	0.7
Gulf War Veterans Illness	13.2	15.0
Health Systems	70.2	79.6
Heart Disease/Cardiovascular Health	72.1	77.4
Infectious Disease	27.6	31.5
Kidney Disorders	18.4	20.3
Lung Disorders	25.2	29.4
Mental Illness	113.0	125.9
Military Occupations and Environmental Exposures	20.8	20.5
Other Chronic Diseases	2.6	2.9
Prosthetics	16.3	22.1
Sensory Loss	18.8	17.2
Special Populations	29.6	26.1
Substance Abuse	28.5	42.9

Source: Department of Veterans Affairs, *Volume II: Medical Programs and Information Technology Programs, Congressional Submission, FY2019 Funding and FY2020 Advance Appropriations*, p. VHA-470, https://www.va.gov/budget/docs/summary/fy2019VAbudgetVolumeIImedicalProgramsAndInformationTechnology.pdf.

Notes: Projects that span multiple areas may be included in several Designated Research Areas (DRAs); therefore, the amounts depicted in this table total to more than the FY2017 amount and the FY2019 request for Medical and Prosthetic Research. Columns for "FY2019 House, "FY2019 Senate," and "FY2019 Enacted" are not included in this table as these figures will only be available after Congress completes the appropriations process and VA determines how much of the appropriated funds will be allocated to each DRA.

Department of Transportation[97]

The primary purposes of the research and development activities of the Department of Transportation (DOT) as defined by Section 6019 of the Fixing America's Surface Transportation Act (P.L. 114-94) are improving mobility of people and goods; reducing congestion; promoting safety; improving the durability and extending the life of transportation infrastructure; preserving the environment; and preserving the existing transportation system.

Funding for DOT R&D is generally included in appropriations line items that also include non-R&D activities. How much of the funding provided by appropriations legislation is allocated to R&D is unclear 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 final appropriations to specific activities and report those figures, and because of this, the President's FY2019 request is compared to FY2017 actual funding rather than FY2018 enacted levels unless otherwise indicated.

The Administration is requesting $836.2 million for DOT R&D activities and facilities in FY2019, a decrease of $103.3 million (11%) from FY2017. (See **Table 19**.) Three DOT agencies—the Federal Aviation Administration (FAA), the Federal Highway Administration (FHWA), and the National Highway Traffic Safety Administration (NHTSA)—would account for nearly 90% of DOT R&D under the FY2019 request.

Federal Aviation Administration

FAA's R&D activities focus on improving the capacity and safety of the national airspace systems and reducing environmental impacts.

The President's FY2018 request of $350.9 million for R&D activities and facilities at FAA would be a decrease of $82 million (18.9%) from FY2017. The request includes $74.4 million for the agency's Research, Engineering, and Development (RE&D) account, a reduction of $102.1 million (57.8%) from FY2017 and $114.5 million (60.6%) below the FY2018 enacted level. Funding within the RE&D account seeks to improve aircraft safety through research in fields such as fire safety, advanced materials, propulsion systems, aircraft icing, and continued airworthiness.

Federal Highway Administration

According to the President's budget request,

> Innovations developed and/or advanced through FHWA's R&T [research and technology] program enable and supports achievement and management of a safer and more reliable transportation system that is cost-effective and sustainable, thus improving overall economic competitiveness and quality of life.[98]

The President's request of $336.5 million for R&D activities and facilities at FHWA would be an increase of $18.8 million (5.9%) from FY2017. The request includes $85 million for FHWA's Highway Research and Development program which seeks to improve safety, enhance the transportation infrastructure, and reduce congestion. The program supports highway research in

[97] This section was written by Marcy E. Gallo, Analyst in Science and Technology Policy, CRS Resources, Science, and Industry Division.

[98] Department of Transportation, *Federal Highway Administration Fiscal Year 2019 Budget*, pp. III-79, https://www.transportation.gov/mission/budget/fhwa-fy-2019-budget-estimates.

such areas as innovative materials, new construction techniques, durability and resilience, and the factors that contribute to death and injury related to roadway design, construction, and maintenance. The request also includes $79 million for research to facilitate the development of a connected, integrated, and automated transportation system under the agency's Intelligent Transportation Systems program.

National Highway Traffic Safety Administration

The President is requesting $63.7 million in R&D and R&D facilities funding in FY2019 for NHTSA, $5.2 million (7.6%) below FY2017. NHTSA R&D focuses on automation, advanced vehicle safety technology, ways of improving vehicle crashworthiness and crash avoidance, reducing unsafe driving behaviors, and alternative fuels vehicle safety.

Other DOT Components

R&D activities are also supported by several other DOT components or agencies (see **Table 19**). The President's FY2019 request includes DOT R&D and R&D facilities funding for

- the Federal Railroad Administration (FRA), totaling $23.4 million, $20.5 million (46.7%) below the FY2017 level of $43.9 million;
- the Federal Transit Administration (FTA), totaling $28 million, the same amount as FY2017;
- the Pipeline and Hazardous Materials Safety Administration (PHMSA), totaling $11.7 million, $9.8 million (45.5%) below the FY2017 level of $21.5 million;
- the Office of the Secretary (OST), totaling $12.9 million, $4.5 million (25.8%) below the FY2017 level of $17.4 million; and
- the Federal Motor Carrier Safety Administration (FMCSA), totaling $9.1 million, slightly below the FY2017 level of $9.2 million.

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

(budget authority, in millions of dollars)

	FY2017	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Federal Aviation Administration	$432.9	[a]	$350.9			
Research, Engineering, and Development	*176.5*	*188.9*	*74.4*			
Federal Highway Administration	317.7	[a]	336.5			
Highway Research and Development	*78.9*	[a]	*85.0*			
Intelligent Transportation Systems	*73.3*	[a]	*79.0*			
National Highway Traffic Safety Administration	69.0	[a]	63.7			
Federal Railroad Administration	43.9	[a]	23.4			
Railroad Research and Development	*40.1*	*40.6*	*19.6*			
Federal Transit Administration	28.0	[a]	28.0			

	FY2017	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Pipeline and Hazardous Materials Safety Administration	21.5	[a]	11.7			
Office of the Secretary	17.4	[a]	12.9			
Federal Motor Carrier Safety Administration	9.2	[a]	9.1			
DOT, R&D Total	**$939.5**	[a]	**$836.2**			

Sources: U.S. Department of Transportation, *Fiscal Year 2019 Budget Estimates*, https://www.transportation.gov/mission/budget/fy-2019-budget-estimates.

Notes: Amounts include R&D and R&D facilities. Components may not add to total due to rounding. Lines in italics are components of the agency lines above them and are not counted separately in the total. Figures for the columns headed "FY2019 House," "FY2019 Senate," and "FY2019 Enacted" will be added, if available, as each action is completed.

a. Cannot be determined, as R&D is included in accounts with non-R&D funding.

Department of Homeland Security[99]

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 achieving all these goals. The Directorate of Science and Technology (S&T) has primary responsibility for establishing, administering, and coordinating DHS R&D activities. Other components, such as the Countering Weapons of Mass Destruction Office, the U.S. Coast Guard, and the Transportation Security Administration, conduct R&D relating to their specific missions.

Because final FY2018 funding was not available at the time the FY2019 budget was prepared, requested R&D funding is compared to the FY2017 actual funding.

The President's FY2019 budget request for DHS includes $485 million for activities identified as R&D. This would be a reduction of 28.6% from $678 million in FY2017. The total includes $311 million for the S&T Directorate and smaller amounts for six other DHS components. See **Table 20**.

The S&T Directorate 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 FY2019 request of $311 million for the S&T Directorate R&D account is a decrease of 33.8% from $471 million in FY2017. About half of the $140 million (32.6%) reduction for Research, Development, and Innovation would result from transferring the Cyber Security/Information Analysis thrust area to the National Protection and Programs Directorate. The other thrust areas within Research, Development, and Innovation would all receive decreased funding except Counter Terrorist, which would receive a 3% increase including first-time funding for detection of opioids and fentanyl at ports of entry and mail-handling facilities. Funding for University Programs, which primarily funds the S&T Directorate's university centers of

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

excellence, would decrease by 46.3% as the number of supported centers would drop from seven to five.

In addition to its R&D account, the S&T Directorate receives funding for laboratory facilities and other R&D-related expenses through its Operations and Support account (not shown in the table). The FY2019 request for S&T Directorate Operations and Support is $272 million, down 12.6% from $311.1 million in FY2017. Within this account, Laboratory Facilities would receive $111 million, down 17.5% from $134 million in FY2017. The Laboratory Facilities request includes no funding for the National Bio and Agro-Defense Facility (NBAF), as DHS is proposing to transfer operational responsibility for NBAF to the USDA. The request also includes reduced funding for the National Biodefense Analysis and Countermeasures Center (NBACC), as the Federal Bureau of Investigation has agreed to assume 40% of NBACC's operational costs.

The request for R&D in the recently established Countering Weapons of Mass Destruction Office is $80 million. Most if not all of this amount would support programs previously funded in the former Domestic Nuclear Detection Office ($155 million for R&D in FY2017).

The request for the R&D account of the National Protection and Programs Directorate is $48 million, up from $6 million in FY2017. This increase reflects the transfer of cybersecurity R&D activities from the S&T Directorate. While the $42 million increase is large in percentage terms, it is less than the $71 million that cybersecurity R&D programs in the S&T Directorate received in FY2017.

Table 20. Department of Homeland Security R&D Accounts

(budget authority, in millions of dollars)

	FY2017	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Science and Technology Directorate	**$471**	**$311**			
Research, Development, and Innovation	430	290			
Apex	*79*	*43*			
Border Security	*56*	*52*			
Chemical, Biological, and Explosive Defense	*62*	*57*			
Counter Terrorist	*75*	*77*			
Cyber Security/Information Analytics	*71*	*—*			
First Responder/Disaster Resilience	*87*	*61*			
University Programs	41	22			
Domestic Nuclear Detection Office	**155**	**—**			
Countering Weapons of Mass Destruction Office	**—**	**80**			
Transportation Security Administration	**5**	**21**			
U.S. Coast Guard	**36**	**19**			
National Protection and Programs Directorate	**6**	**48**			
Office of the Under Secretary for Management	**3**	**3**			
U.S. Secret Service	**3**	**3**			
Total, DHS R&D	**678**	**485**			

Sources: FY2019 DHS congressional budget justification, https://www.dhs.gov/publication/congressional-budget-justification-fy-2019.

Notes: Table includes accounts titled "Research and Development" in each DHS component. Some other accounts may also fund R&D-related activities. Some totals may not add because of rounding. Figures for the

columns headed "FY2019 House," "FY2019 Senate," and "FY2019 Enacted" will be added, if available, as each action is completed.

Environmental Protection Agency[100]

The U.S. Environmental Protection Agency (EPA), the federal regulatory agency responsible for administering 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. Since FY2006, Congress has funded EPA through the Interior, Environment, and Related Agencies appropriations act.

Appropriations for EPA R&D are generally included in line-items that also include non-R&D activities. Annual appropriations bills and the accompanying committee reports and explanatory statements do not identify precisely how much funding is allocated to EPA R&D alone. EPA determines its R&D funding levels in operation through the allocation of appropriations to specific activities and reports those amounts.

The agency's Science and Technology (S&T) appropriations account[101] funds much of EPA's scientific research activities, which include R&D conducted by the agency at its own laboratories and facilities, and R&D and related scientific research conducted by universities, foundations, and other nonfederal entities that receive EPA grants. The S&T account receives a base appropriation, and a transfer from the Hazardous Substance Superfund (Superfund) account for research on more effective methods to clean up contaminated sites.

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 research grants. Programs implemented by other offices within EPA also may have a research component, but the research component is not necessarily the primary focus of the program.

The President's FY2019 budget request includes a total of $6.15 billion for EPA,[102] $1.91 billion (29.7%) less than the total $8.82 billion (including rescissions) enacted appropriations for EPA provided in Titles II and IV of Division G of the Consolidated Appropriations Act, FY2018 (P.L. 115-141).[103] The FY2019 request proposed a number of reductions and elimination of funding distributed across EPA operational functions and activities as well as grants for states, tribes, and

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

[101] The EPA S&T account (and seven other accounts) was established by Congress in 1995 and 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. Currently, in addition to the S&T account, discretionary funding is annually appropriated to EPA among 10 statutory accounts established by Congress over time in annual appropriations acts. Because of the differences in the scope of the activities included in these accounts, comparisons before and after FY1996 are not readily available.

[102] The FY2019 request for EPA includes $740.0 million contained in an addendum to the amounts for EPA as initially released. The addendum was submitted to Congress by the Office of Management and Budget (OMB) on February 12, 2018. See *Addendum to the President's FY19 Budget to Account for the Bipartisan Budget Act of 2018* at https://www.whitehouse.gov/omb/budget/. The adjustments included in the addendum are incorporated into EPA,'s *Fiscal Year 2019 Justification of Appropriations Estimates for the Committee on Appropriation* (https://www.epa.gov/planandbudget/fy-2019-justification-appropriation-estimates-committee-appropriations).

[103] For an overview of Congressional action regarding for EPA enacted appropriations see CRS In Focus IF10717, *U.S. Environmental Protection Agency (EPA) FY2018 Appropriations: Congressional Action*, by Robert Esworthy and David M. Bearden.

local governments. The proposed FY2019 funding would be below FY2018 enacted levels for 8 of the 10 EPA appropriations accounts, including the S&T account, although funding for some program areas and activities within the accounts would increase or remain constant.

Including transfers from the Superfund account, the President's FY2019 budget request would provide $466.4 million for EPA's S&T account.[104] The FY2019 total request for the S&T account including transfers represents 7.6% of the $6.15 billion FY2019 request for EPA overall. The total request for the S&T account is $262.9 million (36.1%) less than the $729.3 million enacted level for FY2018 (P.L. 115-141) and slightly more than the $463.2 million FY2018 request including transfers (but not specific rescissions).

Prior to the Superfund account transfers, the FY2019 requested total base amount for the EPA S&T account is $449.0 million,[105] $264.9 million (37.1%) less than the FY2018 enacted base level of $713.8 million (prior to transfers and account specific rescissions), and is also a decrease compared to the $450.8 million FY2018 requested base amount. The President's FY2019 request would increase the S&T base appropriations by $17.4 million transferred from the Superfund account,[106] compared to $12.4 million requested for FY2018 and $15.5 million transferred in the FY2018 enacted appropriations.

The President's FY2019 request proposes an agency-wide rescission of prior-year funds totaling $220.5 million[107] but does not specify an amount within the individual appropriations accounts. For FY2018, P.L. 115-141 rescinded a total of $148.8 million of prior-year funds, including a specific allocation of $7.4 million from EPA's S&T account[108] (see end of **Table 21**) as well as proportional allocations for the Environmental Programs and Management (EPM) and the State and Tribal Assistance Grants (STAG) account. This accounting difference does not allow for direct comparison of the FY2019 request and the FY2018 enacted amounts total S&T account including rescissions.

Table 21 at the end of this section presents the President's FY2019 request for EPA's S&T account as presented in EPA's FY2019 Congressional Budget Justification compared to the FY2018 enacted appropriations presented in the explanatory statement accompanying the Consolidated Appropriations Act, 2018 (P.L. 115-141), published in the March 22, 2018, *Congressional Record*.[109] Consistent with recent House and Senate Appropriations Committee reports, the explanatory statement accompanying P.L. 115-141[110] did not specify funding for all

[104] See reference to EPA's FY2019 Congressional Budget Justification in footnote 102.

[105] U.S. EPA, *Fiscal Year 2019 Justification of Appropriations Estimates for the Committee on Appropriations: Science and Technology*, February 2018, pp. 43-137, and 803-804, https://www.epa.gov/planandbudget/fy-2019-justification-appropriation-estimates-committee-appropriations.

[106] The initial release of the President's FY2019 budget request (https://www.whitehouse.gov/omb/budget/) proposed a transfer from the Hazardous Substance Superfund (Superfund) account of $12.4 million to the S&T account. The subsequent OMB addendum (see footnote 102) included an additional $327.0 million for the Superfund account but did not specify a transfer amount to the S&T account; however, EPA's FY2019 Congressional Budget Justification (see footnote 105) reported a transfer of $17.4 million from the Superfund account, a $5.0 million increase.

[107] Also referred to as Agency-wide "cancellation of funds" in the President's FY2019 request and the EPA FY2019 Congressional Budget Justification (see footnote 102).

[108] Title II of Division G of the Consolidated Appropriations Act, 2018 (P.L. 115-141) provided a net total of $722.0 million for the EPA S&T account for FY2018 including a $7.4 million rescission within the S&T account. See also "Explanatory Statement" submitted by the Chairman of the House Committee on Appropriations in the *Congressional Record*, vol. 164, no. 50-Book II (March 22, 2018), p. H2621 and pp. H2665-H2666. https://www.gpo.gov/fdsys/pkg/CREC-2018-03-22/content-detail.html.

[109] See reference to the March 22, 2018, *Congressional Record* in footnote 108, pp. H2621-H2622 and H2665-H2666.

[110] "Explanatory Statement Submitted by Mr. Frelinghuysen, Chairman of the House Committee on Appropriations,

sub-program areas reported in EPA's budget justification. Additionally, the FY2019 request has modified the titles for some of the program areas relative to previous Administrations' budget requests and congressional committee reports presentations. S&T subprogram areas not reported in congressional reports and statements are noted in the **Table 21** as "NR" (not reported).

The FY2019 President's budget request, prepared prior to the enactment P.L. 115-141, presented funding comparisons in the request and supporting documents based on estimated FY2018 "annualized" levels associated with the continuing resolutions (CRs) in effect at the time. With the enactment of full-year funding for FY2018, the estimates based on the CR are no longer applicable and are not reported in this CRS report.

As shown in **Table 21**, with few exceptions the requested FY2019 base amount for the S&T account for individual EPA program area and activity line items would be less than the FY2018 enacted appropriations. The following discussion summarizes the largest proposed increases and decreases in funding for specific S&T program areas in the FY2019 request.

- The largest proposed increase in the FY2019 request for a specific S&T program area in terms of dollar amount and percentage is for the "Operations and Administration" program area. The FY2019 request for the program area is $74.8 million, a $6.5 million (9.5%) increase above the FY2018 enacted level of $68.3 million. EPA proposes to use additional funding for "Workforce Reshaping" and efforts to improve the management of its laboratories.[111]
- The largest proposed decrease for FY2019 as requested for a specific S&T program area in terms of dollar amount is for the "Research: Sustainable & Healthy Communities" program area. The FY2019 request for the program area is $52.5 million, a $81.8 million (60.9%) decrease below the FY2018 enacted level of $134.3 million.
- The largest proposed decrease in FY2019 funding in terms of percentage is for the "Research: Air and Energy" program area.[112] The FY2019 request for the program area is $30.7 million, a $61.2 million (66.6%) decrease below the FY2018 enacted level of $91.9 million.

"Workforce Reshaping" was introduced in the FY2018 request described as agency-wide organizational restructuring, "reprioritization of agency activities," and reallocation of resources.[113] According to the EPA FY2019 and FY2018 justifications, the funding for the workforce reshaping program area would include support for voluntary early-out retirement authority, voluntary separation incentive pay, and costs for relocation of staff associated with realignment of work assignments. For FY2018, Congress explicitly did not include funding for workforce reshaping activities as proposed in the FY2018 budget request.[114]

Regarding the House Amendment to Senate Amendment on H.R. 1625," *Congressional Record*, daily edition, vol. 164 (March 22, 2018), pp. H2621-H2622 and H2665-H2666.

[111] See reference to EPA's FY2019 Congressional Budget Justification in footnote 102, pp. 90-91

[112] The "Research: Air and Energy" program area was formerly labeled the "Research: Air, Climate, and Energy" program area.

[113] U.S. EPA, *Fiscal Year 2018 Justification of Appropriations Estimates for the Committee on Appropriations*, May 2017, https://www.epa.gov/planandbudget/fy-2018-justification-appropriation-estimates-committee-appropriations.

[114] The Explanatory Statement accompanying P.L. 115-141 emphasized that any reorganizations, transfer of functions, or downsizing should adhere to reprogramming directives included in the statement. Noting that EPA's current workforce in the EPM and S&T accounts are below FY2017 level, the Explanatory Statement further expresses its expectation that EPA will not undertake adverse personnel actions or incentive programs in FY2018. See reference to

In addition to the workforce reshaping and reprioritization efforts described above, EPA's summary under the heading for its "Reform Plan" in the FY2019 Congressional Budget Justification[115] includes a discussion under a sub-heading "Improving Management of EPA Laboratories." As presented in the FY2019 Justification, "EPA's reform plan represents a series of projects that EPA will complete to implement the goals of Executive Order 13781: *Comprehensive Plan for Reorganizing the Executive Branch*." With respect to EPA laboratories, the FY2019 Budget Justification proposes an initial effort to identify and implement "... an enterprise-wide framework to manage laboratory capabilities and capacity to meet the scientific demands associated with achieving the Agency's mission."[116]

With the exception of "Research: National priorities"[117] the FY2019 request does not propose to completely eliminate funding for the broader program areas presented in **Table** 21. The FY2019 request does propose elimination of funding for line-item activities below the program areas as indicated in the table ($0.0), including the "Atmospheric Protection Program" (formerly "GHG (greenhouse gas) Reporting Program"), and the "Indoor Air Radon Program" and "Indoor Air Reduce Risks of Indoor Air." The FY2018 enacted appropriations for the then-titled "GHG (greenhouse gas) Reporting Program" was $8.0 million. Additionally, according to the EPA FY2019 justification within the "Research: Sustainable & Healthy Communities" and "Research: Air and Energy" program area (formerly labeled "Research: Air, Climate and Energy"), the FY2019 President's request proposed elimination of funding for the Science to Achieve Results (STAR) program.[118]

Table 21. U.S. Environmental Protection Agency Science and Technology (S&T) Account

(appropriations in millions of dollars)

S&T Program Areas/Activities	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Clean Air [and Climate][a]	$116.5	$84.9			
Clean Air Allowance Trading Program	*NR*	*5.7*			
Atmospheric Protection Program [GHG (greenhouse gas) Reporting Program; and Climate Protection Program][a]	*8.0*	*0.0*			
Federal Support for Air Quality Management	*NR*	*4.0*			
Federal Vehicle and Fuel Standards and Certification	*NR*	*75.1*			

the March 22, 2018 *Congressional Record* in footnote 108, p H2621,

[115] See reference to EPA's FY2019 Congressional Budget Justification in footnote 102, pp. 841-845.

[116] See reference to EPA's FY2019 Congressional Budget Justification in footnote 102, p.843.

[117] Referred to as "Congressional Priorities" in the FY2019 Budget Justification; not requesting funding for this program is consistent with previous Administrations' fiscal year budget requests (see footnote 104, pp. 135-137). For FY2018 the $4.1 million (the same as FY2017 and FY2016) appropriated for what is referred to as "Research National Priorities" for FY2018 was for competitively awarded extramural research grants to fund "high-priority water quality and availability research by not-for-profit organizations"; the grants were to be independent of the STAR grant program and subject to a 25% matching funds requirement as specified in the Explanatory Statement for the FY2017 Consolidated Appropriations (see reference to the March 22, 2018, *Congressional Record* in footnote 108, p.H2621).

[118] Funding for these competitive grants and graduate fellowships has historically been allocated from enacted appropriations within multiple program areas within the S&T account. Specific funding levels for STAR have not been requested or appropriated recently in the annual fiscal year appropriations. For discussion of the STAR program in the EPA FY2019 Congressional Budget Justification, see footnote 105, pp. 107, 113, 119, 126, and 818.

S&T Program Areas/Activities	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Enforcement (*Forensics Support*)	13.7	10.5			
Homeland Security	33.1	28.2			
Critical Infrastructure Protection	*NR*	*5.2*			
Preparedness, Response, and Recovery	*NR*	*22.5*			
Protection of EPA Personnel and Infrastructure	*NR*	*0.5*			
Indoor Air and Radiation	6.0	*4.7*			
Indoor Air: Radon Program	*NR*	*0.0*			
Radiation: Protection	*NR*	*1.0*			
Radiation: Response Preparedness	*NR*	*3.7*			
Reduce Risks from Indoor Air	*NR*	*0.0*			
Information Technology/Data Management/Security	3.1	2.7			
Operations and Administration	68.3	74.8			
Facilities Infrastructure and Operations	*NR*	*68.8*			
Workforce Reshaping[b]	—	*6.0*			
Pesticide Licensing	6.0	5.1			
Protect Human Health from Pesticide Risk	*NR*	*2.4*			
Protect the Environment. from Pesticide Risk	*NR*	*2.1*			
Realize value of Pesticide Availability	*NR*	*0.5*			
Research: Air [Climate] and Energy[a]	91.9	30.7			
Research: Chemical Safety and Sustainability	126.9	84.0			
Human Health Risk Assessment	*NR*	*22.3*			
Research: Computational Toxicology	*21.4*	*17.2*			
Research: Endocrine Disruptor	*16.3*	*10.0*			
Research: Other Activities	*NR*	*34.5*			
Research: Safe and Sustainable Water Resources	106.3	67.3			
Research: Sustainable and Healthy Communities	134.3	52.5			
Water: Human Health Protection (Drinking Water Programs)	3.5	3.6			
Research: National/Congressional Priorities (Water Quality and Support Grants)[c]	4.1	0.0			
Subtotal Base Appropriations	**713.8**	**449.0**			
Transfer in from Hazardous Substance Superfund Account	**15.5**	**17.4**			
Total Appropriations Prior to Rescissions	**729.3**	**466.4**			
S&T Account Specific Rescission	**(7.4)**[d]	**NR**[e]			
Total (Net Appropriations)	**722.0**	**466.4**			

Source: Prepared by CRS using information from the *Congressional Record*; House, Senate, and conference committee reports and explanatory statements; and EPA's *Fiscal Year 2019 Justification of Appropriations Estimates for the Committee on Appropriations*, May 2017.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns headed "FY2019 House," "FY2019 Senate," and "FY2019 Enacted" will be added, if available, as each action is completed. NR (not reported) indicates those instances where funding or rescission ("cancelled") amounts were not specified.

a. Brackets [ ] denote title language as presented in previous Administrations EPA budget justifications and congressional reports/explanatory statements.

b. This program activity is included in multiple EPA accounts in the FY2018 budget request and has not been included in previous EPA budget justifications.

c. Referred to as "Congressional Priorities" in the FY2018 and previous Administrations budget justifications.

d. The explanatory statement accompany P.L. 115-141 stipulated that the rescission of unobligated balances of prior fiscal years appropriations within the S&T account was to be applied to program project areas to "reflect changes to funding projections due to routine attrition" during FY2018. The Explanatory Statement noted that EPA's current workforce was below FY2017 levels and therefore included separate rescissions within the S&T and the Environmental Programs and Management (EPM) accounts to "capture expected savings" associated with such changes. It was further stipulated that this rescission is not to be applied to "Research: National Priorities" within the S&T account.

e. The President's FY2019 request included a $220.5 million rescission of unobligated balances of prior-year EPA appropriations, but did not specify a proportional allocation of the rescission by EPA accounts.

Appendix A. Acronyms and Abbreviations

Glossary

Acronym/ Abbreviation	Organization/Term
ACF	Administration for Children and Families
AFRI	Agriculture and Food Research Initiative
AHRQ	Agency for Healthcare Research and Quality
AMP	Advanced Manufacturing Partnership – or – Accelerating Medicines Partnership
AOAM	Agency Operations and Award Management
ARPA-E	Advanced Research Projects Agency–Energy
ARS	Agricultural Research Service
B&F	Buildings and Facilities
BCA	Budget Control Act
BD2K	Big Data to Knowledge
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BOR	Bureau of Reclamation
BRAIN	Brain Research through Advancing Innovative Neurotechnologies
BSEE	Bureau of Safety and Environmental Enforcement
CDC	Centers for Disease Control and Prevention
CLARREO	Climate Absolute Radiance and Refractivity Observatory
CMS	Centers for Medicare and Medicaid Services
CRF	Construction of Research Facilities
DART	Double Asteroid Redirection Test
DHP	Defense Health Program
DHS	Department of Homeland Security
DKIST	Daniel K. Inouye Solar Telescope
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
DRA	Designated Research Area
DSCVR	Deep Space Climate Observatory
EHR	Education and Human Resources
EOP	Executive Office of the President

Acronym/ Abbreviation	Organization/Term
EPA	Environmental Protection Agency
EPM	Environmental Programs and Management
EPSCoR	Experimental Program to Stimulate Competitive Research –or– Established Program to Stimulate Competitive Research
ERS	Economic Research Service
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
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
GHG	greenhouse gas
GRF	Graduate Research Fellowship
GWOT	Global War on Terror
HBCU	Historically Black Colleges and Universities
HHS	Department of Health and Human Services
HIA	Health Impact Assessment
HRSA	Health Resources and Services Administration
ICs	Institutes and Centers
ISS	International Space Station
ITER	International Thermonuclear Experimental Reactor
ITS	Industrial Technology Services
JWST	James Webb Space Telescope
LEO	Low Earth Orbit
LHHS	Labor, HHS, and Education appropriations act
LSST	Large Synoptic Survey Telescope
MEP	Manufacturing Extension Partnership
MREFC	Major Research Equipment and Facilities Construction
NASA	National Aeronautics and Space Administration
NASS	National Agricultural Statistics Service
NBACC	National Biodefense Analysis and Countermeasures Center
NBAF	National Bio and Agro-Defense Facility
NBAF	National Bio and Agro-Defense Facility
NCATS	National Center for Advancing Translational Sciences

Acronym/ Abbreviation	Organization/Term
NCCIH	National Center for Complementary and Integrative Health
NCI	National Cancer Institute
NEI	National Eye Institute
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
NIDILRR	National Institute on Disability, Independent Living, and Rehabilitation Research
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
NIIMBL	National Institute for Innovation in Manufacturing Biopharmaceuticals
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
NIOSH	National Institute for Occupational Safety and Health
NIRSQ	National Institute for Research on Safety and Quality
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
NNI	National Nanotechnology Initiative
NNMI	National Network for Manufacturing Innovation
NOAA	National Oceanic and Atmospheric Administration

Acronym/ Abbreviation	Organization/Term
NOS	National Ocean Service
NPS	National Park Service
NRI	National Robotics Initiative
NRT	NSF Research Traineeships
NSB	National Science Board
NSET	Nanoscale Science, Engineering, and Technology (NSTC Subcommittee)
NSF	National Science Foundation
NSTC	National Science and Technology Council
NWS	National Weather Service
OAR	Oceanic and Atmospheric Research
OCO	Overseas Contingency Operations
OD	NIH Office of the Director
OIG	Office of the Inspector General
OMAO	Office of Marine and Aviation Operations
OMB	Office of Management and Budget
ORD	Office of Research and Development
OSMRE	Office of Surface Mining Reclamation and Enforcement
OST	Office of the Secretary of Transportation
OSTP	Office of Science and Technology Policy
P3	People, Prosperity and the Planet
PACE	Pre-Aerosol, Clouds, and Ocean Ecosystem
PE	Program Element
PHMSA	Pipeline and Hazardous Materials Safety Administration
PHS	Public Health Service
PMI	Precision Medicine Initiative
R&D	Research and Development
RCRV	Regional Class Research Vessels
RDT&E	Research, Development, Test, and Evaluation
RE&D	Research, Engineering, and Development
REE	Research, Education, and Economics
ROE	Report on the Environment
RPG	Research Project Grant
RRA	Research and Related Activities
S&T	Science and Technology
SIR	Surveys, Investigations, and Research
SLS	Space Launch System

Acronym/ Abbreviation	Organization/Term
STAG	State and Tribal Assistance Grants
STAR	Science to Achieve Results
STEM	Science, Technology, Engineering, and Mathematics
STEP	Supercritical Transformational Electric Power
STRS	Scientific and Technical Research and Services
USDA	Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
USPSTF	U.S. Preventive Services Task Force
VA	Department of Veterans Affairs
WFIRST	Wide Field Infrared Space Telescope
WFM	Wildland Fire Management

Appendix B. CRS Contacts for Agency R&D

The following table lists the primary CRS experts on R&D funding for the agencies covered in this report.

Agency	CRS Contact
Department of Agriculture	Tadlock Cowan Specialist in Agricultural Policy
Department of Commerce	
National Institute of Standards and Technology	John F. Sargent Jr., Coordinator Specialist in Science and Technology Policy
National Oceanic and Atmospheric Administration	Harold F. Upton Analyst in Natural Resources Policy
Department of Defense	John F. Sargent Jr., Coordinator Specialist in Science and Technology Policy
Department of Energy	Daniel Morgan Specialist in Science and Technology Policy
Department of Health and Human Services National Institutes of Health	Johnathan H. Duff Analyst in Health Policy
Department of Homeland Security	Daniel Morgan Specialist in Science and Technology Policy
Department of the Interior	Laurie A. Harris Analyst in Science and Technology Policy
Department of Transportation	Marcy E. Gallo Analyst in Science and Technology Policy
Department of Veterans Affairs	Marcy E. Gallo Analyst in Science and Technology Policy
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