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Federal Research and Development (R&D) Funding: FY2022

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SUMMARY

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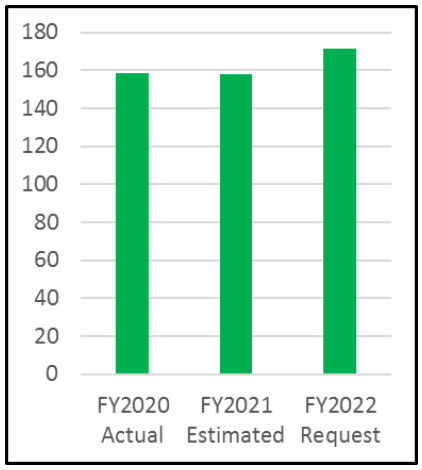
Federal Research and Development (R&D) Funding: FY2022

President Biden's budget request for FY2022 includes approximately $171.3 billion for research and development (R&D), $13.5 billion (8.5%) above the FY2021 estimated level of $157.8 billion. In constant FY2022 dollars, the FY2022 R&D request represents an increase of $10.6 billion (6.6%) above the FY2021 estimated level.

Funding for R&D is concentrated in a few federal departments and agencies. In FY2021, five agencies received 93.0% of total federal R&D funding, with the Department of Defense (DOD, 40.1%) and the Department of Health and Human Services (HHS, 27.6%) combined accounting for more than two-thirds of all federal R&D funding. In the FY2022 request, the top five R&D agencies would account for 92.4%, with DOD accounting for 36.7% and HHS for 29.9%.

Federal Research and Development Funding, FY2020-FY2022
In billions of dollars



Source: CRS analysis of data from OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021.

Under the President's FY2022 budget request, nearly all federal agencies would see their R&D funding increase relative to FY2021. The only exception is DOD, which would decrease by $550 million (0.9%) in FY2022 to $62.8 billion. The largest dollar increases in R&D funding would be made to HHS (up $7.7 billion, 17.8%), the Department of Energy (up $2.1 billion, 11.1%), and the National Aeronautics and Space Administration (up $1.3 billion, 10.1%). The largest percentage increases in R&D funding would be at the Department of the Interior (up 30.8%), the Department of Commerce (up 29.3%), and the Department of Agriculture (up 21.7%).

The President's FY2022 budget request would increase funding for basic research by $4.4 billion (10.2%), applied research by $6.3 billion (14.0%), development by $2.4 billion (3.6%), and R&D facilities and equipment by $380 million (9.0%).

Several multiagency R&D initiatives continue under the President's FY2022 budget request. Some activities supporting these initiatives are discussed in agency budget justifications. However, comprehensive aggregate budget information on these initiatives will likely not be available until budget supplements for each are released later in the year.

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. Congress provides annual R&D appropriations through 9 of the 12 regular appropriations bills.

In recent years, Congress has completed the annual appropriations process after the start of the fiscal year. Completing the process after 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 acquisition of R&D-related equipment.

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Introduction

The 117th 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, federal budget caps have driven executive and legislative branch decisions about the prioritization of R&D, both in the context of the entire federal budget and among competing needs within the federal R&D portfolio.

The U.S. government supports a broad range of scientific and engineering R&D. Its purposes include 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 also 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. As Congress acts to complete the FY2021 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 R&D in President Biden's FY2022 budget request, followed by analyses of R&D funding in the request from a variety of perspectives and for selected multiagency R&D initiatives. The remainder of the report discusses and analyzes 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. **Appendix B** lists the primary CRS experts on R&D funding for the agencies covered in this report.

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."[1] This document provides guidance to agencies in the preparation of the President's annual budget and instructions on budget execution. In 2017, OMB 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. This definition is used in the President's FY2022 budget. The new definition has resulted in lower reported R&D by some agencies, including the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA). For FY2022, OMB has also opted to exclude DOD budget activity 6.6 ("Management Support") funding from its R&D calculations; historically, this funding has been included in the DOD R&D total and federal R&D total figures. DOD R&D funding in **Table 1** and **Table 3** reflect this change for FY2020 and FY2021 (applied retroactively), as well as for FY2022. OMB and DOD are currently evaluating whether budget activity 6.6 may be categorized as experimental development in the future.

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, such as the study of how plant genomes change, but excludes research directed towards a specific application or requirement, such as the optimization of the genome of a specific crop species.

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. It 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. It 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 (NSB/NSF) provides the following definitions of R&D-related terms in its report *Science and Engineering Indicators: 2020*.[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.

Development (or 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," April 2021, https://www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf.

[2] National Science Board/National Science Foundation, *Science and Engineering Indicators 2020*, January 2020, https://ncses.nsf.gov/pubs/nsb20201/glossary.

The President's FY2022 Budget Request

On May 28, 2021, President Biden released his proposed FY2022 budget. President Biden is proposing $171.3 billion for R&D for FY2022, an increase of $13.5 billion (8.5%) above the FY2021 level of $157.8 billion. Adjusted for inflation to FY2022 dollars, the President's FY2022 R&D request represents a constant-dollar increase of 6.6% above the FY2021 actual level.[3]

The President's request includes continued R&D 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 FY2022 request as it relates to R&D and related activities. More information will become available as the House and Senate act on the President's budget request through appropriations bills.

Factors Affecting Analysis of the FY2022 Budget Request

Several factors complicate the analysis of changes in R&D funding for FY2022, both in aggregate and for selected agencies:

- R&D included in President's Biden's proposed American Jobs Plan is not included in his FY2022 budget request. The American Jobs Plan includes $50 billion for the National Science Foundation, $30 billion for R&D at other agencies, and $40 billion to upgrade research infrastructure.
- 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 FY2020 (actual), FY2021 (estimate), and FY2022 (request).[4]

Under the request, eight federal agencies would receive 97% of total federal R&D funding in FY2022: the Department of Defense (DOD), 36.7%; Department of Health and Human Services (HHS), primarily the National Institutes of Health (NIH), 29.9%; Department of Energy (DOE), 12.5%; National Aeronautics and Space Administration (NASA), 8.5%; National Science Foundation (NSF), 4.8%; Department of Agriculture (USDA), 2.1%; Department of Commerce (DOC), 1.6%; and Department of Veterans Affairs (VA), 0.9%. This report provides an analysis of the R&D budget requests for these agencies, as well as for the Department of Homeland Security

[3] As calculated by CRS using the Gross Domestic Product (GDP) (chained) price index for FY2021-FY2022 in Table 10.1, "Gross Domestic Product and Deflators Used in the Historical Tables: 1940–2026," *Budget of the United States Government, Fiscal Year 2022*, https://www.whitehouse.gov/wp-content/uploads/2021/05/hist10z1_fy22.xlsx.

[4] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021, https://www.whitehouse.gov/wp-content/uploads/2021/05/ap_14_research_fy22.pdf.

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

With the exception of DOD, all federal agencies would see their R&D funding increase under the President's FY2022 request compared to their FY2021 estimated levels. The agencies with the largest R&D funding increases (measured in dollars) in the FY2022 request compared to FY2021 estimated levels are HHS (up $7.738 billion), DOE (up $2.140 billion), and NASA (up $1.339 billion). DOD R&D funding would decline by $550 million (down 0.9%). See **Table 1**.

The agencies with the largest percentage increases in R&D funding in the FY2022 request compared to the FY2021 estimated level are DOT (up 30.8%), DOC (up 29.3%), USDA (up 21.7%), DOI (up 18.2%), and HHS (up 17.8%). See **Table 1**.

Table 1. Federal Research and Development Funding by Agency, FY2020-FY2022

(budget authority, dollar amounts in millions)

Department/Agency	FY2020 Actual	FY2021 Estimate	FY2022 Request	FY2021-FY2022 Dollar Change	FY2021-FY2022 Percent Change
Department of Defense	62,438[a]	63,350[a]	62,800	-550	-0.9%
Dept. of Health and Human Services	44,455	43,494	51,232	7,738	17.8%
Department of Energy	19,476	19,312	21,452	2,140	11.1%
NASA	14,801	13,226	14,565	1,339	10.1%
National Science Foundation	6,800	7,408	8,173	765	10.3%
Department of Agriculture	2,989	2,965	3,609	644	21.7%
Department of Commerce	1,953	2,122	2,743	621	29.3%
Department of Veterans Affairs	1,366	1,420	1,498	78	5.5%
Department of Transportation	1,043	1,024	1,339	315	30.8%
Department of the Interior	1,094	1,033	1,221	188	18.2%
Department of Homeland Security	532	590	627	37	6.3%
Smithsonian Institution	516	524	585	61	11.6%
Environmental Protection Agency	237	445	473	28	6.3%
Department of Education	344	322	346	24	7.5%
Other	582	563	597	34	6.0%
Total	**158,626**	**157,798**	**171,260**	**13,462**	**8.5%**

Source: CRS analysis of data from EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021, https://www.whitehouse.gov/wp-content/uploads/2021/05/ap_14_research_fy22.pdf.

Note: Components may not sum to totals due to rounding.

a. DOD R&D in this table does not include funding for budget activity (BA) 6.6 and BA 6.7. OMB considers BA 6.6 to be "non-investment activities" and BA 6.7 to be considered nonexperimental development. Combined BA 6.6 and BA 6.7 funding is $46.2 billion in FY2021 and $48.0 billion for FY2022.

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 Biden's FY2022 request includes $47.387 billion for basic research, up $4.402 billion (10.2%) from the FY2021 estimated level; $51.126 billion for applied research, up $6.283 billion (14.0%); $68.136 billion for development, up $2.397 billion (3.6%); and $4.611 billion for R&D facilities and equipment, up $380 million (9.0%).

Table 2. Federal R&D Funding by Character of Work and Facilities and Equipment, FY2020-FY2022

(budget authority, dollar amounts in millions)

				Change, FY2021-FY2022	
Character of Work, Facilities, and Equipment	**FY2020 Actual**	**FY2021 Estimated**	**FY2022 Request**	**Dollars**	**Percent**
Basic research	44,290	42,985	47,387	4,402	10.2%
Applied research	45,992	44,843	51,126	6,283	14.0%
Development	62,124	65,739	68,136	2,397	3.6%
Facilities and Equipment	6,220	4,231	4,611	380	9.0%
Total	**158,626**	**157,798**	**171,260**	**13,462**	**8.5%**

Source: CRS analysis of data from EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021, https://www.whitehouse.gov/wp-content/uploads/2021/05/ap_14_research_fy22.pdf.

Note: Components may not sum to totals due to rounding.

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

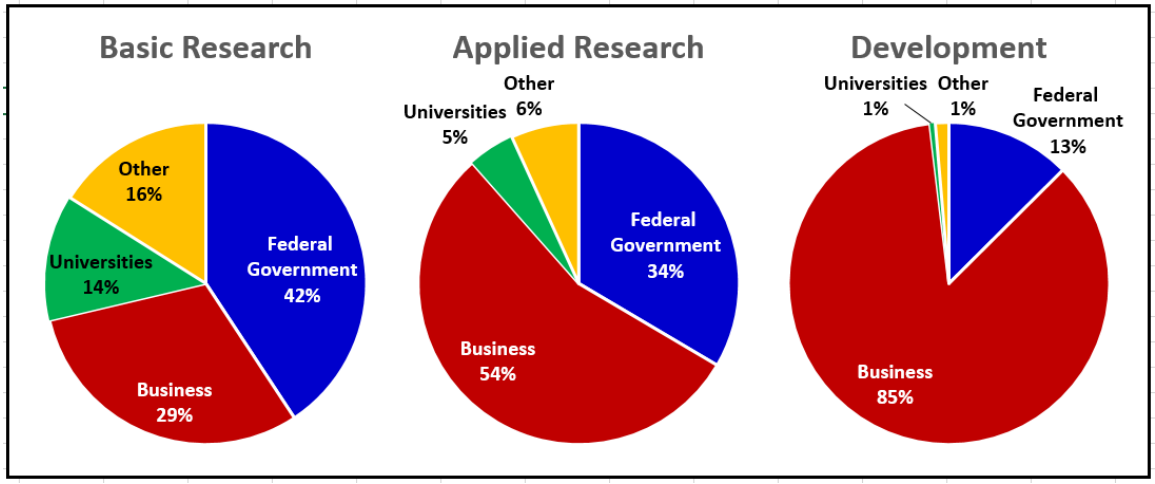
A primary policy justification for public investments in basic research and for incentives (e.g., tax credits) for the private sector to conduct research is the view, widely held by economists, that the private sector will, left on its own, underinvest in basic research from a societal perspective. The 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 and 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 41% of U.S. basic research in 2019 (the most recent year for which comprehensive data are available). Business funded 31% of U.S. basic research in 2019, with state governments, universities, and other nonprofit organizations funding the remaining 29%.[5] For U.S. applied research, business is the primary funder, accounting for an estimated 55% in 2019, while the federal government accounted for an estimated 33%. 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 86% of development funding in 2019, while the

[5] Percentages may not sum to 100% due to rounding.

federal government provided 13%. State governments, universities, and other nonprofit organizations funded the remaining 2% (see **Figure 1**).[6]

Figure 1. Composition of U.S. Basic Research, Applied Research, and Development by Funding Sector, 2019



Source: CRS analysis of National Science Foundation, *National Patterns of R&D Resources: 2018–19 Data Update*, NSF 21-325, Tables 7-9, April 9, 2021.

Notes: Components may not add to total due to rounding. Data are preliminary and may be revised.

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 in each of these categories as proposed in the President's FY2022 budget. 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 of R&D funding among basic research, applied research, development, and facilities and equipment).

In President Biden's FY2022 budget request, the Department of Health and Human Services, primarily NIH, would account for more than half (50.7%) of all federal funding for basic research. HHS would also be the largest federal funder of applied research, accounting for about 52.5% of all federally funded applied research in the President's FY2022 budget request. DOD would be the primary federal funder of experimental development, accounting for 80.5% of total federal development funding in the President's FY2022 budget request. DOE would be the primary federal funder of R&D facilities and equipment, accounting for 58.2% of total federal R&D facilities and equipment funding in the President's FY2022 budget request.[7]

[6] CRS analysis of National Science Foundation, *National Patterns of R&D Resources: 2018–19 Data Update*, NSF 21-325, Tables 6-9, April 9, 2021. Data are preliminary and may be revised. Components may not add to total due to rounding.

[7] CRS analysis of data from EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2021, Research and Development*, February 10, 2020, https://www.whitehouse.gov/wp-content/uploads/2020/02/ap_17_research_fy21.pdf.

Table 3. Selected R&D Funding Agencies by Character of Work, Facilities, and Equipment, FY2020 Actual, FY2021 Estimated, and FY2022 Request

(budget authority, dollar amounts in millions)

Character of Work/Agency	FY2020 Actual	FY2021 Estimate	FY2022 Request	Change, FY2021-FY2022 Dollars	Change, FY2021-FY2022 Percent
Basic Research					
Health and Human Services	21,826	21,872	24,022	2,150	9.8%
NSF	5,437	5,966	6,532	566	9.5%
Energy	5,494	5,519	5,892	373	6.8%
Applied Research					
Health and Human Services	22,081	21,297	26,835	5,538	26.0%
Energy	8,444	7,395	7,669	274	3.7%
Defense	6,274	6,654	5,559	-1,095	-16.5%
Experimental Development					
Defense	51,764	54,045	54,859	814	1.5%
NASA	5,430	5,990	5,915	-75	-1.3%
Energy	3,060	3,715	5,206	1,491	40.1%
Facilities and Equipment					
Energy	2,478	2,683	2,685	2	0.1%
Commerce	366	352	657	305	86.6%
NSF	529	594	594	0	0.0%

Source: CRS analysis of data from EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021, https://www.whitehouse.gov/wp-content/uploads/2021/05/ap_14_research_fy22.pdf.

Note: This table shows only the top three funding agencies in each category, based on the FY2022 request.

Multiagency R&D Initiatives

For many years, presidential budgets have reported on multiagency R&D initiatives. Often, they have also 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 a specific statutory mandate, and may be eliminated at the discretion of the President. President Biden's FY2022 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[8]

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. The NITRD National Coordination Office (NCO) coordinates the information technology R&D activities of 24 federal agency members and more than 45 other participating agencies with program interests and activities in IT R&D. NITRD efforts are further coordinated by the National Science and Technology Council (NSTC) NITRD Subcommittee.[9]

P.L. 102-194, as reauthorized by the American Innovation and Competitiveness Act of 2017 (P.L. 114-329), requires the director of the NITRD NCO to prepare an annual report to be delivered to Congress along with the President's budget request. This annual report, often referred to as a budget supplement, is to include, among other things, detailed information on the program's budget for the current and previous fiscal years and the proposed budget for the next fiscal year (FY). The latest annual report was published in August 2020 and related to the FY2021 budget request. 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. Additional information on the NITRD Program can be obtained at https://www.nitrd.gov.

Table 4. Networking and Information Technology Research and Development Program Funding, FY2019-FY2022

(budget authority, in millions of current dollars)

	FY2019 Actual	FY2020 Enacted	FY2021 Request	FY2022 Request
Total, NITRD	6,472.1	6,692.2[a]	6,505.0	n/a

Source: EOP, NSTC, *The Networking and Information Technology Research and Development Program: Supplement to the President's FY2021 Budget*, August 14, 2020.

Note: n/a = not available.

a. Includes $6,666.5 million in regular appropriations and additional $25.7 million in supplemental appropriation.

[8] For additional information on the Networking and Information Technology Research and Development program, please contact Patricia Moloney Figliola, Specialist in Internet and Telecommunications Policy.

[9] 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: EOP, 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/.

U.S. Global Change Research Program[10]

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."[11] In FY2019, 10 departments and agencies received appropriations for their USGCRP participation. USGCRP efforts are coordinated by the NSTC Subcommittee on Global Change Research. Each agency develops and carries out its activities as its contribution to the USGCRP, and funds are appropriated to each agency for those activities; those activities may or may not be identified as associated with the USGCRP in agency budget justifications or other program materials available publicly. Complementing USGCRP activities are many federal climate change or global change-related activities with programmatic missions, not predominantly scientific. These are reported separately in budget justifications.

The Global Change Research Act of 1990 (GCRA, P.L. 101-606) requires each federal agency or department involved in global change research to report annually to Congress on each element of its proposed global change research activities, as well as the portion of its budget request allocated to each element of the program.[12] The President is also required to identify those activities and the annual global change research budget in the President's annual budget request. The President's budget requests for years later than FY2017 do not report these budget data required by the GCRA, although some agencies report their contributions in their budget justifications to Congress.

In addition, in the 20 years prior to FY2018, language in appropriations laws 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…."[13] As these are no longer reported by OMB, **Table 5** presents data compiled by CRS from communications with departments and agencies that participated in the USGCRP in FY2018.

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

Table 5. U.S. Global Change Research Program Funding, FY2019-FY2022

(budget authority, in millions of current dollars)

	FY2019 Enacted	FY2020 Request	FY2021 Request	FY2022 Request
Total, USGCRP	2,436	1,943	n/a	n/a

Source: GlobalChange.gov, https://www.globalchange.gov/about.

[10] For additional information on the U.S. Global Change Research Program, please contact Jane A. Leggett, Specialist in Energy and Environmental Policy.

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

[12] 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.

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

Notes: n/a = not available. Funding for activities that contribute to the USGCRP has been appropriated to more than a dozen federal departments and agencies in the past, and some spending of it is transferred or coordinated through interagency agreements. Almost all of the funding is spent directly by agencies on research and related activities; a small percentage is spent for interagency coordination and communications in the USGCRP program office.

National Nanotechnology Initiative[14]

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 sometimes useful ways from the properties of individual atoms or bulk matter.[15] 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. NNI efforts are coordinated by the NSTC Subcommittee on Nanoscale Science, Engineering, and Technology (NSET). For FY2020, the President's request included NNI funding for 15 federal departments and independent agencies and commissions with budgets dedicated to nanotechnology R&D. The NSET includes other federal departments and independent agencies and commissions with responsibilities for health, safety, and environmental regulation; trade; education; intellectual property; international relations; and other areas that might affect or be affected by nanotechnology.

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, often referred to as a budget supplement, 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 latest annual report was published in October 2020 and related to the FY2021 budget request. President Trump requested $1.723 billion for NNI research in FY2021, a decrease of $117 million (6.3%) from the enacted FY2020 level.[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. Additional NNI information can be obtained at http://www.nano.gov.

[14] For additional information on the National Nanotechnology Initiative, please contact John F. Sargent, Jr., Specialist in Science and Technology Policy.

[15] 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.

[16] EOP, NSTC, *The National Nanotechnology Initiative: Supplement to the President's 2020 Budget*, August 2019.

Table 6. National Nanotechnology Initiative Funding, FY2019-FY2022

(budget authority, in millions of current dollars)

	FY2019 Estimated	FY2020 Enacted	FY2021 Request	FY2022 Request
Total, NNI	1,858.3	1,839.7	1,723.2	n/a

Source: EOP, NSTC, *The National Nanotechnology Initiative: Supplement to the President's 2021 Budget,* October 2020.

FY2022 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 FY2020 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 has acted on six of the appropriations bills that provide R&D funding; the Senate has not acted on any of the appropriations acts.

In addition to this report, CRS produces individual reports on each of the appropriations bills and for a number of federal agencies. 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 "Appropriations Status Table," available at http://www.crs.gov/AppropriationsStatusTable/Index.

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

Department/Agency	Regular Appropriations Bill
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[17]

The mission of the Department of Defense is to provide "the military forces needed to deter war and ensure our nation's security."[18] 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. This section includes funding for budget activities 6.6 and 6.7 which OMB no longer counts as R&D.

Most of what DOD spends on RDT&E is appropriated in Title IV of the annual defense appropriations bill. (See **Table 8**.) Title IV RDT&E funds support activities such as R&D performed by academic institutions, DOD laboratories, and companies, as well as test and evaluation activities at specialized DOD facilities, among other things.

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.

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

[18] Department of Defense, https://www.defense.gov/Our-Story/.

- 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 appropriations bill.

For more than a decade, 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 Administrations referred to as Overseas Contingency Operations (OCO). In appropriations bills, the term Overseas Contingency Operations/Global War on Terror (OCO/GWOT) was used. Typically, the RDT&E funds appropriated for OCO activities were directed toward specified Program Elements (PEs) in Title IV. President Biden's FY2022 request does not include separate OCO/GWOT funding.

For FY2022, the Biden Administration is requesting $111.964 billion for DOD's Title IV RDT&E PEs, $4.509 billion (4.2%) above the estimated FY2021 level. (See **Table 8**.) In addition, the FY2022 request includes $630.7 million in RDT&E through the Defense Health Program (DHP; down $1.762 billion, 73.6% from FY2021), $1.001 billion in RDT&E through the Chemical Agents and Munitions Destruction program (up $58.7 million, 6.2% from FY2021), and $2.4 million for the Inspector General for RDT&E-related activities (up $1.3 million, 118.2% from FY2021). The FY2022 budget includes no RDT&E funding via the National Defense Sealift Fund, the same as the FY2021 estimated level.

RDT&E funding can be analyzed in different ways. RDT&E funding can be characterized organizationally. Each military department requests and receives its own RDT&E funding. So, too, do various DOD agencies (e.g., the Missile Defense Agency and the Defense Advanced Research Projects Agency), collectively aggregated within the Defense-wide account. RDT&E funding also can be characterized by budget activity (i.e., the type of RDT&E supported). Those budget activities designated as 6.1, 6.2, and 6.3 (basic research, applied research, and advanced technology development, respectively) constitute what is called DOD's Science and Technology (S&T) program and represent the more research-oriented part of the RDT&E program. Budget activities 6.4 and 6.5 focus on the development of specific weapon systems or components 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.[19] Budget activity 6.7 supports the development of system improvements in existing operational systems.[20] A new budget activity, 6.8, was added in the FY2021 budget and supports software and digital technology pilot programs.[21]

Many congressional policymakers are particularly interested in DOD S&T program funding, since these funds support the development of new technologies and the science that underlies them. Some in the defense community see ensuring adequate support for S&T activities as

[19] Beginning in FY2022, budget activity 6.6 is no longer counted as research and development funding by OMB.

[20] Beginning in FY2018, budget activity 6.7 is no longer counted as research and development funding by OMB.

[21] 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.

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 FY2022 request for Title IV S&T funding is $14.685 billion, $2.131 billion (12.7%) below the FY2021 estimated level. Within the S&T program, basic research (6.1) receives special attention, particularly by the nation's universities, as over half of DOD's basic research budget is spent at universities. The Biden Administration is requesting $2.283 billion for DOD basic research for FY2022, $342.9 million (13.1%) below the FY2021 estimated level. The proposed FY2022 cuts in S&T are spread across a variety of program elements in the Army, Navy, and Air Force accounts. The Army would see the largest cut in both dollars and percentage ($1.3 billion, 33%), followed by the Air Force ($560 million, 18.1%), and the Navy ($309 million, 11.6%). Among the proposed FY2022 program element cuts are the University Research Initiatives program elements in the Army ($18 million, 20.9%), Navy ($27 million, 18.5%), and Air Force ($34 million, 17.4%). Increases in S&T funding would be provided to the Space Force ($36 million, 16.4%) and Defense-wide accounts ($29 million, 0.4%).

While DOD is not the largest federal funder of basic research, it is a substantial source of federal funds for university R&D in certain fields, such as aerospace, aeronautical, and astronautical engineering (65%); electrical, electronic, and communications engineering (58%); industrial and manufacturing engineering (58%); mechanical engineering (49%); computer and information sciences (48%); materials science (44%); and metallurgical and materials engineering (41%).[22]

Table 8. Department of Defense RDT&E

(total obligational authority, in millions of dollars)

Budget Account	FY2021 Estimate[a]	FY2022 Request	FY2022 House	F2022 Senate	FY2022 Enacted
Army	14,144.9	12,799.6			
Navy	20,138.4	22,639.4			
Air Force	36,360.8	39,184.3			
Space Force	10,540.1	11,266.4			
Defense-wide	26,013.5	25,857.9			
Director, Operational Test and Evaluation	257.1	216.6			
Total Title IV—By Account	**107,454.8**	**111,964.2**			
Budget Activity					
6.1 Basic Research	2,625.8	2,282.9			
6.2 Applied Research	6,436.3	5,508.9			
6.3 Advanced Technology Development	7,754.4	6,893.5			
6.4 Advanced Component Development and Prototypes	27,997.3	31,255.3			
6.5 Systems Dev. and Demonstration	15,748.0	15,760.8			
6.6 Management Support[b]	7,626.8	7,387.3			

[22] CRS analysis of data from NSF, *Higher Education Research and Development Survey, Fiscal Year 2019*, Table 13, January 2021, https://ncses.nsf.gov/pubs/nsf21314 /.

Budget Account	FY2021 Estimate[a]	FY2022 Request	FY2022 House	F2022 Senate	FY2022 Enacted
6.7 Operational Systems Development[c]	38,602.8	40,591.5			
6.8 Software and Digital Technology Pilot Projects	663.4	2,284.1			
Total Title IV—by Budget Activity	**107,454.8**	**111,964.2**			
Title V—Revolving and Management Funds					
National Defense Sealift Fund	0.0	0.0			
Title VI—Other Defense Programs					
Defense Health Program	2,392.6	630.7			
Chemical Agents and Munitions Destruction	942.5	1,001.2			
Inspector General	1.1	2.4			
Grand Total, RDT&E[d]	**110,790.9**	**113,598.5**			

Source: CRS analysis of *Department of Defense Budget, Fiscal Year 2022, RDT&E Programs (R-1)*, May 2021.

Notes: n/a = not available. Figures for the columns currently blank may become available as action is completed. Totals may differ from the sum of the components due to rounding. 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.

a. Includes funding provided in Division C, Title IX and Division J, Title IV of the Consolidated Appropriations Act, 2021 (P.L. 116-260).

b. Includes funding for Director of Test and Evaluation.

c. Includes funding for Classified Programs.

d. The Grand Total, RDT&E amounts for FY2021 and FY2022 include funding for budget activities 6.6 and 6.7 that OMB no longer counts as R&D. For these and other reasons, these amounts do not align with the DOD totals in **Table 1**.

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."[23] This section focuses on HHS research and development funded through the National Institutes of Health, an HHS agency that accounts for nearly 97% of total HHS R&D funding.[24] Other HHS agencies that support R&D include the Centers for Disease Control and Prevention (CDC), Centers for Medicare and

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

[24] Unpublished data provided to CRS by the Office of Management and Budget. Email communication, May 28, 2021.

Medicaid Services (CMS), Food and Drug Administration (FDA), Agency for Healthcare Research and Quality (AHRQ), Health Resources and Services Administration (HRSA), and Administration for Children and Families (ACF); additional R&D funding is attributed to departmental management.[25]

National Institutes of Health[26]

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."[27] The agency consists of the NIH Office of the Director (OD) and 27 institutes and centers (ICs), 25 of which manage research programs. Each IC plans and manages its own research programs in coordination with OD. According to NIH, about 10% of the NIH budget supports intramural research projects conducted by the nearly 6,000 NIH federal scientists, most of whom are located on the NIH campus in Bethesda, MD. All 25 research ICs have an intramural research program of varying sizes. More than 80% of NIH's budget goes 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.[28]

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.[29] 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 Public Health Service Act (PHSA) Section 330B, for the Special Diabetes Program for type 1 diabetes, most recently extended through FY2023 with an annual funding level of $150 million by the Consolidated Appropriations Act, 2021 (P.L. 116-260; Division BB, Title III). As shown in **Table 9**, separate appropriations are provided to 24 of the 27 ICs, as well as to OD, the Innovation Account (established by the 21st Century Cures Act in 2016, P.L. 114-255), and an intramural Buildings and Facilities account. The other three centers, which perform centralized support services, are funded through transfers from the other ICs. Some funding is also pursuant to the PHS Evaluation Set-Aside, also known as the PHS Evaluation Tap transfer authority, under Section 241 of the PHS Act (42 U.S.C. §238j). This provision allows the

[25] Ibid.

[26] This section was written by Kavya Sekar, Analyst in Health Policy, CRS Domestic Social Policy Division, with support from Isaac Nicchitta, Research Assistant, CRS Domestic Social Policy Division. For background information on NIH, see CRS Report R41705, *The National Institutes of Health (NIH): Background and Congressional Issues*, by Judith A. Johnson and Kavya Sekar.

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

[28] NIH, "What We Do: Budget," https://www.nih.gov/about-nih/what-we-do/budget.

[29] The Superfund program was created to carry out the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; P.L. 96-510), which authorized the federal government to prioritize contaminated sites in the United States for cleanup in coordination with the states in which the sites are located and to make the "potentially responsible parties" connected to those sites financially liable for the cleanup costs. The Superfund program is administered by the Environmental Protection Agency. For more information on the Superfund program, see CRS Report R41039, *Comprehensive Environmental Response, Compensation, and Liability Act: A Summary of Superfund Cleanup Authorities and Related Provisions of the Act*, by David M. Bearden.

Secretary of HHS, with the approval of appropriators, to redistribute a portion of eligible PHS agency appropriations across HHS for program evaluation purposes.[30] 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 FY2021, P.L. 116-260, Division H).[31] Those acts also have typically directed specific amounts of funding from the tap for transfer to a number of HHS programs, including at NIH—particularly for the National Institute of General Medical Sciences (NIGMS). Readers should note that funding amounts in this report show amounts "transferred in" to NIH under the PHS evaluation set-aside, but do not show amounts "transferred out" under the same authority.

NIH also receives funding through LHHS appropriations that is subject to different budget enforcement rules than the rest of the NIH funding in the act—appropriations to the NIH Innovation Account created by the 21st Century Cures Act ("the Cures Act," P.L. 114-255) to fund programs authorized by that act. Appropriations of funds in this account are, in effect, not subject to discretionary spending limits.[32] 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. All amounts authorized by the Cures Act have been fully appropriated to the Innovation Account since FY2017, including $404 million for FY2021. For FY2022, $496 million is authorized to be appropriated.[33]

On December 27, 2020, Congress and the President enacted the Consolidated Appropriations Act, 2021 (P.L. 116-260), which included final FY2021 LHHS appropriations in Division H, Interior/Environment appropriations in Division G, and full year mandatory type 1 diabetes funding in Division BB. The enacted FY2021 NIH program level is $43.084 billion and is made up of the following:[34]

- $41.356 billion in discretionary LHHS budget authority (nontransfer);
- $1.272 billion pursuant to the PHS program evaluation transfer and a $225 million transfer from the HHS nonrecurring expenses fund (NEF; this amount is not reflected in the program level total shown above);[35]
- $81.5 million for the Superfund research program and related activities from Interior/Environment appropriations; and

[30] For more information on the PHS evaluation tap, or PHS Evaluation Set-Aside, see discussion in CRS Report R44916, *Public Health Service Agencies: Overview and Funding (FY2016-FY2018)*, coordinated by C. Stephen Redhead and Agata Dabrowska.

[31] Specifically, P.L. 116-260, Division H, Title II, Section 204.

[32] See section on 21st Century Cures Act in CRS Report R41705, *The National Institutes of Health (NIH): Background and Congressional Issues*.

[33] P.L. 114-255, Section 1001.

[34] This report uses numbers from U.S. Congress, House Committee on Appropriations, *Report Accompanying Departments of Labor, Health and Human Services, Education, and Related Agencies Appropriations Bill*, 117th Cong., July 19, 2021, H.Rept. 117-96 as amended by H.R. 2502 passed by the House on July 29, 2021. In some cases, there are discrepancies between the numbers in H.Rept. 117-96 and the FY2021 and FY2022 amounts as enacted in P.L. 116-260, Division H and in NIH FY2022 budget request documents.

[35] The nonrecurring expenses fund (NEF) permits HHS to transfer unobligated balances of expired discretionary funds from FY2008 and subsequent years into the NEF account. The uses of funds include capital acquisitions such as information technology (IT) and facilities infrastructure (42 U.S.C. §3514a). Congress may direct uses of NEF in appropriations laws.

- $150 million in annual funding for the mandatory type 1 diabetes research program.

President Biden's FY2022 budget request proposes that NIH be provided with a total program level of $51.883 billion, an increase of $8.799 billion (+20%) from FY2021-enacted levels. The proposed FY2022 program level would be made up of[36]

- $50.378 billion in discretionary LHHS budget authority (nontransfer);
- $1.272 billion pursuant to the PHS program evaluation transfer;
- $83.5 million for the Superfund research program and related activities from Interior/Environment appropriations; and
- $150 million in annual funding for the mandatory type 1 diabetes research program.[37]

Under the President's FY2022 request, all existing IC accounts would receive an increase compared to FY2021 funding levels, except for the OD, which would receive a decrease of $174 million (-7%). In addition, the full amount ($496 million) authorized by the Cures Act for FY2022 would be appropriated to the Innovation Account. The Buildings and Facilities (B&F) account would receive an increase of $50 million (+25%) in LHHS discretionary budget authority, but an overall decrease of $175 million (-41%) when accounting for the additional NEF transfer of $225 million directed to the B&F account in FY2021 appropriations.[38]

The FY2022 budget request also proposes the creation of an Advanced Research Projects Agency for Health (ARPA-H) within NIH. The budget request includes $6.5 billion for ARPA-H "to build platforms and capabilities to deliver cures for cancer, Alzheimer's disease, diabetes, and other diseases."[39] The $6.5 billion for ARPA-H would account for 74% of the FY2022 budget request's $8.799 billion increase from FY2021 enacted levels. The creation of a new NIH component may require amendments to the PHSA, especially Section 401(d), which specifies that "[i]n the National Institutes of Health, the number of national research institutes and national centers may not exceed a total of 27." Further information on the ARPA-H proposal is provided below.

[36] NIH, *Congressional Justification: FY2022*, May 28, 2021, p. 89-91, at https://officeofbudget.od.nih.gov/pdfs/FY22/br/2022%20CJ%20Overview%20Volume%20May%2028.pdf.

[37] The FY2022 NIH budget request shows sequestration of $8.55 million for the $150 million in mandatory appropriations for FY2022. See "Budget Mechanism Table," p. 92 in https://officeofbudget.od.nih.gov/pdfs/FY22/br/2022%20CJ%20Overview%20Supplementary%20Tables.pdf.

[38] Accounting for the directed NEF transfer, the Buildings and Facilities account has a total FY2021 funding level of $425 million.

[39] NIH, Congressional Justification: FY2022, May 28, 2021, p. 10, at https://officeofbudget.od.nih.gov/pdfs/FY22/br/2022%20CJ%20Overview%20Volume%20May%2028.pdf.

Advanced Research Projects Agency for Health (ARPA-H) in the FY2022 Budget Request

The budget request includes $6.5 billion for a new Advanced Research Projects Agency for Health (ARPA-H) "to build platforms and capabilities to deliver cures for cancer, Alzheimer's disease, diabetes, and other diseases." Funding was requested for a period of three years to "allow for both scale-up in FY 2022 and redeployment of resources in the next two years if projects fail to meet performance milestones." The vast majority of funding would support extramural research, with a small amount of funding reserved for staffing and administrative functions. Unlike extant NIH Institutes and Centers (ICs), ARPA-H would not have its own intramural research program.

ARPA-H would be modeled after the Defense Advanced Research Projects Agency (DARPA), and would have several "DARPA model" characteristics, including a flat and nimble organizational structure, tenure-limited program managers with a high degree of autonomy to select and fund projects, and a milestone-based contract approach. While this organizational structure would be "operationally unique" from NIH ICs, ARPA-H would still coordinate research and activities with NIH ICs and other HHS agencies.

The FY2022 budget request describes four broad project areas that ARPA-H would fund:

- tackling bold challenges requiring large scale, sustained, cross-sector coordination;
- creating new capabilities (e.g., technologies, data resources, disease models);
- supporting high-risk exploration that could establish entirely new paradigms; and
- overcoming market failures through critical solutions, including financial incentives.

Most ARPA-H awards would be given to industry, universities, and nonprofit research institutions, and could involve some agreements with other federal agencies. ARPA-H would make use of some of NIH's flexible hiring and funding authorities, such as its Other Transaction Authority mechanisms.[40]

For further information and analysis regarding ARPA-H, see CRS Insight IN11674, *Advanced Research Projects Agency for Health (ARPA-H): Considerations for Congress*.

In July 2020, the House passed a consolidated appropriations bill, H.R. 4502, with proposed FY2022 funding levels for NIH accounts in Division A (LHHS appropriations) and Division E (Interior/Environment appropriations). House-passed appropriations would provide NIH with a FY2022 estimated program level of $49.587 billion, an increase of $6.503 billion (+15%) from FY2021-enacted levels and a decrease of $2.296 billion (-4%) from the FY2022 budget request. The House-proposed FY2022 program level includes the following amounts:[41]

- $48.082 billion in discretionary LHHS budget authority (nontransfer);
- $1.272 billion pursuant to the PHS program evaluation transfer;
- $83.5 million for the Superfund research program and related activities from Interior/Environment appropriations; and
- $150 million in annual funding for the mandatory type 1 diabetes research program.

House-passed appropriations would provide increases to all existing IC accounts compared to FY2021 funding levels. Compared to the FY2022 budget request, House-passed appropriations would provide increases to all existing IC accounts except for the National Institute of Child Health and Human Development (-$252 million) and the National Institute of Arthritis and Musculoskeletal and Skin Diseases (-$1 million). The House also included $3.0 billion for ARPA-

[40] NIH, *Congressional Justification: FY2022*, May 28, 2021, pp. 10-11, at https://officeofbudget.od.nih.gov/pdfs/FY22/br/2022%20CJ%20Overview%20Volume%20May%2028.pdf and HHS, "FY2022 Budget in Brief," pp. 59-60, at https://www.hhs.gov/sites/default/files/fy-2022-budget-in-brief.pdf.

[41] H.Rept. 117-96, Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriations Bill, 2022, July 19, 2021, pp. 475-477, at https://www.congress.gov/117/crpt/hrpt96/CRPT-117hrpt96.pdf.

H available through September 30, 2024, a decrease of $3.5 billion (-54%) compared to the FY2022 budget request, and specified that funding would only be available if legislation specifically establishing ARPA-H is enacted into law.

Table 9. National Institutes of Health Funding

(budget authority, in millions of dollars)

Institutes/Centers	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Final
Cancer Institute (NCI)	6,560	6,733	6,994		
Heart, Lung, and Blood Institute (NHLBI)	3,665	3,846	3,867		
Dental/Craniofacial Research (NIDCR)	485	516	519		
Diabetes/Digestive/Kidney (NIDDK)[a]	2,132	2,219	2,239		
Neurological Disorders/Stroke (NINDS)	2,513	2,783	2,800		
Allergy/Infectious Diseases (NIAID)	6,070	6,246	6,558		
General Medical Sciences (NIGMS)[b]	1,720	1,825	1,868		
Child Health/Human Development (NICHD)	1,590	1,942	1,690		
National Eye Institute (NEI)	836	859	877		
Environmental Health Sciences (NIEHS)[c]	733	854	858		
National Institute on Aging (NIA)	3,899	4,036	4,258		
Arthritis/Musculoskeletal/Skin Diseases (NIAMS)	634	680	679		
Deafness/Communication Disorders (NIDCD)	498	512	523		
National Institute of Mental Health (NIMH)	2,104	2,214	2,223		
National Institute on Drug Abuse (NIDA)	1,480	1,853	1,860		
Alcohol Abuse/Alcoholism (NIAAA)	555	570	582		
Nursing Research (NINR)	175	200	201		
Human Genome Research Institute (NHGRI)	616	633	646		
Biomedical Imaging/Bioengineering (NIBIB)	411	422	431		
Minority Health/Health Disparities (NIMHD)	391	652	662		
Complementary/Integrative Health (NCCIH)	154	184	185		
Advancing Translational Sciences (NCATS)	855	879	898		
Fogarty International Center (FIC)	84	96	97		
National Library of Medicine (NLM)	464	475	487		
Office of Director (OD)[d]	2,424	2,250	2,680		
Innovation Account[e]	109	150	150		
Buildings and Facilities (B&F)[f]	200	250	250		

Institutes/Centers	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Final
Advanced Research Projects Agency for Health (ARPA-H)	—	6,500	3,000		
Subtotal, NIH (LHHS Discretionary BA)	**41,356**	**50,378**	**48,082**		
PHS Program Evaluation (provided to NIGMS)	1,272	1,272	1,272		
Superfund (Interior approp. to NIEHS)[g]	82	84	84		
Nonrecurring Expenses Fund (NEF) Transfer (to Buildings and Facilities)[h]	225	—	—		
Mandatory type 1 diabetes funds (to NIDDK)[i]	150	150[j]	150		
NIH Program Level	**43,084**	**51,883**	**49,587**		

Source: U.S. Congress, House Committee on Appropriations, *Report Accompanying Departments of Labor, Health and Human Services, Education, and Related Agencies Appropriations Bill*, 117th Cong., July 19, 2021, H.Rept. 117-96 as amended by H.R. 2502 passed by the House on July 29, 2021.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed. 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 to the evaluation tap from the agencies' appropriation. In general, amounts provided to NIH for emergency requirements are excluded from these totals (e.g., FY2020 amount does not include the amounts provided in the coronavirus supplemental appropriations acts).

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

b. Amounts for NIGMS do not include funds from PHS Evaluation Set-Aside (§241 of the PHS Act).

c. Amounts for NIEHS do not include Interior/Environment Appropriations amount for Superfund research (see note g).

d. Includes $12.6 million transfer from the Pediatric Research Initiative Fund (PRIF) as authorized by the Gabriella Miller Kids First Research Act.

e. The amount shown for the NIH Innovation Account in each column represents only a portion of the total appropriation to the account ($404 million for the FY2021; $496 million for FY2022). The remaining funds for this account are reflected, where applicable, in the totals for other ICs. For FY2022, this includes $194 to NCI for cancer research and $76 million to each of NINDS and NIMH for the BRAIN Initiative ($152 million total).

f. FY2021 amount for Buildings and Facilities does not reflect directed nonrecurring expenses fund transfer in FY2021 appropriations. See note h.

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

h. The nonrecurring expenses fund permits HHS to transfer unobligated balances of expired discretionary funds from FY2008 and subsequent years into the NEF account. Congress and the President authorized use of the funds for capital acquisitions including information technology (IT) and facilities infrastructure (42 U.S.C. §3514a). Recent LHHS appropriations, including FY2021 appropriations, have directed that specific NEF funding amounts be transferred to the NIH Buildings and Facilities account.

i. Mandatory funds are available to NIDDK for type 1 diabetes research under PHSA Sec. 330B, which was most recently extended through FY2023 by the Consolidated Appropriations Act, 2021 (P.L. 116-260, Division BB, Title III).

j. FY2022 budget request documents show the FY2022 amount for the type 1 diabetes research program ($141 million) as lower than enacted funding level for FY2022 ($150 million). According to the budget request, the FY2022 amount reflects sequestration of $8.55 million. See "Budget Mechanism Table," p. 92 in https://officeofbudget.od.nih.gov/pdfs/FY22/br/2022%20CJ%20Overview%20Supplementary%20Tables.pdf.

Department of Energy[42]

The Department of Energy 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, particularly 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 FY2022 budget request for DOE includes about $20.518 billion for R&D and related activities, including programs in three broad categories: science, national security, and energy. This request is about 16.1% more than the comparable enacted FY2021 amount of $17.677 billion. The House bill would provide about $19.376 billion. (See **Table 10** for details.)

The request for the DOE Office of Science is $7.440 billion, an increase of 5.9% from the FY2021 appropriation of $7.026 billion. Funding would increase for all six of the office's major research programs. In the largest program, Basic Energy Sciences, requested increases of $109 million for research and $30 million for operations and equipment at scientific user facilities would be partially offset by a requested decrease of $85 million for facility construction. In Biological and Environmental Research, funding for the Earth and Environmental Systems Sciences subprogram would increase by $71 million (20.3%), with a focus on Earth system modeling. In Fusion Energy Sciences, the U.S. contribution to construction of the International Thermonuclear Experimental Reactor (ITER), a fusion energy demonstration and research facility in France, would be $221 million (down from $242 million in FY2021). Following a reorganization of the Office of Science in FY2020, a new program in Isotope R&D and Production ($90 million requested) would support activities previously funded in Nuclear Physics ($75 million in FY2021), while a new program in Accelerator R&D and Production ($24 million requested) would support activities previously funded in High Energy Physics ($17 million in FY2021).

The House bill would provide $7.320 billion for the Office of Science. The High Energy Physics and Fusion Energy Sciences programs would receive more than requested, while the other major programs would receive less. All but Nuclear Physics would receive more than in FY2021. In Fusion Energy Sciences, the U.S. contribution to ITER would be $242 million.

The request for DOE national security R&D is $5.252 billion, an increase of 1.5% from $5.175 billion in FY2021. In the Weapons Activities account, funding for Stockpile Research, Technology, and Engineering would decrease by 4.4%. The bulk of this decrease would be for Assessment Science ($690 million, down from $769 million in FY2021) and Inertial Confinement Fusion ($529 million, down from $575 million in FY2021). Funding for Naval Reactors would increase by $177 million (10.5%), including increases for operations and infrastructure (up $63 million), development (up $73 million) and construction (up $61 million).

The House bill would provide $5.398 billion for national security R&D. In Weapons Activities, Assessment Science would receive the FY2021 amount, while Inertial Confinement Fusion would receive $5 million more than the FY2021 amount. Naval Reactors would receive $6 million

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

(0.3%) more than the Administration request. Defense Nuclear Nonproliferation R&D would receive $43 million (6.3%) more than the request.

The request for DOE energy R&D is $7.826 billion, an increase of 42.9% from $5.477 billion in FY2021. Funding for energy efficiency and renewable energy R&D would increase by 57.9%, with increases in all major research areas and a priority on reducing emissions in the near term (in contrast to Trump Administration budgets, which proposed a focus on early-stage R&D). An 18.7% increase for the Fossil Energy and Carbon Management account (formerly Fossil Energy R&D) would be focused on climate-centric activities such as carbon capture, utilization, and storage (up $117 million, 62.0%) and environmental- and emissions-related natural gas technologies (up $73 million, 128.1%). Funding for nuclear energy R&D would increase by $343 million (22.7%), including increases of $120 million (48.1%) for advanced reactor demonstration and $100 million (222.2%) for the Versatile Test Reactor project. 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 receive $500 million (up 17.1%), while a proposed new Advanced Research Projects Agency–Climate (ARPA-C) would receive $200 million.

The House bill would provide $6.658 billion for energy R&D. Most programs in this category would receive more than in FY2021 but less than the Administration request. In Nuclear Energy, the bill would not fund the Versatile Test Reactor project. ARPA-E would receive $100 million (20.0%) more than the request. ARPA-C, however, would not be funded, and the committee report directs DOE to fund the work proposed for ARPA-C through ARPA-E.

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

(budget authority, in millions of dollars)

	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Science	**7,026**	**7,440**	**7,320**		
Basic Energy Sciences	2,245	2,300	2,293		
High Energy Physics	1,046	1,061	1,078		
Biological and Environmental Research	753	828	805		
Nuclear Physics	713	720	665		
Advanced Scientific Computing Research	1,015	1,040	1,025		
Fusion Energy Sciences	672	675	698		
Isotope R&D and Production	—	90	82		
Accelerator R&D and Production	—	24	18		
Other	582	702	656		
National Security	**5,175**	**5,252**	**5,398**		
Weapons Activities Stockpile RT&E	2,814	2,691	2,788		
Naval Reactors	1,684	1,861	1,867		
Defense Nuclear Nonproliferation R&D[a]	642	673	715		
Def. Environmental Cleanup Technol. Devel.	35	28	28		
Energy	**5,477**	**7,826**	**6,658**		
Energy Efficiency and Renewable Energy[b]	2,484	3,924	3,188		

	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Fossil Energy and Carbon Management[c]	750	890	816		
Nuclear Energy	1,508	1,851	1,675		
Electricity	212	327	267		
Cybersec., En. Secy., and Emerg. Respon. R&D	96	135	112		
Advanced Research Projects Agency–Energy	427	500	600		
Advanced Research Projects Agency–Climate	—	200	0		
DOE, Total	**17,677**	**20,518**	**19,376**		

Source: FY2021 enacted from P.L. 116-260 and explanatory statement, *Congressional Record*, December 21, 2020, Book IV. FY2022 request from DOE FY2022 congressional budget justification, https://www.energy.gov/cfo/articles/fy-2022-budget-justification. FY2022 House from H.R. 4502 as passed by the House and H.Rept. 117-98 (on H.R. 4549).

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed.

a. Including National Technical Nuclear Forensics R&D.

b. Excluding Weatherization and Intergovernmental Activities.

c. Fossil Energy R&D in FY2021.

National Aeronautics and Space Administration[43]

The National Aeronautics and Space Administration 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.

The Administration has requested about $21.751 billion for NASA R&D in FY2022. This would be 7.0% more than the FY2021 level of about $20.324 billion. For a breakdown of these amounts, see **Table 11**. NASA R&D funding comes through five accounts: Science; Aeronautics; Space Technology; Exploration (called Deep Space Exploration Systems in the Administration's budget request); and the ISS, Commercial Crew, and Commercial Low Earth Orbit (LEO) Development portions of Space Operations.

The OMB figures presented in **Table 1** indicate a substantially smaller amount for NASA R&D than the figures presented in this section. One reason for this is that OMB treats about half of the Exploration account as R&D. As systems being developed under that account move from R&D to testing and ultimately operations, the share of the account spent on R&D has decreased. To allow consistent tracking as Congress acts on FY2022 appropriations legislation, this section treats the entirety of the Exploration account as R&D.

The FY2022 request for Science is $7.931 billion, an increase of 8.6% from FY2021. The request for Earth Science includes funding for the Pre-Aerosol, Clouds, and Ocean Ecosystem (PACE) and Climate Absolute Radiance and Refractivity Observatory (CLARREO) Pathfinder missions ($119 million and $19 million, respectively). It also includes funding to initiate the development

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

of a system of future satellites known as the Earth System Observatory. The request for Astrophysics includes $502 million for the Roman Space Telescope (formerly the Wide Field Infrared Space Telescope, WFIRST) but no funds for the Stratospheric Observatory for Infrared Astronomy (SOFIA, $85 million in FY2021). PACE, CLARREO Pathfinder, WFIRST, and SOFIA were all proposed for termination in previous budgets. A requested reduction in funding for the James Webb Space Telescope in FY2022 reflects that mission's planned launch in November 2021. The Planetary Science request includes $653 million (up from $246 million in FY2021) for a Mars sample return mission and $472 million (up from $435 million in FY2021) for a mission to orbit Jupiter's moon Europa.

The FY2022 request for Aeronautics is $915 million, an increase of 10.4% from $829 million in FY2021. The budget proposes to initiate a Sustainable Flight National Partnership, including the development of a full-scale demonstrator aircraft with an electrified powertrain ($91 million in FY2022).

The FY2022 request for Space Technology is $1.425 billion, an increase of 29.5% from $1.100 billion in FY2021. The bulk of the requested increase would be for the Technology Maturation program ($491 million, up from $227 million). No funds are requested for nuclear propulsion, but the request for Technology Demonstration includes $34 million for nuclear surface power systems for the Moon and Mars. The combined RESTORE/SPIDER mission to demonstrate in-space satellite servicing and robotic manufacturing would receive $227 million, the same as in FY2021. In recent years, appropriations report language has directed NASA to focus Space Technology on broad technology goals that can serve all of NASA, not just its human exploration activities. The FY2022 budget justification states, "The Space Technology portfolio is broadening to develop technologies that can benefit other NASA Directorates, the commercial space sector and other government agencies, as appropriate."

The FY2022 request for Deep Space Exploration Systems (currently Exploration) is $6.880 billion, an increase of 5.6% from $6.517 in FY2021. Within this account, the request for Exploration Systems Development includes $1.407 billion for the Orion crew capsule (up from $1.404 billion in FY2021) and $2.487 billion for the Space Launch System heavy-lift rocket (SLS, down from $2.561 billion). The proposed 21.5% increase for Exploration R&D reflects a request for $1.195 billion (up from $928 million) for development of a Human Landing System (HLS) for lunar exploration. NASA's decision to award a single HLS contract on the grounds of limited funding was protested by the unselected vendors and remains controversial in Congress. NASA has suggested that additional funds (beyond those requested in the budget) might be needed to enable selection of a second HLS contractor.

In the Space Operations account, the request includes $1.328 billion for the ISS in FY2022 (up from $1.322 in FY2021); $155 million for the Commercial Crew program (down from $300 million); and $101 million for Commercial LEO Development (up from $17 million). Commercial crew activities are transitioning from development to operations (which is funded separately). SpaceX launched its first post-certification crewed flight to the ISS in November 2020; certification of Boeing's competing commercial crew system is anticipated in 2022. The Commercial LEO Development program, intended to stimulate a commercial space economy in low Earth orbit, was initiated in the FY2019 budget. The Trump Administration requested $150 million for it each year from then through FY2021; Congress has so far appropriated a total of $72 million.

Table 11. National Aeronautics and Space Administration R&D

(budget authority, in millions of dollars)

	FY2021 Op. Plan	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Science	**7,301**	**7,931**			
Earth Science	2,000	2,250			
Planetary Science	2,700	3,200			
Astrophysics	1,356	1,400			
James Webb Space Telescope	415	175			
Heliophysics	751	797			
Biological and Physical Sciences	79	109			
Aeronautics	**829**	**915**			
Space Technology	**1,100**	**1,425**			
Exploration / Deep Space Expl. Systems	**6,517**	**6,880**			
Exploration Systems Development	4,545	4,484			
Exploration R&D	1,973	2,397			
Space Operations[a]	**1,638**	**1,583**			
International Space Station	1,322	1,328			
Commercial Crew	300	155			
Commercial LEO Development	17	101			
Subtotal R&D	**17,385**	**18,735**			
Non-R&D Programs[b]	2,521	2,627			
Safety, Security, and Mission Services	2,937	3,049			
Associated with R&D[c]	*2,565*	*2,674*			
Construction & Environmental C&R	429	390			
Associated with R&D[c]	*374*	*342*			
NASA, Total (R&D)	**20,324**	**21,751**			
NASA, Total	**23,271**	**24,801**			

Sources: FY2021 operating plan and FY2022 request from NASA FY2022 congressional budget justification, http://www.nasa.gov/news/budget/.

Notes: FY2021 operating plan amounts reflect enacted appropriations adjusted for transfers and reprogramming. Totals may differ from the sum of the components due to rounding. LEO = Low Earth Orbit. C&R = Compliance and Remediation. Figures for the columns currently blank may become available as action is completed.

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

b. Non-R&D activities in Space Operations (see note a); STEM Engagement; 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.

National Science Foundation[44]

The National Science Foundation supports basic research and education in the nonmedical sciences and engineering. Congress established the foundation as an independent federal agency in 1950 to "promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes."[45] The NSF is a major source of federal support for U.S. university research, especially in the social sciences, 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.

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

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 over 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.[46] 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 FY2021 enacted (or estimated, for subaccount and R&D amounts as noted) and FY2022 requested levels are reported by account, including amounts for R&D conduct and physical assets where applicable, in **Table 12**.

Funding for NSF for FY2021 was enacted on December 27, 2020.[47] Additionally, NSF received $600 million in supplemental two-year appropriations in the American Rescue Plan Act of 2021 (P.L. 117-2) "to fund or extend new and existing research grants, cooperative agreements, scholarships, fellowships, and apprenticeships, and related administrative expenses to prevent, prepare for, and respond to coronavirus."[48] Funding details below the account level were not available at the time the FY2022 budget request was prepared. Therefore, at the account level, the FY2022 request amounts are compared to the FY2021 enacted amounts in this analysis; below the account level, the FY2022 request amounts are compared to FY2021 estimated amounts for subaccounts and R&D amounts. FY2021 enacted/estimated and FY2022 requested amounts are reported by account and for R&D conduct and facilities and equipment in **Table 12**.

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

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

[46] R&D actual (FY2020), estimated (FY2021), and requested (FY2022) amounts are reported in the "Quantitative Data Tables" section of the NSF *FY2022 Budget Request to Congress*, May 28, 2021, pp. QDT-1–QDT-7.

[47] The Consolidated Appropriations Act, 2021 (P.L. 116-260); and Explanatory Statement, Consolidated Appropriations Act, 2021, Division B (Commerce, Justice, Science, and Related Agencies Appropriations Act, 2021), *Congressional Record*, vol. 166, no. 218—Book III (December 21, 2021), pp. H7947-H7948.

[48] These funds are not included in the FY2021 enacted/estimated funding amounts because they are two-year funds that will not be fully allocated in FY2021; for further information, see NSF *FY2022 Budget Request to Congress*, p. Performance and Management-12.

Overall. The Administration is requesting $10.2 billion for the NSF in FY2022, $1.68 billion (19.8%) more than the FY2021 enacted amount. The request would increase budget authority in all three of the R&D accounts relative to the FY2021 enacted level: RRA by $1.23 billion (17.8%), EHR by $319 million (33.0%), and MREFC by $8.0 million (3.3%). Overall, NSF estimates that, under the FY2022 request, agency-wide funding rates for competitive awards (i.e., the percentage of submitted proposals that are successfully awarded funding after competitive review) would increase slightly from 27% to 29%, with an estimated 13,800 awards.

For FY2022, $8.17 billion is requested for R&D activities, a $1.29 billion increase from FY2021 estimated funding for R&D. R&D activities account for approximately 80% of NSF's total funding. The total request for R&D activities includes $7.58 billion (93%) for the conduct of R&D, and $595 million (7%) for R&D facilities and major equipment. Of funding requested for the conduct of R&D, 86% is requested for basic research, and 14% for applied research. Overall funding for R&D facilities and major equipment supports not only the construction and acquisition phases, funded through MREFC ($249 million requested), but also planning, design, and post-construction operations and maintenance, funded through RRA ($346 million requested).

Research. The Administration seeks $8.14 billion for RRA in FY2022, a $1.23 billion (17.8%) increase compared to the FY2021 enacted funding. Within the RRA account, the FY2022 request includes $7.30 billion for R&D, an increase of $1.13 billion (18.3%) compared to the FY2021 estimated amount. Of this amount, the majority ($6.96 billion, 95%) is requested for the conduct of research, including $6.30 billion for basic research and $659 million for applied research.

Compared to the FY2021 estimated levels, the FY2022 request includes increases for all 11 RRA subaccounts.[49] This includes a request of $865 million for a proposed new Directorate for Technology, Innovation, and Partnerships (TIP), meant to support crosscutting programs and activities, accelerate the translation of research to market, and catalyze partnerships across academia, industry, government, investors, and civil society.[50] The FY2022 request also includes $240 million for the Established Program to Stimulate Competitive Research (EPSCoR) program, a $39.6 million (19.8%) increase compared to FY2021 estimated funding.

Education. The FY2022 request for the EHR account is $1.29 billion, $319 million (33%) more than the FY2021 enacted amount. By program division, in terms of both dollars and percent, the Division of Human Resource Development would receive the largest increase, $92.5 million (43%) over the FY2021 estimated level. EHR programs of particular interest to congressional policymakers include the Graduate Research Fellowship Program (GRFP) and National Research Traineeship (NRT) programs. The FY2022 request for GRFP is $318 million, an increase of $34.0 million (12%) from the FY2021 estimated level.[51] The FY2022 request for NRT is $58 million, equal to the FY2021 estimated level.

Within EHR, requested funding for R&D is $620 million, which is $154 million (33%) more than the FY2021 estimated funding amount and accounts for approximately 7.6% of the agency's total R&D request. Nearly all of the requested funding would support the conduct of R&D, including $232 million for basic research and $388 million for applied research.

[49] The RRA funding table in the budget request seems to show a decrease for the IA subaccount. As noted in the IA summary funding table, this is because two programs previously in the IA subaccount are moved to other accounts: the Graduate Research Fellowship program is consolidated into the EHR account, and the Convergence Accelerator (discussed below) is moved to the TIP subaccount; NSF *FY2022 Budget Request to Congress*, p. IA-1.

[50] For more information on the TIP Directorate, see NSF, *FY2022 Budget Request to Congress*, pp. TIP-1 – TIP-8, https://www.nsf.gov/about/budget/fy2022/pdf/52_fy2022.pdf.

[51] The subset of GRFP funds provided through RRA in prior years would be consolidated into EHR in FY2022.

***Construction*.** The MREFC account supports large construction projects and larger mid-scale research infrastructure, with all of the funding supporting R&D facilities. The construction phases of such large-scale projects tend to span multiple years; therefore, NSF provides out-year estimates of funding for major facilities for the duration of the anticipated timeline, which are updated annually. This section of the analysis includes comparisons to FY2021 estimated funding, based on these projections. The Administration is seeking $249 million for MREFC in FY2022, $8.0 million (3.3%) more than the FY2021 enacted amount.

Requested MREFC funding would support continued construction of the Vera C. Rubin Observatory ($40.8 million requested, equal to the FY2021 estimate)—previously called the Large Synoptic Survey Telescope (LSST)—and the Antarctic Infrastructure Recapitalization program (AIR, $90.0 million requested, equal to the FY2021 estimate).[52] The request includes $36.0 million for upgrades to the Large Hadron Collider in Switzerland, which would represent the third year of a five-year project. Additionally, $76.2 million is requested for Mid-scale Research Infrastructure projects (those projects with funding amounts in the $20 million to $100 million range); this was a new funding line-item in the MREFC account as of FY2020, meant to manage support for upgrades to major facilities and stand-alone projects in this range as a portfolio.

Other Initiatives. The FY2022 NSF budget request includes funding for multiple agency-wide investments, including the Big Ideas and Convergence Accelerator (CA), as well as three multiagency initiatives. This funding is included in multiple NSF appropriations accounts, and R&D amounts are not separately provided.

For FY2022, NSF requests funding for eight Big Ideas, including five Research and three Enabling Big Ideas. The Big Ideas were first proposed in 2016 as an "endeavor to break down the silos of conventional scientific research … to define and push the frontiers of global science and engineering leadership and to invest in fundamental research."[53] Requested funding amounts for each of the Big Ideas compared to the FY2021 estimated amounts include the following:[54]

- Harnessing the Data Revolution for 21st-Century Science and Engineering (HDR): $180 million requested, up $5.8 million (3.3%) from FY2021.
- The Future of Work at the Human Technology Frontier (FW-HTF): $173 million requested, up $11 million (6.8%) from FY2021.
- Navigating the New Arctic (NNA): $37.2 million requested, up $1.0 million (2.8%) from FY2021.
- Understanding the Rules of Life (URoL): Predicting Phenotype: $113 million requested, up $30 million (36%) from FY2021.
- Windows on the Universe (WoU): $66.8 million requested, up $2.6 million (4.1%) from FY2021.

[52] The FY2022 funding for AIR is requested as part of re-baselining of the Antarctic Infrastructure Modernization for Science (AIMS) program, which encountered significant disruptions and delays due to COVID-19 restrictions as field work and on-ice construction work was in the early stages; NSF, *FY2022 Budget Request to Congress*, pp. MREFC-8 – MREFC-13.

[53] NSF, *FY2021 Budget Request to Congress*, February 10, 202, pp. Overview-9 – Overview-10.

[54] Starting in FY2021, activities of the Quantum Leap Big Idea are to be managed within NSF's broader Quantum Information Science (QIS) portfolio.

- Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES): $46.5 million requested, up $26.5 million (132%) from FY2021.
- Growing Convergence Research at NSF (GCR): $24.2 million requested, up $8.2 million (51%) from FY2021.
- Mid-Scale Research Infrastructure: $126 million requested, up $17.3 million (16%) from FY2021.[55]

The Convergence Accelerator

> is an organizational framework that stands separately from the NSF research directorates, with its own budget, staff, and initiatives. Each CA research track will be a time-limited entity focused on specific research topics and themes. Therefore, CA research tracks will evolve over time and will be informed by external stakeholder input. The CA will reward high-risk, innovative thinking by multidisciplinary teams of researchers who want to accelerate discovery and innovation. The CA is a way of achieving rapid lab-to-market or research outcomes.[56]

While the initial CA research tracks focused on a subset of the Big Ideas, the FY2022 request is intended to support new research tracks informed by responses to a Request for Information, current national priorities, and other external stakeholder input. NSF has requested $70 million for the CA in FY2022, equal to the FY2021 estimated amount.

The budget request also includes three multi-agency initiatives. The National Nanotechnology Initiative would receive $471 million, $29.0 million (6.6%) more than the FY2021 estimate. The Networking and Information Technology Research and Development program would receive $2.07 billion, an increase of $484 million (31%). The U.S. Global Change Research Program would receive $762 million, $241 million (46%) more than the FY2021 estimate.[57] These figures represent funding within agency budgets for those agencies involved in these interagency activities. The coordination offices for these initiatives have much smaller budgets.

Table 12. National Science Foundation Funding

(budget authority, in millions of dollars)

Account	FY2021 Enacted/ Estimated[a]	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Research and Related Activities (RRA)	**6,909.8**	**8,139.7**			
R&D, RRA Total	6,174.7	7,304.7			
Conduct of R&D	*5,882.3*	*6,958.9*			
R&D Facilities and Major Equipment	*292.4*	*345.9*			
Education and Human Resources (EHR)	**968.0**	**1,287.3**			
R&D, EHR Total	465.9	619.6			
Conduct of R&D	*465.8*	*619.5*			

[55] This total includes Mid-scale Research Infrastructure-1, funded through RRA, for projects costing $6 million-$20 million, as well as Mid-scale Research Infrastructure-2, funded through MREFC, for projects costing $20 million-$100 million.

[56] NSF, *FY2021 Budget Request to Congress*, February 10, 2020, p. Overview-10.

[57] For additional information on these initiatives, see "NSF-Wide Investments."

Account	FY2021 Enacted/ Estimated[a]	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
R&D Facilities and Major Equipment	*0.1*	*0.1*			
Major Research Equipment and Facilities Construction (MREFC)	**241.0**	**249.0**			
R&D, MREFC Total	241.0	249.0			
Conduct of R&D	*0.0*	*0.0*			
R&D Facilities and Major Equipment	*241.0*	*249.0*			
Agency Operations and Award Management (AOAM)[b]	**345.6**	**468.3**			
Office of the Inspector General (OIG)[b]	**17.9**	**20.4**			
National Science Board (NSB)[b]	**4.5**	**4.6**			
NSF, Total Discretionary[c]	**8,486.8**	**10,169.3**			
R&D, NSF Total	6,881.6	8,173.3			
Total, Conduct of R&D	*6,348.2*	*7,578.4*			
Total, R&D Facilities & Major Equipment	*533.4*	*595.0*			

Sources: Data in the columns titled "FY2021 Enacted/Estimated" and "FY2022 Request" are from P.L. 116-260 and the NSF *FY2022 Budget Request to Congress*.

Notes: Appropriations accounts are in bold. NSF total may differ from the sum of the accounts due to rounding. Nonbold R&D funding amounts are a subset of funding for the specified accounts. Figures for the columns currently blank may become available as action is completed. The term "n/a" = not available.

a. FY2021 account funding amounts (bold) are as enacted (P.L. 116-260); FY2021 R&D funding amounts (nonbold) are as estimated by NSF. These amounts do not include $600 million in two-year appropriations for NSF as enacted in the American Rescue Plan Act of 2021 (P.L. 117-2) "to fund or extend new and existing research grants, cooperative agreements, scholarships, fellowships, and apprenticeships, and related administrative expenses to prevent, prepare for, and respond to coronavirus."

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

c. In addition to discretionary funding, NSF reports mandatory funding from H-1B visa and donation sources, which are not included in this total.

Department of Agriculture[58]

The U.S. Department of Agriculture was created in 1862 to support agricultural research in an expanding, agriculturally dependent country. Today, USDA conducts intramural research at federal facilities with federally employed scientists, and supports extramural research at universities and other facilities through competitive grants and capacity (formula-based) funding. The breadth of contemporary USDA research spans traditional agricultural production practices, as well as organic and sustainable agriculture, bioenergy, nutritional needs and food composition,

[58] This section was written by Genevieve K. Croft, Analyst in Agricultural Policy, CRS Resources, Science, and Industry Division.

food safety, animal and plant health, pest and disease management, economic decisionmaking, and other social sciences affecting consumers, farmers, and rural communities.

The four agencies of USDA's Research, Education, and Economics (REE) mission area carry out the Department's research and education activities.[59] These agencies are the Agricultural Research Service (ARS), the principal intramural research agency; the National Institute of Food and Agriculture (NIFA), the principal extramural research agency; the National Agricultural Statistics Service (NASS), which undertakes a variety of surveys to capture data about agriculture and food production; and the Economic Research Service (ERS), which applies economic analysis to a wide range of topics related to food and agriculture. In addition to the four REE agencies, the Office of the Chief Scientist (OCS), a staff office within the Office of the Under Secretary of REE, coordinates science activities across the department.

The House-passed FY2022 appropriations bill (H.R. 4502) would provide a total of $3,699.1 million in discretionary spending for the REE agencies in FY2022,[60] an increase of $332.2 million (9.9%) from the FY2021 amount ($3,366.9 million) enacted in P.L. 116-260.[61] Most of that difference is attributable to increases for ARS buildings and facilities ($35.7 million provided in P.L. 116-260, versus $126.5 million recommended in H.R. 4502) and NIFA research and education activities ($992.6 million provided in P.L. 116-260, versus $1,063.3 million recommended in H.R. 4502). The House-passed recommendation for FY2022 discretionary appropriations and the Administration's FY2022 request are discussed below for the four research agencies and the Office of the Under Secretary of REE. Funding amounts are presented in **Table 13**.

Certain appropriations for the REE agencies and OCS are not presented in **Table 13**, including appropriations made in the General Provisions of P.L. 116-260 and H.R. 4502. For FY2021, the REE agencies and OCS also received certain funding in addition to those amounts provided through P.L. 116-260, Division A, Title I (Agricultural Programs). Funding from these other sources is discussed separately in the text, and is not presented in **Table 13**. Within the Consolidated Appropriations Act, 2021, Division A, Title VII (General Provisions) provided an additional $31.7 million, and Division M (Coronavirus Response and Relief Supplemental Appropriations Act, 2021) provided $140.5 million of supplementary discretionary funding, and $20 million of annual mandatory funding, for certain REE programs. Separately, the American Rescue Plan Act of 2021 (P.L. 117-2) provided additional appropriations for USDA, some of which may be administered through REE, though implemented amounts and specific programming are not yet known. In addition to discretionary appropriations, agricultural research is funded by certain mandatory funding authorized by the 2018 farm bill (P.L. 115-334P.L. 116-260, as well as state matching contributions and private donations or grants.

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[59] For additional information, see CRS Report R40819, *Agricultural Research: Background and Issues*, by Genevieve K. Croft.

[60] The committee report for the House-passed FY2022 appropriations bill for agriculture (H.R. 4502, Division B) is H.Rept. 117-82. This report remains associated with the original bill reported for agriculture (H.R. 4356). The committee report associated with H.R. 4502 (H.Rept. 117-96) does not address agriculture.

[61] FY2021 enacted appropriations and related congressional directives presented in this report section derive from P.L. 116-260; the accompanying *Explanatory Statement, Division A – Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2021*; H.Rept. 116-446 (to accompany the House FY2021 agriculture appropriations bill, H.R. 7610, 116th Congress); and the Senate explanatory statement to accompany the Senate agriculture appropriations draft bill, both available at https://www.appropriations.senate.gov/news/committee-releases-fy21-bills-in-effort-to-advance-process-produce-bipartisan-results. For P.L. 116-260, Division A, Title I (Agricultural Programs), provides regular appropriations for USDA, including the REE agencies and OCS. In this report section, unless otherwise noted, funds provided outside of this division and title are discussed separately from FY2021 discretionary funding totals.

Agricultural Research Service

ARS is USDA's in-house basic and applied research agency, and has major responsibilities for conducting and leading the national agricultural research effort. ARS operates approximately 90 laboratories, with about 5,000 permanent employees, including approximately 2,000 research scientists. ARS laboratories include a focus on efficient and sustainable 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 (NAL). NAL is the world's largest agricultural research library, and is a primary information repository for food, agriculture, and natural resource sciences.

For FY2022, H.R. 4502 would provide $1,638.0 million for ARS salaries and expenses, a 9.8% increase over the FY2021 appropriation ($1,491.8 million), and 11.4% less than the Administration's FY2022 request ($1,849.6 million). The House-passed bill would provide $126.5 million for ARS buildings and facilities, a 254.4% increase from the FY2021 appropriation ($35.7 million) and 178.6% more than the Administration's FY2022 request ($45.4 million, **Table 13**). The House-passed bill includes $46.7 million in community project funding[62] for six ARS facilities as part of the ARS buildings and facilities total.

Among Administration requests for ARS are (1) $92 million for climate science, (2) $5 million for the USDA climate hubs, and (3) $95 million for an agreement with the Department of Energy for the Administration's proposed Advanced Research Projects Agency–Climate (ARPA-C). The House-passed bill includes $50 million to support some of these proposals, including $10 million for the climate hubs. In H.Rept. 117-82, the committee "strongly supports the Administration's request" for ARS engagement in climate science research, but the House-passed bill does not provide ARS funding for ARPA-C because "the budget request lacks an adequate justification of ARS's role."[63]

ARS continues to coordinate with the Department of Homeland Security on the new National Bio and Agro-Defense Facility (NBAF), which DHS is constructing to replace the outdated Plum Island Animal Disease Center (PIADC).[64] In January 2019, USDA and DHS signed a Memorandum of Agreement to govern the transition of NBAF from DHS to USDA, with ownership to transfer upon its completion and commissioning.[65] USDA projects the transfer of operations from PIADC to NBAF will be completed by December 2023.[66] The House-passed bill stipulates that when this transfer takes place, it shall occur without reimbursement (H.R. 4502,

[62] *Community project funding*, also referred to as *earmarks*, provides appropriations for specific projects at the request of Members of Congress. The House Appropriations Committee announced it would accept such appropriations requests for FY2022. For additional information, see House Committee on Appropriations, "DeLauro Announces Community Project Funding in Fiscal Year 2022," February 26, 2021, https://appropriations.house.gov/news/press-releases/delauro-announces-community-project-funding-in-fiscal-year-2022.

[63] USDA, "Agricultural Research Service," *2022 USDA Budget Explanatory Notes for Committee on Appropriations*, 2021, p. 16.

[64] For additional information, see CRS In Focus IF11492, *National Bio and Agro-Defense Facility: Purpose and Status*, by Genevieve K. Croft.

[65] USDA and DHS, *Memorandum of Agreement Between the U.S. Department of Agriculture Marketing and Regulatory Programs, the U.S. Department of Agriculture Research, Education, and Economics, and the Department of Homeland Security Science and Technology Directorate*, June 20, 2019, at https://www.usda.gov/sites/default/files/documents/usda-dhs-moa.pdf.

[66] USDA, "USDA and DHS S&T Revise NBAF Project Timeline," Press Release, December 15, 2020, https://www.usda.gov/nbaf/media/press-releases/2020/usda-dhs-st-revise-nbaf-project-timeline.

Division B, §730). For NBAF in FY2022, H.R. 4502 would provide $21.3 million in ARS salaries and expenses and does not specify funds within the ARS buildings and facilities account. The Administration requested a total of $118.7 million in ARS salaries and expenses, and an increase of $10.6 million in ARS buildings and facilities funds.

National Institute of Food and Agriculture

The National Institute of Food and Agriculture is USDA's principal extramural research agency. It provides federal funding for research, education, and extension projects conducted in partnership with land-grant colleges and universities (LGUs), State Agricultural Experiment Stations, the Cooperative Extension System, other research and education institutions, private organizations, and individuals. NIFA partnerships include the three types of LGUs—1862 (original) Institutions, 1890 (historically Black) Institutions, and 1994 (tribal) Institutions—as well as other higher education institutions.[67] Federal funds awarded through NIFA capacity (formula-based) and competitive grants enhance research capacity at these institutions.[68] While NIFA is headquartered in Washington, DC, USDA relocated the majority of NIFA staff positions to Kansas City, MO, in 2019.[69]

The House-passed bill recommends $1,656.8 million in discretionary spending for NIFA activities in FY2022. This is $86.8 million more (5.5%) than was enacted in FY2021 ($1,570.0 million) and $299.0 million less (-15.3%) than the Administration request (**Table 13**).

The Administration's FY2022 budget request proposes a change in appropriations language that would combine three separate NIFA funding accounts—for research and education, extension, and integrated activities—into one agency account that includes all programs.[70] The Administration argues that consolidating the accounts would "mirror the organization as a National Institute with a unified mission and offer opportunities to streamline administration of funds."[71] The House-passed bill does not comment on or adopt this recommendation.

Research and Education. Hatch Act and Evans-Allen Act funds support capacity grants for research and education activities at 1862 and 1890 Institutions, respectively. For Hatch Act programs, H.R. 4502 would provide $265.0 million, $64.4 million less (-19.6%) than the Administration request ($329.4 million) and $6.0 million more than the FY2021 enacted amount. For Evans-Allen programs, H.R. 4502 would provide $92.8 million, the same as the Administration request, and $19.8 million more than the FY2021 amount. The McIntire-Stennis program provides capacity funds for forestry research at LGUs and state colleges of forestry. For FY2022, H.R. 4502 would provide $38.0 million for this program, $2.0 million more than the FY2021 enacted amount, and $7.8 million less than the Administration request.

[67] 1862, 1890, and 1994 refer to the years of enactment of the laws that created these institutional classifications. For more information on LGUs and other NIFA-funded institutions, see CRS Report R45897, *The U.S. Land-Grant University System: An Overview*, by Genevieve K. Croft, and CRS In Focus IF11847, *1890 Land-Grant Universities: Background and Selected Issues*, by Genevieve K. Croft.

[68] 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.

[69] For further information, see CRS In Focus IF11527, *Relocation of the USDA Research Agencies: NIFA and ERS*, by Genevieve K. Croft.

[70] Similar consolidations in NIFA were also proposed by the Obama and Trump Administrations, but were not adopted by Congress.

[71] USDA, "National Institute of Food and Agriculture," *2022 USDA Budget Explanatory Notes for Committee on Appropriations*, 2021, p. 21-27.

The Agriculture and Food Research Initiative (AFRI) is USDA's flagship competitive research grants program, and currently represents about 28% of NIFA's total discretionary budget. The House-passed bill would provide $450.0 million for AFRI. This is $15.0 million more (3.4%) than the FY2021 enacted amount. The Administration is requesting $700.0 million—the full amount authorized by the 2018 farm bill—a 60.9% increase over FY2021. NIFA also funds the Sustainable Agriculture Research and Education (SARE) program. For FY2021, P.L. 116-260 provides $40.0 million for SARE. For FY2022, H.R. 4502 would provide $50.0 million and the Administration requests $60.0 million.

Extension. Smith-Lever Act 3(b) and 3(c) programs provide capacity grants to 1862 Institutions to support cooperative extension. The House-passed bill recommends $320.0 million for FY2021, $5.0 million (1.5%) more than both the enacted FY2021 amount and the Administration's FY2022 request ($315.0 million).

Smith-Lever Act 3(d) programs provide competitive grants to LGUs to support cooperative extension. These programs include grants for food and nutrition education; new technologies for agricultural extension; federally recognized tribes; children, youth, and families at risk; and farm safety education. For Smith-Lever 3(d) programs in FY2022, the House-passed bill recommends $88.1 million and the Administration is requesting $89.6 million. For both FY2022 proposals, $70.0 million would support the Expanded Food and Nutrition Education Program (EFNEP) and $3.2 million would support the Federally Recognized Tribes Extension Program (FRTEP).

Integrated Activities. Integrated activities are those activities that include some combination of teaching, education, and research. For integrated activities in FY2022, the House-passed bill proposes $40.0 million, and the Administration requests $39.0 million—the same as the FY2021 appropriation.

***Other appropriations*.** Congress may also provide funding—in addition to those sums discussed above—for certain NIFA programs and activities, in the general provisions of annual appropriations acts. The President's budget request for FY2022 includes funding requests for a NIFA pilot program to enhance farming and ranching activities for military veterans ($5.0 million), the 1890 Centers of Excellence ($10.0 million), and establishing a business innovation center at an 1890 Institution ($2.0 million). In H.R. 4502, Division B, Title VII (General Provisions) would provide the requested funding for the military veterans pilot program and the 1890 Centers of Excellence, but not for the business innovation center. They would also provide funding for the Beginning Farmer and Rancher Development Program ($5 million), among other NIFA programs and activities.

In addition to P.L. 116-260, other appropriations provide FY2021 funding for NIFA. The Coronavirus Response and Relief Supplemental Appropriations Act includes $140.5 million for NIFA programs in FY2021, including $75.0 million for the Gus Schumacher Nutrition Incentive Program, $37.5 million for the Beginning Farmer and Rancher Development Program, and $28.0 million for the Farm and Ranch Stress Assistance Network. NIFA may also administer some portion of the $1.01 billion provided to USDA for socially disadvantaged farmers and ranchers through the American Rescue Plan Act of 2021 (P.L. 117-2, §1006).[72]

[72] As of the submission of this report, USDA has not announced how it plans to spend this funding.

National Agricultural Statistics Service

The National Agricultural Statistics Service conducts the quinquennial Census of Agriculture and provides official statistics on agricultural production and farm sector indicators. It is one of the 13 principal statistical agencies of the U.S. Federal Statistical System.

The House-passed bill recommends $189.2 million for NASS in FY2022, and the Administration is requesting $193.7 million. Both proposed amounts include $46.9 million for the Census of Agriculture. The House-passed bill directs NASS to plan a study of agritourism in FY2022, and to continue stakeholder outreach on how to improve data collection on urban, indoor, and emerging agricultural production.

Economic Research Service

The Economic Research Service supports economic and social science analysis about agriculture, rural development, food, commodity markets, and the environment. It also collects and disseminates data concerning USDA programs and policies. Like NASS, ERS is one of the principal statistical agencies of the U.S. Federal Statistical System. While ERS is headquartered in Washington, DC, USDA relocated the majority of ERS staff positions to Kansas City, MO, in 2019.[73]

For FY2022, H.R. 4502 recommends $88.6 million for ERS, an increase of $3.1 million (3.6%) over FY2021, and $2.0 million less (2.2%) than the Administration's FY2021 request. The House-passed bill includes $2.0 million for ERS to expand its data modeling capabilities with respect to climate change and its impact on production and the farm economy.

Office of the REE Under Secretary and Office of the Chief Scientist

Congress created the Office of the Chief Scientist in 2008 when it established the dual role of the Under Secretary for REE as the USDA Chief Scientist (7 U.S.C. §6971). OCS coordinates research programs and activities across USDA. Administratively, it is a component of the Office of the Under Secretary of REE.

In recent years, congressional appropriations for the Office of the Under Secretary of REE have included funds for the Under Secretary and a partial staff.[74] Congress has not provided direct appropriations for OCS since its establishment. As such, OCS has been funded via interagency agreement among the REE agencies. The President's budget request for FY2021 included for the first time a separate request for OCS; however FY2021 enacted appropriations did not provide the requested funds.

For the Office of the Under Secretary of REE in FY2022, H.R. 4502 would provide $4.3 million, $2.0 million (-31.6%) less than the President's budget request. Of the amounts proposed for this office, the House-passed bill would allocate $2.0 million for OCS, and the President's budget request would allocate $5.0 million.

In both cases, the OCS funds are not requested to replace USDA interagency funding of the office, but rather to support the Agriculture Advanced Research and Development Authority (AGARDA). The 2018 farm bill (P.L. 115-334, §7132) establishes AGARDA as a pilot project

[73] See CRS In Focus IF11527, *Relocation of the USDA Research Agencies: NIFA and ERS,* by Genevieve K. Croft.

[74] For example, Table OSEC-5 of USDA's FY2021 explanatory notes identifies $800,000 and three staff years for the Office of the Under Secretary for REE. USDA, "Office of the Secretary," *2021 USDA Budget Explanatory Notes for Committee on Appropriations,* 2020, p. 1-9.

within OCS to target long-term and high-risk research and development that private industry would be unlikely to undertake. The 2018 farm bill authorized $50 million in annual appropriations through FY2023 and required OCS to issue an AGARDA strategic plan by December 2019. To date, AGARDA has not received appropriations, USDA has not established the pilot program, and USDA has not publicly issued a strategic plan.

H.R. 4502 would also provide OCS with an additional $400,000 through General Provisions, for pollinator research coordination, the same amount as provided in FY2021 enacted appropriations.

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

(budget authority, in millions of dollars)

Agency or Major Program	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Agricultural Research Service (ARS)					
Salaries and Expenses	1,491.8	1,849.6	1,638.0		
Buildings and Facilities	35.7	45.4	126.5		
Subtotal, ARS	**1,527.5**	**1,895.0**	**1,764.6**		
National Institute of Food and Agriculture (NIFA)					
Research and Education					
AFRI (competitive grants)	435.0	700.0	450.0		
Hatch Act (1862 Institutions)	259.0	329.4	265.0		
Evans-Allen (1890 Institutions)	73.0	92.8	92.8		
McIntire-Stennis (forestry)	36.0	45.8	38.0		
Other	189.6	210.4	217.5[a]		
Subtotal, Research and Education	**992.6**	**1,378.4**	**1,063.3**[a]		
Extension					
Smith-Lever 3(b) and 3(c)	315.0	315.0	320.0		
Smith-Lever 3(d)	90.1	89.6	88.1		
1890 Extension Activities	62.0	62.0	67.0		
1994 Extension Activities	8.5	8.5	9.5		
Other	62.8	63.3	68.9		
Subtotal, Extension	**538.4**	**538.4**	**553.5**		
Integrated Activities	**39.0**	**39.0**	**40.0**		
Subtotal, NIFA	**1,570.0**	**1,955.8**	**1,656.8**[a]		
National Agricultural Statistics Service (NASS)	**183.9**	**193.7**	**189.2**		
Economic Research Service (ERS)	**85.5**	**90.6**	**88.6**		
Total, USDA Research, Education, and Economics Agencies	**3,366.9**	**4,135.1**	**3,699.1**[a]		
Office of the Under Secretary of REE	**0.8**	**6.3**	**4.3**		
Office of the Chief Scientist	-	5.0	2.0		

Sources: CRS, compiled from P.L. 116-260 *Consolidated Appropriations Act, 2021, FY2021 Explanatory Statement, Division A; FY2022 USDA Budget Justification Notes*; H.R. 4502; and H.Rept. 117-82.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed. Amounts do not include appropriations included in General Provisions or mandatory funding. FY2021 enacted amounts do not include $160.5 million provided through P.L. 116-260, Division M (Coronavirus Response and Relief Supplemental Appropriations Act, 2021), or funds provided in Section 1006 of the American Rescue Plan Act of 2021 (P.L. 117-2). Section 1006 provides $1.01 billion, of which not less than 5% is intended to supplement agricultural research, education, and extension. As of the writing of this report, USDA has not announced how it intends to allocate these funds.

a. This amount is $2 million higher than in H.Rept. 117-82 due to amendments included in H.R. 4502.

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[75]

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."[76] 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.[77]

Regular appropriations for NIST are provided through the annual Commerce, Justice, Science, and Related Agencies Appropriations Act (CJS Act). President Biden is requesting $1,497.2 million for NIST in FY2022, an increase of $462.7 million (44.7%) from the FY2021 enacted appropriation of $1,034.5 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 FY2022 request includes $915.6 million for laboratory R&D programs, corporate services, and standards coordination and special programs in the STRS account, an increase of $127.6 million (16.2%) from the FY2021 enacted level.[78] Program increases include

- Climate and Energy Measurements, Tools, and Testbeds, $54.8 million (up $18.0 million);[79]

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

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

[77] 15 U.S.C. §272.

[78] CRS analysis of data from U.S. Department of Commerce, National Institute of Standards and Technology, National Institute of Standards and Technology/National Technical Information Service, Fiscal Year 2022 Budget Submission to Congress, p. NIST-3, https://www.commerce.gov/sites/default/files/2021-06/fy2022_nist_congressional_budget_justification.pdf.

[79] Ibid., p. NIST-64.

- Quantum Information Science, Engineering, and Metrology, $61.8 million (up $15.0 million);[80]
- Partnerships, Research, and Standards to Advance Trustworthy Artificial Intelligence, $45.4 million (up $15.0 million);[81]
- Supporting the American Bioeconomy, $34.3 million (up $13.8 million);[82]
- Advanced Communications Research and Standards, $36.4 million (up $11.5 million);[83]
- Next-Generation Semiconductor Research and Standards, $34.5 million (up $10.0 million);[84]
- Measurements and Data to Enable the Circular Economy, $13.5 million (up $5.0 million);[85] and
- Strengthening Equity and Diversity in the Standards Workforce, $13.6 million (up $2.1 million).[86]

The FY2022 request would provide $441.6 million for the ITS account, up $275.1 million (165.2%) from the FY2021 enacted level.[87] Within the ITS account, the request would provide $275.0 million for the Manufacturing Extension Partnership (MEP) program, an increase of $125.0 million (83.3%) from the FY2021 enacted level, and $166.6 million for Manufacturing USA, $150.1 million (909.7%) higher than the FY2021 enacted level of $16.5 million.[88]

According to NIST, the funding requested for MEP would, among other things, strengthen the performance of the existing network, assist growth oriented small- and medium-sized enterprises' abilities to respond to critical national needs, and provide additional services to more companies in critical supply chains and workforce development.[89]

Of the funds for Manufacturing USA, $10.0 million would support NIST's first Manufacturing USA institute, the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL); $150.0 million would be for the establishment of two additional institutes; $5.0 million would be for support of the Manufacturing USA network; and $1.7 million would be for grants to develop industrial technology roadmaps.[90]

The President is requesting $140.0 million for the CRF account for FY2022, up $60.0 million (75.0%) from the FY2021 enacted level. This funding would support repair and revitalization of facilities to address NIST's major utility infrastructure maintenance backlog and to modernize its IT networking infrastructure; no funding is requested for construction and major renovations.[91]

[80] Ibid., p. NIST-37.

[81] Ibid., p. NIST-42.

[82] Ibid., p. NIST-52.

[83] Ibid., p. NIST-47.

[84] Ibid., p. NIST-56.

[85] Ibid., p. NIST-61.

[86] Ibid., p. NIST-69.

[87] Ibid., p. NIST-3.

[88] Ibid., p. NIST-105.

[89] Ibid., p. NIST-112.

[90] Ibid., pp. NIST-119-NIST-120.

[91] Ibid., pp. NIST-3, NIST-138, NIST-147, NIST-149.

Table 14. National Institute of Standards and Technology Funding

(budget authority, in millions of dollars)

	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Scientific and Technical Research and Services	788.0	915.6			
Laboratory Programs	*687.1*	*806.0*			
Corporate Services	*17.5*	*18.1*			
Standards Coordination and Special Programs	*83.4*	*91.5*			
Industrial Technology Services	166.5	441.6			
Manufacturing Extension Partnership	*150.0*	*275.0*			
Manufacturing USA	*16.5*	*166.6*			
Construction of Research Facilities	80.0	140.0			
Construction & Major Renovations	*6.1*	0.0			
Safety, Capacity, Maintenance and Major Repairs	*73.9*	140.0			
NIST, Total[a]	1,034.5	1,497.2			

Source: U.S. Department of Commerce, National Institute of Standards and Technology, National Institute of Standards and Technology/National Technical Information Service, Fiscal Year 2022 Budget Submission to Congress, 2021, https://www.commerce.gov/sites/default/files/2021-06/fy2022_nist_congressional_budget_justification.pdf.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed.

a. The NIST Public Safety Communications Research Fund (not included in the table) was established to help develop wireless technologies for public safety users, as part of the National Wireless Initiative (WIN) included in the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96). The act provided 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 NIST FY2022 budget justification notes, "The [NIST Public Safety Communications Research Fund's] availability extends through 2022 and began to execute in FY 2015; $92.7 million was transferred to NIST in FY 2015, $7.3 million was released from sequester in FY 2016, an additional $186.4 million was transferred in FY 2016, and $13.6 million was released from sequester in FY 2017. Currently, WIN has $108.7 million in total resources with $71.9 million available for obligation in FY 2021 and $36.8 million to be available in FY 2022. Additional transfers to NIST from NTIA are possible as proceeds from the spectrum auctions become available."

National Oceanic and Atmospheric Administration[92]

The National Oceanic and Atmospheric Administration conducts scientific research in areas such as ecosystems, atmosphere, global climate change, weather, and oceans; collects and provides data on the oceans and atmosphere; and manages coastal and marine species and environments. NOAA was created in 1970 by Reorganization Plan No. 4.[93]

NOAA's administrative structure is organized into six line offices: the National Environmental Satellite, Data, and Information Service (NESDIS); National Marine Fisheries Service (NMFS); National Ocean Service (NOS); National Weather Service (NWS); Office of Oceanic and

[92] This section was written by Eva Lipiec, Analyst in Natural Resources Policy, CRS Resources, Science, and Industry Division.

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

Atmospheric Research (OAR); and the Office of Marine and Aviation Operations (OMAO). The line offices are supported by an additional office, Mission Support, which provides cross-cutting administrative functions related to education, planning, information technology, human resources, and infrastructure. Congress provides most of the discretionary funding for the line offices and Mission Support through two accounts: (1) Operations, Research, and Facilities, and (2) Procurement, Acquisition, and Construction.

In 2010, NOAA published its *Next Generation Strategic Plan*.[94] The strategic plan is organized into four categories of long-term goals: (1) climate adaptation and mitigation, (2) a weather-ready nation, (3) healthy oceans, and (4) resilient coastal communities and economies.[95] The strategic plan also lists three groups of enterprise objectives related to (1) stakeholder engagement, (2) data and observations, and (3) integrated environmental modeling.[96] The strategic plan serves as a guide for NOAA's R&D plan. The most recent R&D plan was published in June 2020, and identifies R&D priorities within three vision areas: (1) reducing societal impacts from hazardous weather and other environmental phenomena, (2) sustainable use and stewardship of ocean and coastal resources, and (3) a robust and effective research, development, and transition enterprise.[97]

For FY2022, President Biden requested $1.512 billion in direct obligations for NOAA R&D funding, $486.9 million (47.5%) above the FY2021 enacted level of $1.025 billion.[98] According to Congress, direct obligations include annual appropriations, transfers, and recoveries from prior-year obligations.[99] The President's budget request and NOAA's estimate of R&D funding amounts in the FY2021 appropriations act (P.L. 116-260) include discretionary direct obligations and a relatively small amount of mandatory and other direct obligations.[100] **Table 15** provides R&D amounts enacted in FY2021 and requested by the Administration for FY2022.

The President's FY2022 request for NOAA R&D was 20.8% of the requested FY2022 NOAA total direct obligations of $7.258 billion.[101] The FY2022 request includes $832.7 million for research (55.1% of the total requested for NOAA R&D), $198.1 million for development (13.1%), and $481.0 million (31.8%) for R&D equipment and facilities.[102]

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[94] National Oceanic and Atmospheric Administration (NOAA), *NOAA's Next-Generation Strategic Plan*, Silver Spring, MD, December 2010, at https://www.performance.noaa.gov/wp-content/uploads/NOAA_NGSP.pdf. Hereinafter NOAA, *Strategic Plan*, 2010.

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

[96] NOAA defines the enterprise objectives as "cross-cutting requirements for addressing NOAA's strategic goals as a whole" (NOAA, *Strategic Plan*, 2010, p. 32).

[97] NOAA, *NOAA Research and Development Vision Areas: 2020-2026*, June 2020, at https://nrc.noaa.gov/LinkClick.aspx?fileticket=z4iHSl3P4KY%3d&portalid=0.

[98] Email correspondence with the NOAA Budget Office, June 9, 2021 and June 22, 2021.

[99] For further descriptions of what types of obligations are direct versus reimbursable, see Office of Management and Budget, *Circular No. A-11, Preparation, Submission, and Execution of the Budget*, July 2020, p. 3 of Section 83, at https://www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf.

[100] R&D funding amounts are estimated by NOAA because neither the legislative text nor the explanatory statement provide a breakout of R&D funding and only include discretionary direct obligations. Telephone conversation with NOAA Budget Office, September 3, 2020.

[101] NOAA, *Budget Estimates Fiscal Year 2022*, 2021, at https://www.noaa.gov/sites/default/files/2021-06/NOAA%20FY22%20CJ.pdf, p. Control Table-15. Hereinafter referred to as NOAA, *Budget Estimates Fiscal Year 2022*.

[102] Email correspondence with the NOAA Budget Office, June 9, 2021.

OAR accounts for the majority of NOAA R&D in most years, including FY2022. The Administration requested $756.7 million for OAR R&D in FY2022, which is $184.1 million (32.2%) above the FY2021 enacted funding level of $572.6 million.[103] OAR conducts research in three major areas: (1) weather and air chemistry; (2) climate; and (3) oceans, coasts, and the Great Lakes. A significant portion of these efforts is implemented through OAR's laboratories and cooperative research institutes. The President requested $231.7 million for OAR labs and cooperative institutes in FY2022, $34.2 million (17.3%) more than the FY2021 enacted amount of $197.5 million.[104]

Another OAR program, the National Sea Grant College Program, is composed of 33 university-based state programs and supports scientific research and stakeholder engagement to identify and solve problems faced by coastal communities. The Administration's FY2022 request would provide $115.7 million to the National Sea Grant College Program, an increase of $40.7 million (54.3%) from the FY2021 enacted amount, and $13.1 million to its related Aquaculture Research program, an increase of $0.1 million (1.0%) from FY2021.[105]

Table 15. National Oceanic and Atmospheric Administration R&D

(direct obligations, in millions of dollars)

	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
National Environmental Satellite, Data, and Information Service (NESDIS)	28.9	50.2			
National Marine Fisheries Service (NMFS)	75.8	75.4			
National Ocean Service (NOS)	102.9	138.5			
National Weather Service (NWS)	24.2	36.8			
Office of Marine and Aviation Operations (OMAO)[a]	205.6	416.3			
Office of Oceanic and Atmospheric Research (OAR)	572.6	756.7			
Mission Support	15.0	38.0			
Total R&D	**1,024.9**	**1,511.8**			
NOAA Total Direct Obligations, Total R&D and Non-R&D	5,649.5	7,258.0			

Sources: Line office amounts provided by the NOAA Budget Office via email correspondence on June 9, 2021, and June 22, 2021. CRS calculated NOAA, Total R&D and non-R&D using amounts in P.L. 116-260 and NOAA, *Budget Estimates Fiscal Year 2022*, 2021, at https://www.noaa.gov/sites/default/files/2021-06/NOAA%20FY22%20CJ.pdf, p. Control Table-15.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed. Direct obligations include annual appropriations, transfers, and recoveries from prior-year obligations. Congress and NOAA use several different budgetary terms, such as direct obligations, budget authority, and appropriations. For more information, see CRS In Focus IF11518,

[103] Email correspondence with the NOAA Budget Office, June 9, 2021, and June 22, 2021.

[104] NOAA, *Budget Estimates Fiscal Year 2022,* and U.S. Congress, House Committee on Appropriations, *Committee Print on H.R. 133/P.L. 116-260, Legislative Text and Explanatory Statement, Book 1 of 2, Divisions A-F*, committee print, 117th Cong., 1st sess., March 2021, p. 222. Hereinafter *Committee Print on H.R. 133*.

[105] *Committee Print on H.R. 133*, p. 222, and NOAA, *Budget Estimates Fiscal Year 2022*.

National Oceanic and Atmospheric Administration (NOAA) FY2021 Budget Request and Appropriations, by Eva Lipiec. NOAA's estimate of R&D funding in the FY2022 President's budget request and the FY2021 enacted amount include discretionary direct obligations and a relatively small amount of mandatory and other direct obligations.

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

Department of Veterans Affairs[106]

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.[107]

The President is requesting $1.631 billion for VA R&D in FY2022, an increase of $159 million (11%) from FY2021 enacted levels. (See **Table 16**.) According to the President's request, FY2022 strategic priorities for VA R&D include increasing the access of veterans to clinical trials; increasing the transfer and translation of VA R&D; and the effective use of VA data for veterans. Additionally, crosscutting priorities for VA R&D include efforts to treat veterans at risk of suicide and research to address chronic pain and opioid addiction, posttraumatic stress disorder, traumatic brain injury, precision oncology, and Gulf War illness and military exposures.[108]

VA R&D is funded through two accounts—the Medical and Prosthetic Research account and the Medical Care Support account. The Medical Care Support account also includes non-R&D funding, and the amount of funding that will be allocated to support R&D through appropriations legislation is unclear unless Congress provides funding at the precise level of the request. In general, R&D funding levels from the Medical Care Support account are known only after the VA allocates its appropriations to specific activities and reports those figures.

The FY2022 request includes $882 million for VA's Medical and Prosthetic Research account, an increase of $87 million (11%) compared to FY2021 enacted levels. The request includes $750 million in funding for research supported by the agency's Medical Care Support account, an increase of $81 million (12%) compared to FY2021. The Medical Care Support account provides administrative and other support for VA researchers and R&D projects, including infrastructure maintenance.

The Medical and Prosthetics R&D program is an intramural program managed by the Veterans 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 includes "improv[ing] Veterans' health and well-being via basic, translational, clinical, health services, and rehabilitative research and apply[ing] scientific knowledge to develop effective individualized care solutions for Veterans."[109] ORD consists of four main research services, each headed by a director:

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

[107] Department of Veterans Affairs, *FY2018-2024 Strategic Plan*, May, 31, 2019, p. 5, https://www.va.gov/oei/docs/VA2018-2024strategicPlan.pdf.

[108] Department of Veterans Affairs, *Volume II: Medical Programs and Information Technology Programs, Congressional Submission, FY2022*, p. VHA-542.

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

- Biomedical Laboratory R&D conducts preclinical research to understand life processes at the molecular, genomic, and physiological levels.
- Clinical Science R&D supports clinical trials and other human subjects research to determine the feasibility and effectiveness of new treatments such as drugs, therapies, or devices; compare existing therapies; and improve clinical care and practice.
- 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 conducts research and develops novel approaches to improving the quality of life of impaired and disabled veterans.

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 FY2022 budget request, these additional R&D resources are estimated at $540 million in FY2022. However, unlike other 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 July 29, 2021, the House passed the Labor, Health and Human Services, Education, Agriculture, Rural Development, Energy and Water Development, Financial Services and General Government, Interior, Environment, Military Construction, Veterans Affairs, Transportation, and Housing and Urban Development Appropriations Act, 2022 (H.R. 4502). Division F would provide $902 million for the Medical and Prosthetic Research account. This would represent an increase of $107 million (13%) above the FY2021 enacted level and $20 million (2%) above the request.

Table 16 summarizes R&D program funding for VA in the Medical and Prosthetic Research and the Medical Care Support accounts. **Table 17** details amounts to be spent in Designated Research Areas (DRAs), which VA describes as "areas of importance to our veteran patient population."[110] Funding for research projects that span multiple areas may be included in several DRAs; thus, the amounts in **Table 17** total to more than the appropriation or request for VA R&D.

Table 16. Department of Veterans Affairs R&D

(budget authority, in millions of dollars)

Account	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Medical and Prosthetic Research	795.0[a]	882.0	902.0		
Veterans Medical Care and Health Fund	9.0[b]	n/a	[c]		
Medical Care Support	668.9	749.7	[c]		
Veterans Affairs, Total R&D	**$1,473.0**	**$1,631.7**	[c]		

Source: Department of Veterans Affairs, *Volume II: Medical Programs and Information Technology Programs, Congressional Submission, FY2022*, p. VHA-541, https://www.va.gov/budget/docs/summary/fy2022VAbudgetVolumeIImedicalProgramsAndInformationTechnology.pdf.

[110] Department of Veterans Affairs, *Volume II: Medical Programs and Information Technology Programs, Congressional Submission, FY2022*, p. VHA-585.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed. n/a = not applicable. 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; these resources are estimated at $540 million in FY2021 and $540 million in FY2022. Additionally, the VA estimates reimbursements associated with agency R&D at $81 million in FY2021 and $61 million in FY2022, increasing the total amount of R&D performed at VA to $2.09 billion in FY2021 and $2.23 billion in the FY2022 request.

a. The Consolidated Appropriations Act, 2021 (P.L. 116-26) included a rescission of $20 million from the Medical and Prosthetic Research account; the enacted amount was $815 million.

b. The American Rescue Plan Act (P.L. 117-2, Section 8002) included $14.482 billion for medical care and health needs; VA plans to use $9 million of the provided funding for research under a new budget account, the Veterans Medical Care and Health Fund.

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

Table 17. Department of Veterans Affairs R&D by Designated Research Area

(in millions of dollars)

Designated Research Area	FY2021 Estimate	FY2022 Request
Acute and Traumatic Injury	26.0	26.0
Aging	147.7	147.7
Autoimmune, Allergic, and Hematopoietic Disorders	38.9	38.9
Cancer	64.3	69.3
Central Nervous System Injury and Associated Disorders	107.1	127.1
Degenerative Diseases of Bones and Joints	41.1	41.1
Dementia and Neuronal Degeneration	41.6	41.6
Diabetes and Major Complications	47.1	47.1
Digestive Diseases	26.1	26.1
Emerging Pathogens/Bio-Terrorism	3.0	3.0
Gulf War Veterans Illness	15.5	15.5
Health Systems	69.9	69.9
Heart Disease/Cardiovascular Health	71.6	71.6
Infectious Disease	47.1	57.1
Kidney Disorders	18.2	18.2
Lung Disorders	27.9	27.9
Mental Illness	121.6	121.6
Military Occupations and Environmental Exposures	23.4	30.4
Other Chronic Diseases	7.6	7.6
Prosthetics	25.5	25.5
Sensory Loss	23.2	23.2
Special Populations	42.8	42.8
Substance Abuse	29.9	29.9

Source: Department of Veterans Affairs, *Volume II: Medical Programs and Information Technology Programs, Congressional Submission, FY2022*, pp. VHA-586-VHA-587, https://www.va.gov/budget/docs/summary/fy2022VAbudgetVolumeIImedicalProgramsAndInformationTechnology.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 FY2021 amount and the FY2022 request for Medical and Prosthetic Research. Columns for "FY2022 House," "FY2022 Senate," and "FY2022 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[111]

The Department of Transportation was established by the Department of Transportation Act (P.L. 89-670) on October 15, 1966. The primary purposes of DOT research and development activities 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. The amount of funding provided by appropriations legislation that 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.

In FY2022, the Administration is requesting a total of $1.203 billion for DOT R&D activities and facilities at the Federal Aviation Administration (FAA), the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), the Federal Railroad Administration (FRA), the Federal Transit Administration (FTA), the Pipeline and Hazardous Materials Safety Administration (PHMSA), the Office of the Secretary (OST), and the Federal Motor Carrier Safety Administration (FMCSA) (see **Table 18**). In FY2021, three DOT agencies—FAA, FHWA, and NHTSA—accounted for nearly 90% of DOT R&D funding.

Federal Aviation Administration

The President's FY2022 request of $547.4 million for R&D activities and facilities at FAA would be an increase of $68.8 million (14.4%) from the FY2021 enacted amount. The request includes $258.5 million for the agency's Research, Engineering, and Development (RE&D) account, an increase of $60.5 million (30.6%) from FY2021. 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, in addition to safety research related to unmanned aircraft systems and the integration of commercial space operations into the national airspace. The RE&D account also supports research to reduce the environmental impacts of aviation (i.e., noise and emissions). Much of the proposed increase to the RE&D account ($50 million) would support a Climate Aviation Program with the goal of enhancing and accelerating research in the areas of sustainable aviation fuels for jet engines; unleaded fuel alternatives for piston-engine aircraft; and alternate aircraft technologies, including electric propulsion.

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

Federal Highway Administration

According to the President's budget request

> FHWA's contributions to researching and implementing transformative innovations and technologies are changing the way roads, bridges, and other facilities are planned, designed, built, managed, and maintained across the country to be more responsive to current and future needs.[112]

The President's request of $420 million for R&D activities and facilities at FHWA would be an increase of $43.8 million (11.6%) from the FY2021 enacted amount. The request includes $125 million for FHWA's Highway Research and Development program, which seeks to improve safety, foster innovation, accelerate projects, enhance the design and construction of transportation infrastructure, provide data and analysis for decisionmaking, and reduce congestion. The request also includes $100 million for the deployment of technology to enhance the safety, efficiency, and convenience of surface transportation under the agency's Intelligent Transportation Systems program.

On July 29, 2021, the House passed the Labor, Health and Human Services, Education, Agriculture, Rural Development, Energy and Water Development, Financial Services and General Government, Interior, Environment, Military Construction, Veterans Affairs, Transportation, and Housing and Urban Development Appropriations Act, 2022 (H.R. 4502). Division G would provide $260.5 million for FAA's R&D account. This would represent an increase of $62.5 million (32%) above the FY2021 enacted level and $2 million (1%) above the request.

National Highway Traffic Safety Administration

The President is requesting $66.0 million in R&D and R&D facilities funding in FY2022 for NHTSA, $16.0 million (32.1%) above the FY2021 enacted amount. NHTSA R&D focuses on automation and the study of human machine interfaces, advanced vehicle safety technology, improving vehicle crashworthiness and crash avoidance, and reducing unsafe driving behaviors.

Other DOT Components

R&D activities are also supported by several other DOT components or agencies (see **Table 18**). The President's FY2022 request includes DOT R&D activities and facilities funding for:

- the Federal Railroad Administration, totaling $58.8 million, $17.8 million (43.5%) above the FY2021 enacted level of $41.0 million;
- the Federal Transit Administration, totaling $30 million, the same amount as FY2021;
- the Pipeline and Hazardous Materials Safety Administration, totaling $24.5 million, $5.5 million (29%) above the FY2021 enacted level of $19.0 million;
- the Office of the Secretary, totaling $47.4 million, $21.6 million (83.5%) above the FY2021enacted level of $25.8 million; and
- the Federal Motor Carrier Safety Administration, totaling $9.1 million, the same amount as FY2021.

[112] Department of Transportation, Federal Highway Administration, *FHWA FY2022 Budget*, p. I-4, https://www.transportation.gov/sites/dot.gov/files/2021-06/fhwa-fy-2022_budget_508.pdf.

Table 18. Department of Transportation R&D Activities and Facilities

(budget authority, in millions of dollars)

	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Federal Aviation Administration	478.6	547.4	[a]		
Research, Engineering, and Development	*198.0*	*258.5*	*260.5*		
Federal Highway Administration	376.2	420.0	[a]		
Highway Research and Development	*111.1*	*125.0*	[a]		
Intelligent Transportation Systems	*89.9*	*100.0*	[a]		
National Highway Traffic Safety Administration	50.0	66.0	[a]		
Federal Railroad Administration	41.0	58.8	53.8		
Federal Transit Administration	30.0	30.0	[a]		
Pipeline and Hazardous Materials Safety Administration	19.0	24.5	[a]		
Office of the Secretary	25.8	47.4	57.0		
Federal Motor Carrier Safety Administration	9.1	9.1	[a]		
DOT, R&D Total	**$1,029.6**	**$1,203.1**	[a]		

Sources: U.S. Department of Transportation, *Fiscal Year 2022 Budget Estimates*, https://www.transportation.gov/mission/budget/fiscal-year-2022-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 currently blank may become available as action is completed.

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

Department of the Interior[113]

The Department of the Interior was created to conserve and manage the nation's natural resources and cultural heritage, to provide scientific and other information about those resources, and to uphold "the nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper." 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.[114] The Administration is requesting $17.4

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

[114] Department of the Interior, *Strategic Plan for Fiscal Years 2018-2022* and *Strategic Plan for Fiscal Years 2014-2018*, available at https://www.doi.gov/performance/strategic-planning.

billion in net discretionary funding for DOI in FY2022.[115] Of that amount, $1.34 billion is proposed for R&D, $315 million (31%) above the FY2021 estimated level of $1.02 billion.[116]

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 29, 2021, the Labor, Health and Human Services, Education, Agriculture, Rural Development, Energy and Water Development, Financial Services and General Government, Interior, Environment, Military Construction, Veterans Affairs, Transportation, and Housing and Urban Development Appropriations Act, 2022 (H.R. 4502) would provide a total of $15.6 billion in discretionary funding for DOI, $250 million (1.6%) below the FY2022 request and $2.29 billion (17.1%) above the FY2021 enacted level.[117] This amount includes both R&D and non-R&D funding.

U.S. Geological Survey

The U.S. Geological Survey 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; Energy and Mineral Resources; Natural Hazards; Water Resources; Core Science Systems; Science Support; and Facilities.

The President's total FY2022 budget request for USGS is $1.6 billion, up $327 million (26%) from the FY2021 enacted level.[118] Of the proposed FY2022 total, $947 million would be for R&D, an increase of $256 million (37%) from the FY2021 estimated level of $691 million.[119]

As passed by the House, H.R. 4502 would provide $1.6 billion for USGS, equal to the FY2022 requested amount. This amount includes both R&D and non-R&D funding.[120]

Other DOI Components

The President's FY2022 request also includes R&D funding for the following DOI components:[121]

- Bureau of Reclamation (BOR): $122 million for FY2022, down $11 million (8.3%) from the FY2021 estimate.

[115] Department of the Interior, *Fiscal Year 2022: The Interior Budget in Brief*, May 2021, p. DH-3.

[116] EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021, p. 178, https://www.whitehouse.gov/wp-content/uploads/2021/05/ap_14_research_fy22.pdf.

[117] U.S. Congress, House Committee on Appropriations, *Department of the Interior, Environment, and Related Agencies Appropriation Bill, 2022*, explanatory report, 117th Cong., 1st sess., H.Rept. 117-83 (Washington, DC: GPO, 2021), p. 283, as incorporated by reference in H.R. 4502.

[118] Department of the Interior, *Fiscal Year 2022: The Interior Budget in Brief*, May 2021, p. BH-59.

[119] Email communications between CRS and OMB, May 26, 2021.

[120] H.Rept. 117-83, p. 266.

[121] Ibid.

- Bureau of Ocean Energy Management (BOEM): $112 million for FY2022, up $30 million (37%) from the FY2021 estimate.
- Fish and Wildlife Service (FWS): $57 million for FY2022, up $24 million (73%) from the FY2021 estimate.
- National Park Service (NPS): $34 million for FY2022, up $6 million (21%) from the FY2021 estimate.
- Bureau of Safety and Environmental Enforcement (BSEE): $32 million for FY2022, up $5 million (19%) from the FY2021 estimate.
- Bureau of Land Management (BLM): $21 million for FY2022, equal to the FY2021 estimate.
- Bureau of Indian Affairs (BIA): $5 million for FY2022, equal to the FY2021 estimate.
- Wildland Fire Management (WFM): $8 million for FY2022, up $5 million (167%) from the FY2021 estimate.[122]
- Office of Surface Mining Reclamation and Enforcement (OSMRE): $1 million for FY2022, equal to the FY2021 estimate.

Table 19 summarizes FY2021 estimated R&D funding and the President's FY2022 R&D funding request for DOI components.

Table 19. Department of the Interior R&D

(budget authority, in millions of dollars)

	FY2021 Estimate	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
U.S. Geological Survey (USGS)	691	947	n/s		
Bureau of Reclamation (BOR)	133	122	n/s		
Bureau of Ocean Energy Management (BOEM)	82	112	n/s		
Fish and Wildlife Service (FWS)	33	57	n/s		
National Park Service (NPS)	28	34	n/s		
Bureau of Safety and Environmental Enforcement (BSEE)	27	32	n/s		
Bureau of Land Management (BLM)	21	21	n/s		
Bureau of Indian Affairs (BIA)	5	5	n/s		
Wildland Fire Management (WFM)	3	8	n/s		
Office of Surface Mining Reclamation and Enforcement (OSMRE)	1	1	n/s		
Department of the Interior, R&D Total	**1,024**	**1,339**	**n/s**		

Source: EOP, OMB, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2022, Research and Development,* May 28, 2021, p. 178; and email communications between CRS and OMB, May 26, 2021.

[122] Ibid.

Notes: Totals may differ from the sum of the components due to rounding. Figures for the columns currently blank may become available as action is completed. n/s = not specified.

Department of Homeland Security[123]

The Department of Homeland Security 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.

The President's FY2022 budget request for DHS includes $618 million for activities identified as R&D. This would be an increase of 8.4% from $570 million in FY2021. The total includes $503 million for the R&D account in the S&T Directorate and smaller amounts for five 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 FY2022 request of $503 million for the S&T Directorate R&D account would be an increase of 13.4% from $444 million in FY2021. Within the R&D account, the Research, Development, and Innovation budget line would increase by $53 million, including increases for Cyber Security/Information Analysis (up $29 million); First Response/Disaster Resilience (up $21 million); and Counter Terrorist (up $13 million); and a decrease for Border Security (down $11 million). In the University Programs budget line, the request for university centers of excellence is $46 million, up from $39 million in FY2021. The requested increase for centers of excellence would support increased funding for continuing centers as well as the planned selection of two new centers.

In addition to its R&D account, the S&T Directorate receives funding for laboratory facilities and other R&D-related expenses through two other accounts (not shown in the table). The total request for the directorate is $823 million, an increase of 7.5% from $766 million in FY2021. The directorate's Procurement, Construction, and Improvements account would receive $9 million under the Administration's request (versus $19 million in FY2021) for closure of the Plum Island Animal Disease Center—which is being replaced by the National Bio and Agro-Defense Facility—and for preparation of Plum Island itself for sale.[124]

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

[124] The S&T Directorate is building NBAF using previously appropriated funds and is to transfer the facility to the USDA once it becomes operational. For more information, see CRS In Focus IF11492, *National Bio and Agro-Defense Facility: Purpose and Status*, by Genevieve K. Croft.

Table 20. Department of Homeland Security R&D Accounts

(budget authority, in millions of dollars)

	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Science and Technology Directorate	444	503			
Countering Weapons of Mass Destruction Office	65	66			
Transportation Security Administration	30	36			
U.S. Coast Guard	10	7			
Cybersecurity and Infrastructure Security Agency	9	4			
U.S. Secret Service	12	2			
Total, DHS R&D	**570**	**618**			

Sources: FY2021 enacted from P.L. 116-260. FY2022 request from DHS congressional budget justification, https://www.dhs.gov/publication/congressional-budget-justification-fy-2022.

Notes: Table includes accounts titled "Research and Development" in each DHS component. Some other accounts may also fund R&D-related activities. Some amounts may not add to totals due to rounding. Figures for the columns currently blank may become available as action is completed.

Environmental Protection Agency[125]

The U.S. Environmental Protection Agency, the federal regulatory agency responsible for administering multiple environmental pollution control laws, funds a broad range of R&D activities intended to provide scientific tools and knowledge that support decisions relating to preventing, regulating, and abating environmental pollution. Since FY2006, Congress has funded EPA's discretionary budget through the Interior, Environment, and Related Agencies annual appropriations acts.

Appropriations for EPA R&D are generally included in programs and activities that also include non-R&D functions. Annual appropriations bills and the accompanying committee reports do not identify precisely how much funding is allocated to EPA R&D alone. EPA determines R&D funding levels for its operations through allocating the agency's appropriations for authorized activities and reporting those amounts.

The agency's Science and Technology (S&T) appropriations account[126] 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,

[125] This section was written by Jerry H. Yen, Analyst in Environmental Policy, CRS Resources, Science, and Industry Division. For an overview of FY2021 appropriations, President's FY2021 budget request, and FY2020 enacted appropriations for EPA, see CRS In Focus IF11563, *U.S. Environmental Protection Agency FY2021 Appropriations*, by Robert Esworthy and David M. Bearden.

[126] In 1995, Congress established eight statutory accounts for EPA, including the S&T account. The S&T account incorporates elements of the former EPA Research and Development account, as well as portions of the former Salaries and Expenses and Program Operations accounts, which were in place until FY1996. Currently, including 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, a comparable breakout of funding for these same activities before FY1996 is not readily available.

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 for remediating contaminated sites.[127]

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 EPA-supported R&D external to the agency. 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 particular program.

As passed by the House on July 29, 2021, Division E of H.R. 4502 includes the Department of the Interior, Environment, and Related Agencies appropriations bill for FY2022. Division E of H.R. 4502 incorporates H.R. 4372 (H.Rept. 117-83), which was reported by the House Committee on Appropriations on July 6, 2021. The House-passed bill would provide $842.2 million for EPA's S&T account, which includes a $33.0 million transfer from the Superfund account. The House-passed funding level for EPA's S&T account is a proposed increase of $82.1 million (10.8%) over the enacted FY2021 appropriation of $760.1 million, which includes a $30.8 million transfer from the Superfund account.[128] Also, the House-passed funding level for EPA's S&T account is $18.7 million (2.2%) less than the President's request of $861.0 million, which includes a proposed $31.0 million transfer from the Superfund account.[129] Proposed increases in funding for the "Clean Air" and "Research: Air and Energy" program areas combined make up 80.8% of the President's requested increase in funding to EPA's S&T account compared with FY2021 enacted appropriations.

Table 21 presents a comparison of the FY2021 enacted appropriations, the President's FY2022 request, and the FY2022 appropriations proposed in House-passed H.R. 4502 for program areas and activities funded within EPA's S&T account. The program areas and activities listed in **Table 21** are only those identified in funding tables presented in explanatory statements accompanying annual appropriations bills that fund EPA. The explanatory statements include additional breakouts of funding and directive language for certain activities within these broader program areas. EPA's annual budget justification also identifies specific amounts of funding for various subprogram activities not listed in these explanatory statements.

Table 21. U.S. Environmental Protection Agency Science and Technology Account

(appropriations, in millions of dollars)

S&T Program Areas and Activities	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Clean Air[a]	118.6	139.2	139.2		
Atmospheric Protection Program[b]	*7.9*	*10.0*	*10.0*		
Enforcement	14.0	14.1	14.1		
Homeland Security	35.7	40.4	40.4		

[127] See footnote 29 for more information on Superfund.

[128] For FY2021 enacted appropriations for program areas and activities funded within the EPA S&T account, see *Congressional Record*, vol. 166, no. 218—Book IV (December 21, 2020), pp. H8592-H8593 (funding tables).

[129] EPA, *Fiscal Year 2022 Justification of Appropriation Estimates for the Committee on Appropriations*, EPA-190-R-21-002, May 2021, https://www.epa.gov/planandbudget/fy-2022-justification-appropriation-estimates-committee-appropriations, pp. 3, 7-9, and 459 (pp. 22, 27-29, and 483 of the PDF).

S&T Program Areas and Activities	FY2021 Enacted	FY2022 Request	FY2022 House	FY2022 Senate	FY2022 Enacted
Indoor Air and Radiation	5.1	6.7	6.7		
Information Technology/Data Management/Security	3.1	3.1	3.1		
Operations and Administration	67.5	68.5	68.5		
Pesticide Licensing	5.9	6.0	6.0		
Research: Air and Energy[c]	95.3	156.2	125.0		
Research: Chemical Safety and Sustainability	127.0	135.2	135.2		
Research: Computational Toxicology	*21.4*	*22.2*	*22.2*		
Research: Endocrine Disruptor	*16.3*	*16.9*	*16.9*		
Research: National Priorities[d]	7.5	0.0	8.5		
Research: Safe and Sustainable Water Resources	112.3	116.6	116.6		
Research: Sustainable and Healthy Communities	133.0	137.4	137.4		
Water: Human Health Protection	4.4	6.4	6.4		
Subtotal Base S&T Account	**729.3**	**830.0**	**809.3**		
Transfer from Hazardous Substance Superfund Account to the S&T Account	**30.8**	**31.0**	**33.0**		
Total, S&T Account (Net Appropriations)	**760.1**	**861.0**	**842.2**		

Source: Prepared by CRS. Amounts in the table are generally as presented in P.L. 116-260; the explanatory statement accompanying H.R. 133 (P.L. 116-260) as printed in the *Congressional Record,* vol. 166, no. 218—Book IV (December 21, 2020), pp. H8592-H8593 (funding tables); EPA, *Fiscal Year 2022 Justification of Appropriation Estimates for the Committee on Appropriations,* EPA-190-R-21-002, May 2021, https://www.epa.gov/planandbudget/fy-2022-justification-appropriation-estimates-committee-appropriations, pp. 3, 7-9, and 459 (pp. 22, 27- 29, and 483 of the PDF); H.R. 4502, Division E, Title II; and U.S. Congress, House Committee on Appropriations, *Department of the Interior, Environment, and Related Agencies Appropriations Bill, 2022*, report together with minority views to accompany H.R. 4372, 117th Cong., 1st sess., H.Rept. 117-83, (Washington, DC: GPO, 2021), pp. 79-85, and 283-284.

Notes: Totals may differ from the sum of the components due to rounding. Figures for columns currently blank may become available as action is completed.

a. EPA's FY2022 budget justification refers to this program area as "Clean Air and Climate." Recent EPA budget justifications have referred to this program area in a way that is consistent with funding tables prepared by the House and Senate Committees on Appropriations.

b. EPA's FY2022 budget justification refers to this program area as "Climate Protection." Recent EPA budget justifications have referred to this program area in a way that is consistent with funding tables prepared by the House and Senate Committees on Appropriations.

c. EPA's FY2022 budget justification refers to this program area as "Research: Air, Climate, and Energy." Recent EPA budget justifications have referred to this program area in a way that is consistent with funding tables prepared by the House and Senate Committees on Appropriations.

d. EPA's FY2022 budget justification refers to this program area as "Research: Congressional Priorities." For FY2021, Congress appropriated funding for "National Priorities" to support grants for the same purpose as in FY2020: "high-priority water quality and [water] availability research" as specified in S.Rept. 116-123.

Appendix A. Acronyms and Abbreviations

Acronym/ Abbreviation	Organization/Term
ACF	Administration for Children and Families
AFRI	Agriculture and Food Research Initiative
AGARDA	Agriculture Advanced Research and Development Authority
AHRQ	Agency for Healthcare Research and Quality
AI	Artificial Intelligence
AIMS	Arctic Infrastructure Modernization for Science
AOAM	Agency Operations and Award Management
ARPA-C	Advanced Research Projects Agency-Climate
ARPA-E	Advanced Research Projects Agency-Energy
ARPA-H	Advanced Research Projects Agency-Health
ARS	Agricultural Research Service
B&F	Buildings and Facilities
BA	Budget Authority
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BOR	Bureau of Reclamation
BSEE	Bureau of Safety and Environmental Enforcement
CA	Convergence Accelerator
CDC	Centers for Disease Control and Prevention
CJS	Commerce, Justice, Science, and Related Agencies
CLARREO	Climate Absolute Radiance and Refractivity Observatory
CMS	Centers for Medicare and Medicaid Services
CR	Continuing Resolution
CRF	Construction of Research Facilities
DARPA	Defense Advanced Research Projects Agency
DHP	Defense Health Program
DHS	Department of Homeland Security
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
EFNEP	Expanded Food and Nutrition Education Program

Acronym/ Abbreviation	Organization/Term
EHR	Education and Human Resources
EOP	Executive Office of the President
EPA	Environmental Protection Agency
EPSCoR	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
FW-HTF	Future of Work at the Human Technology Frontier
FWS	Fish and Wildlife Service
FY	Fiscal Year
GCR	Growing Convergence Research
GCRA	Global Change Research Act of 1990 (P.L. 101-606)
GDP	Gross Domestic Product
GRFP	Graduate Research Fellowship Program
GWOT	Global War on Terror
HBCU	Historically Black Colleges and Universities
HDR	Harnessing the Data Revolution (for 21st-Century Science and Engineering)
HHS	Department of Health and Human Services
HLS	Human Landing System
HRSA	Health Resources and Services Administration
ICs	Institutes and Centers
INCLUDES	Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science
ISS	International Space Station
IT	Information technology
ITER	International Thermonuclear Experimental Reactor
ITS	Industrial Technology Services
LEO	Low Earth Orbit
LGUs	Land-Grant Colleges and Universities
LHHS	Labor, HHS, and Education
LSST	Large Synoptic Survey Telescope
MEP	Manufacturing Extension Partnership

Acronym/ Abbreviation	Organization/Term
MREFC	Major Research Equipment and Facilities Construction
MSI	Minority Serving Institutions
NAL	National Agricultural Library
NASA	National Aeronautics and Space Administration
NASS	National Agricultural Statistics Service
NBAF	National Bio and Agro-Defense Facility
NCATS	National Center for Advancing Translational Sciences
NCI	National Cancer Institute
NCO	National Coordinating Office (NITRD)
NEF	Nonrecurring Expenses Fund
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
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
NIST	National Institute of Standards and Technology
NITRD	Networking and Information Technology Research and Development

Acronym/ Abbreviation	Organization/Term
NLM	National Library of Medicine
NMFS	National Marine Fisheries Service
NNA	Navigating the New Arctic
NNI	National Nanotechnology Initiative
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPS	National Park Service
NRT	National Research Traineeship
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
OCS	Office of the Chief Scientist (USDA)
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
PACE	Pre-Aerosol, Clouds, and Ocean Ecosystem
PE	Program Element
PHMSA	Pipeline and Hazardous Materials Safety Administration
PHSA	Public Health Service Act
PIADC	Plum Island Animal Disease Center
PRIF	Pediatric Research Initiative Fund
QIS	Quantum Information Science
R&D	Research and Development
RDT&E	Research, Development, Test, and Evaluation
RE&D	Research, Engineering, and Development
REE	Research, Education, and Economics
RRA	Research and Related Activities

Acronym/ Abbreviation	Organization/Term
SARE	Sustainable Agriculture Research and Education
S&T	Science and Technology
SIR	Surveys, Investigations, and Research
SLS	Space Launch System
SOFIA	Stratospheric Observatory for Infrared Astronomy
STEM	Science, Technology, Engineering, and Mathematics
STRS	Scientific and Technical Research and Services
TIP	Technology, Innovation, and Partnerships (NSF Directorate)
TOA	Total Obligational Authority
URoL	Understanding the Rules of Life
USDA	Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VA	Department of Veterans Affairs
WFIRST	Wide Field Infrared Space Telescope
WFM	Wildland Fire Management
WoU	Windows on the Universe

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	Genevieve K. Croft Analyst in Agricultural Policy
Department of Commerce	
National Institute of Standards and Technology	John F. Sargent Jr. Specialist in Science and Technology Policy
National Oceanic and Atmospheric Administration	Eva Lipiec Analyst in Natural Resources Policy
Department of Defense	John F. Sargent Jr. 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	Kavya Sekar 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
Environmental Protection Agency	Jerry Yen Analyst in Environmental Policy
National Aeronautics and Space Administration	Daniel Morgan Specialist in Science and Technology Policy
National Science Foundation	Laurie A. Harris Analyst in Science and Technology Policy

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