

AAAS Guide to the President's Budget: Research & Development FY 2021

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The Trump Administration has again proposed broad reductions in federal research and development spending while prioritizing a few areas for notable increases. This report surveys science and technology agencies and programs in the White House's FY 2021 budget request to Congress, which was issued on February 10, 2020.

Note: *The President's budget is a proposal, not a final document. Final decisions on annual spending are ultimately up to appropriators in Congress, who wield the "power of the purse." Congress may accept or reject as much of the President's budget request as legislators see fit. Thus, the budget request is best seen as the start of negotiations between branches of government.*

Visit www.aaas.org/rd for additional information and subsequent updates.

Overview and Context

A major element of the spending debate in 2019 over the 2020 fiscal year (FY) was whether the discretionary spending caps – adopted in 2011 – would be allowed to drop as required by existing law and force deep and wide spending cuts, or whether Congress would once again step in to resolve the issue, prevent the spending drop, and protect agencies and programs reliant on discretionary spending.

Congress did ultimately step in with the Bipartisan Budget Act of 2019, a deal to raise the caps for two years. This included a more than \$40 billion year-over-year increase in FY 2020, though a far smaller increase in FY 2021.

When Congress achieved this deal, it seemed to settle the debate in FY 2021, the final year of caps under the original Budget Control Act of 2011. But the White House did not see it this way: instead of adhering to the previous deal, the White House again recommended spending changes to increase the defense budget at the expense of the nondefense budget. For FY 2021, this meant the defense cap would have remained in place, allowing for a \$5 billion or 0.8 percent increase in capped defense spending, while the nondefense cap declined by \$36.5 billion below current law, and by \$31.5 billion or 5.1 percent below FY 2020

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Spending Caps in the FY 2021 Budget Request

Billions of nominal dollars

	FY 2019 Actual	FY 2020 Actual	FY 2021 Current	Change from FY20	
				Amount	Percent
Nondefense	\$597	\$622	\$627	\$5	0.8%
White House-proposed change			-\$37		
White House-proposed FY21 cap			\$590	-\$32	-5.1%
Defense	\$647	\$667	\$672	\$5	0.8%

Excludes OCO, \$2.5 billion in FY 2020 for Census, and other emergency spending not subject to caps.

levels (see table and graphs, this page and following page).

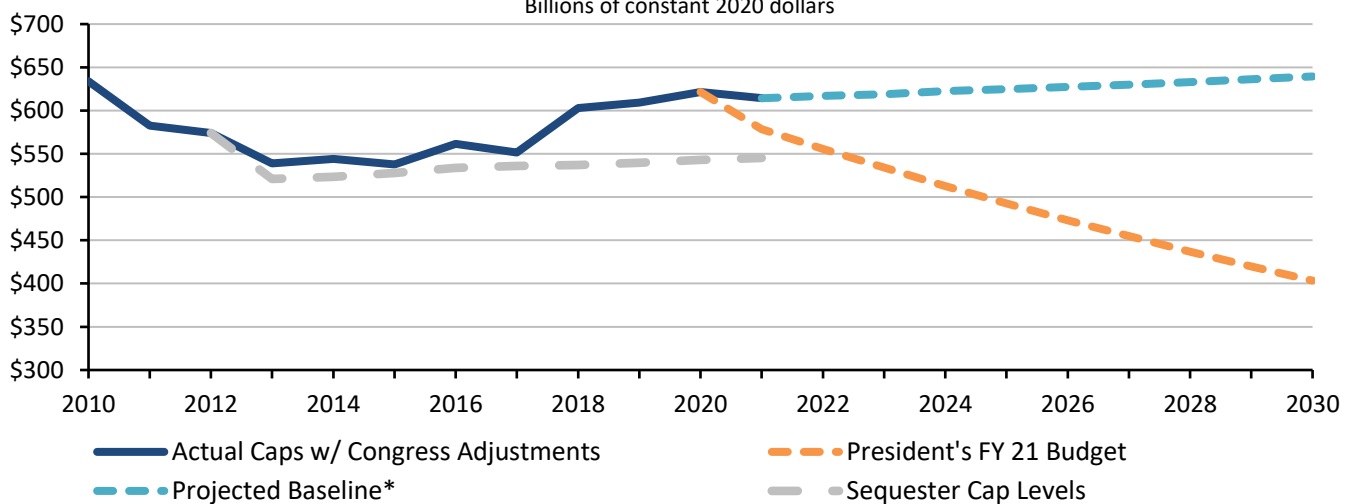
The White House would continue reducing nondefense spending by nearly \$11 billion per year until the end of the decade, leading to a cumulative nondefense reduction of \$1.6 trillion compared to the Office of Management and Budget's current-services baseline.¹ By FY 2030, nondefense discretionary spending would end up approximately 35 percent below current levels, adjusting for purchasing power.

These changes set the backdrop for another round of proposed reductions to federal research and development programs, which are

outlined in the following pages. But within 24 hours, these broad recommendations were discarded by Congressional leadership, with several senior Democratic officials as well as Senate Majority Leader Mitch McConnell (R-KY) indicating that appropriations would stick with the prior cap deal. These and other comments from key legislators are clear indication that, once again, the topline numbers presented by the Trump Administration would factor much less into appropriators' thinking than the actual substance of research agencies' budget requests, including program changes and new initiatives.

Limits on Nondefense Discretionary Spending, Current and Proposed

Billions of constant 2020 dollars



*OMB current services projections. Based on OMB budget documents and past budget resolutions and other legislation. © AAAS 2020

¹ See OMB's Summary Table S-7, Page 121, for details:

https://www.whitehouse.gov/wp-content/uploads/2020/02/budget_fy21.pdf

However, even without more stringent nondefense limits, current-law levels will still present a challenge for appropriators. With a less than one percent year-over-year increase (see table above), and an array of demands on the federal budget, it will likely be difficult to increase funding for priority investments while safeguarding spending for other programs, many of which may be popular with certain legislators or voting blocs. Appropriators will likely be faced with tough choices as they search for acceptable balance, and these tough choices will certainly extend to R&D programs as well.

Research and Development Priorities

The big picture for R&D spending in the FY 2021 budget request is depicted in the above table. These figures are based on White House Office of Management and Budget (OMB) data updated with additional data from agency budgets and budget offices, but do not yet include FY 2020 or FY 2021 R&D spending

FY 2021 Budget Request for R&D by Type

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Basic Research	39,394	43,405	40,623	-2,781.9	-6.4%
Applied Research	45,673	46,872	40,469	-6,403.2	-13.7%
Development	60,551	67,773	65,968	-1,805.5	-2.7%
R&D Facilities	4,358	6,004	3,817	-2,186.9	-36.4%
Total R&D	141,196	157,066	143,902	-13,164.3	-8.4%
Defense R&D 1/	63,211	73,502	69,496	-4,006.5	-5.5%
Nondefense R&D	77,985	83,564	74,406	-9,157.7	-11.0%

Source: OMB R&D data. Does not include emergency FY 2020 or amended FY 2021 spending.

Note: The projected inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

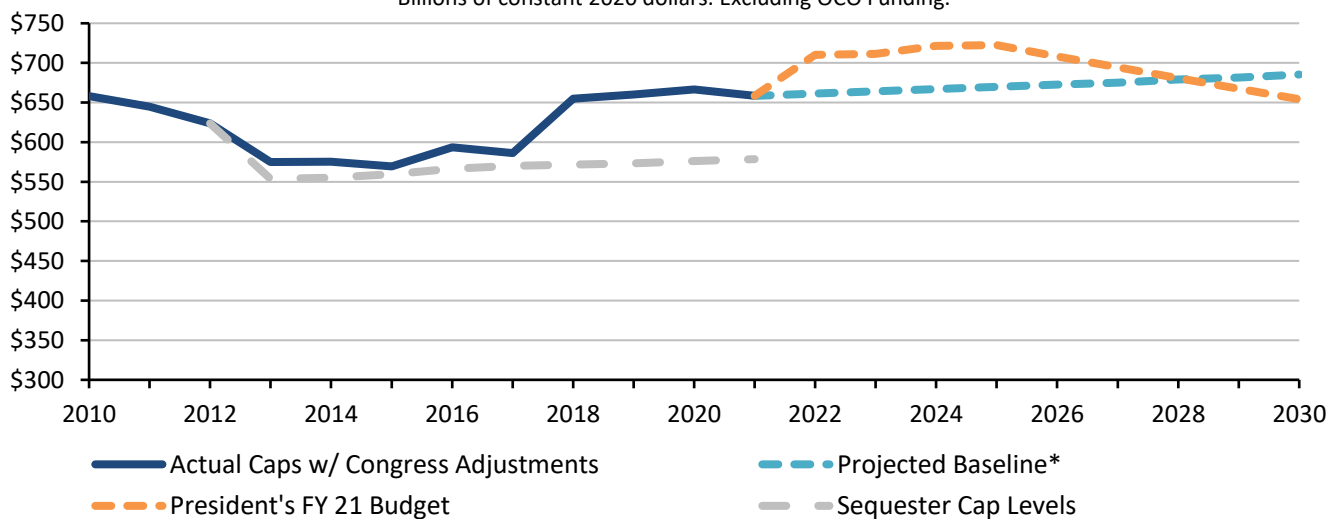
1/ Includes Defense Dept. and NNSA.

related to COVID-19. Visit www.aaas.org/rd for subsequent updates and revisions.

At the agency level, the FY 2021 budget request bears striking similarity with prior Trump Administration budgets: a willingness to reduce even basic science spending, unusual for most presidential administrations; targeted support for NASA and the Defense Advanced Research Projects Agency (DARPA); and particularly sharp reductions for energy technology and environmental research (see graph on following page).

Limits on Defense Discretionary Spending, Current and Proposed

Billions of constant 2020 dollars. Excluding OCO Funding.



*OMB current services projections. Based on OMB budget documents and past budget resolutions and other legislation. © AAAS 2020

Despite these broad reductions, some areas would see noteworthy boosts. These include:

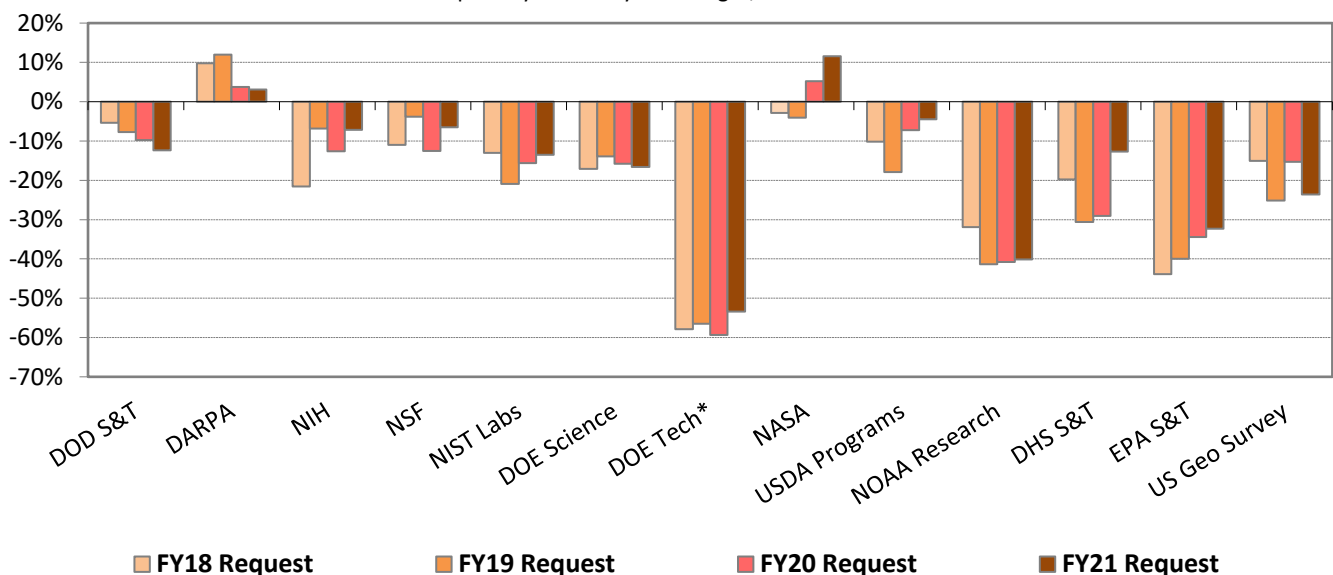
Artificial Intelligence (AI). The budget request pledges a doubling of AI R&D by FY 2022, including a more than \$600 million increase in FY 2021.² This includes a more than 70 percent increase above FY 2020 request levels (data on actual spending is not yet available) for the National Science Foundation (NSF) to \$868 million, which will contribute to the establishment of several public-private multidisciplinary AI research institutes. The Department of Energy (DOE) Office of Science would receive a \$54 million increase to \$125 million; the Agriculture and Food Research Initiative, a competitive grants program, would receive \$100 million for AI-related activities; and the National Institutes of Health (NIH) and DARPA would both receive \$50 million increases.

Quantum Information Science (QIS). The FY 2021 request similarly requests a two-year doubling path for quantum, with NSF receiving a \$120 million boost to \$230 million – more than double the current year. The DOE Office of Science would receive an additional \$70 million to \$237 million total for its quantum initiative.

Space Exploration. The White House would continue its efforts to achieve robust funding for its lunar exploration activities in preparation for a manned Mars mission, collectively dubbed the Artemis program. The FY 2021 budget requests \$12.4 billion for these activities, a \$3.5 billion increase above FY 2020, primarily for exploration systems and technology. The bulk of this increase is for development of a human lunar lander, though support for other big-ticket items like the Orion crew capsule and the Gateway orbital platform would also continue. The program will also pursue technological challenges related to power, in situ resource

Science & Tech Agencies in the Trump Administration's Budgets

Proposed year-over-year changes, nominal dollars



*Includes renewables, efficiency, nuclear, fossil, grid research, cybersecurity, ARPA-E. Based on White House and agency budget documents. | AAAS

² For background see the White House AI Initiative annual report from February 2020: [https://www.whitehouse.gov/wp-](https://www.whitehouse.gov/wp-content/uploads/2020/02/American-AI-Initiative-One-Year-Annual-Report.pdf)

[content/uploads/2020/02/American-AI-Initiative-One-Year-Annual-Report.pdf](https://www.whitehouse.gov/wp-content/uploads/2020/02/American-AI-Initiative-One-Year-Annual-Report.pdf)

utilization, lunar science, and robotic Mars missions.

Other Areas. Some support is also requested for other areas mentioned in the administration's R&D budget priorities memo from August 2019.³ On the advanced manufacturing front, both the National Institute of Standards and Technology (NIST) and the Department of Defense (DOD) would receive funding for new public-private manufacturing innovation institutes under the Manufacturing USA umbrella. Cybersecurity and critical grid infrastructure programs within DOD and DOE would also continue to receive robust funding, and the National Oceanic and Atmospheric Administration (NOAA) Space Weather Follow On satellite mission would also receive a \$44 million increase. In support of veterans' health, Veterans Affairs (VA) medical and prosthetic research would receive a 4.9 percent or \$37 million increase.

Novel coronavirus response also became a late-breaking priority in March 2020, with additional requested FY 2021 funding for NIH's National Institute of Allergy and Infectious Disease (NIAID) and the Centers for Disease Control and Prevention (CDC).⁴ In both cases, the additional requested funding would offset what had originally been sizable budget cuts under the initial White House request. The White House and Congress have also moved rapidly on emergency spending in the current 2020 fiscal year for several agencies; most of that data is also shown in the agency tables in this guide, though updated R&D estimates for FY 2020 are not yet available.

However, several other White House-identified "priorities" that appeared in last year's memo

appear to not have gotten the same treatment. For instance, oceans R&D and energy R&D were both cited as priorities, and yet related programs within NOAA and DOE face reductions as steep as those proposed in past budgets (and rejected by Congress). DOE's earth modeling program and certain NASA earth observation missions similarly face steep reductions or eliminations even though last year's memo cited earth system predictability as a priority investment area. Federal STEM education programs once again face wide and diverse reductions. And while the Trump Administration would establish new advanced manufacturing institutes, other manufacturing-related activities within DOE and DOD would see reductions as well.

See the following pages for tables showing total R&D by agency; basic research by agency; R&D by budget function; and general composition of the FY 2021 request by category of outlays.

³ <https://www.whitehouse.gov/wp-content/uploads/2019/08/FY-21-RD-Budget-Priorities.pdf>

⁴ <https://www.whitehouse.gov/wp-content/uploads/2020/03/Letter-regarding-additional-funding-to-support-the-United-States-response-to-COVID-19-3.17.2020.pdf>

Total R&D in the White House Request by Agency

(estimated budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense*	55,905	65,750	60,869	-4,881	-7.4%
S&T (6.1-6.3)	15,317	16,062	14,070	-1,991	-12.4%
All Other DOD	40,588	49,688	46,798	-2,890	-5.8%
Health and Human Services	38,459	40,750	37,825	-2,926	-7.2%
National Institutes of Health	37,094	39,485	36,915	-2,571	-6.5%
All Other HHS	1,365	1,265	910	-355	-28.1%
Energy	18,223	19,217	16,793	-2,424	-12.6%
Atomic Energy Defense	7,306	7,752	8,627	875	11.3%
Office of Science	6,517	6,923	5,760	-1,163	-16.8%
Energy Programs	4,400	4,542	2,406	-2,136	-47.0%
NASA	10,698	14,057	13,334	-723	-5.1%
National Science Foundation	6,648	6,752	6,327	-425	-6.3%
Agriculture	3,025	2,940	2,769	-171	-5.8%
Commerce	1,957	1,940	1,498	-442	-22.8%
NOAA	1,064	972	670	-302	-31.0%
NIST	763	805	652	-153	-19.0%
Transportation	1,033	1,097	590	-506	-46.2%
Homeland Security	600	534	462	-72	-13.5%
Veterans Affairs	1,370	1,313	1,351	38	2.9%
Interior	958	974	726	-248	-25.5%
US Geological Survey	640	661	461	-200	-30.3%
Environ Protection Agency	489	492	318	-174	-35.4%
Others	1,830	1,250	1,041	-209	-16.7%
Total R&D	141,196	157,066	143,902	-13,164	-8.4%
Defense R&D**	63,224	73,517	69,502	-4,015	-5.5%
Nondefense R&D	77,972	83,549	74,400	-9,150	-11.0%
By Type					
Basic Research	39,394	43,405	40,623	-2,782	-6.4%
Applied Research	45,673	46,872	40,469	-6,403	-13.7%
Development	60,551	67,773	65,968	-1,805	-2.7%
Facilities & Equipment	4,358	6,004	3,817	-2,187	-36.4%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

*Defense Dept. R&D is converted from total obligational authority.

**Includes Dept. of Defense, National Nuclear Security Administration, and DHS Cybersecurity and Infrastructure Security Agency.

Major Functional Categories of R&D

(budget authority in millions of dollars, base budget only)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change		% of Total ('21)
				Amount	Percent	
Defense (050)*	63,224	73,517	69,502	-4,015	-5.5%	48.3%
Nondefense	77,972	83,549	74,400	-9,150	-11.0%	51.7%
Space (252)	10,133	13,482	12,704	-778	-5.8%	8.8%
Health (550)	38,998	40,726	37,802	-2,925	-7.2%	26.3%
Energy (270)	4,473	4,619	2,488	-2,131	-46.1%	1.7%
General Science (251)	13,165	13,675	12,087	-1,588	-11.6%	8.4%
Environment (300)	2,850	2,777	1,995	-782	-28.2%	1.4%
Agriculture (350)	2,719	2,631	2,514	-117	-4.5%	1.7%
Transportation (400)	1,621	1,695	1,255	-440	-26.0%	0.9%
Commerce (370)	920	995	854	-141	-14.1%	0.6%
International (150)	235	226	73	-153	-67.7%	0.1%
Justice (750)	613	524	445	-80	-15.2%	0.3%
All Other	2,243	2,198	2,183	-15	-0.7%	1.5%
Total R&D	141,196	157,066	143,902	-13,164	-8.4%	100.0%

Source: OMB R&D data, agency budget justifications, and other agency documents and data. Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Classifications generally follow the government's budget function categories.

Numbers in parentheses are the federal government budget function codes.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

* Includes Dept. of Defense, National Nuclear Security Administration, and DHS Cybersecurity and Infrastructure Security Agency.

Agency Highlights: Department of Defense (DOD)

As discussed in the introduction, the defense spending cap in FY 2021 is limited to only a \$5 billion year-over-year increase. Accordingly, the base (capped) portion of the Pentagon budget would rise by \$3.1 billion, a less than one percent increase. However, additional “base” spending is provided via the Pentagon’s Overseas Contingency Operations or OCO account, which is not subject to the spending caps. This account was originally intended to fund overseas warfighting but has been increasingly used as means to get around the caps to fund “base requirements,” or activities not directly related to ongoing conflicts. Thus, the de facto “base budget” would actually rise by \$14.2 billion total, a 2.2 percent increase, even as uncapped overseas spending continues to decline.⁵

Most of this increase is eaten up by personnel costs, though Research, Development, Test, and Evaluation (RDT&E) funding would also increase slightly. However, as in past requests, the FY 2021 Pentagon budget is friendlier to the downstream development accounts (“6.4” through “6.7” in the Pentagon nomenclature), which are focused on nearer-term systems acquisition. On the other hand, science and technology – including basic and applied research and early-stage technology – would receive percentage cuts in the double digits.

The DOD tables after this section show full details. Note that there is not a perfect overlap between “RDT&E” and “R&D” as defined by the White House Office of Management and Budget: the “6.7” operational systems

development account no longer counts as R&D.⁶

DOD priorities continue to include the cyber domain (\$9.8 billion in total funding, not limited to R&D), space programs and the Space Force (\$18 billion), missile defense (\$20.3 billion), and the nuclear deterrent (\$17.7 billion). Advanced technology priorities include hypersonic weapons (\$3.2 billion), microelectronics and 5G (\$1.5 billion), autonomous systems (\$1.7 billion), and AI (\$0.8 billion).

Basic Research (6.1) Programs. As seen in the tables on the following pages, Pentagon basic research programs would decline by \$284 million or 10.9 percent under the budget request. The brunt of these reductions would fall on university-based research programs and support for STEM education and minority-serving institutions.

Funding for the Multidisciplinary University Research Initiative (MURI), the Defense University Research Instrumentation Program (DURIP), and the Presidential Early Career Awards for Scientists and Engineers (PECASE) program would see varying changes based on military branch. The Defense Research Sciences program elements – the primary accounts funding in-house research at the military labs as well as extramural research – would suffer marginally less, especially under Navy research. Funding for the Vannevar Bush Faculty Fellowship (VBFF) Program would be trimmed.

The Minerva social science initiative would be put on a path to elimination, as core funding from DOD’s basic research directorate – set at \$11.4 million in FY 2020 – would end.

DARPA Programs. Within its 3.1 percent or \$108 million increase, the Defense Advanced

⁵ Pentagon budget overview and other materials: <https://comptroller.defense.gov/Budget-Materials/>

⁶ For more information, see: <https://www.aaas.org/news/federal-government-tweaking-what-counts-rd-ga>

Research Projects Agency (DARPA) would see increases across an array of disciplines and program areas, with an emphasis on AI and machine learning, and multiple new projects.

Biomedical technology funding would also increase, with new projects on deployable countermeasures; enhancing warfighter physiology in demanding environments; fieldable low-cost gene editing technology; and spinal cord injury healing and recovery. Another DARPA project would develop novel personal protective equipment (PPE) for chem/bio attacks.

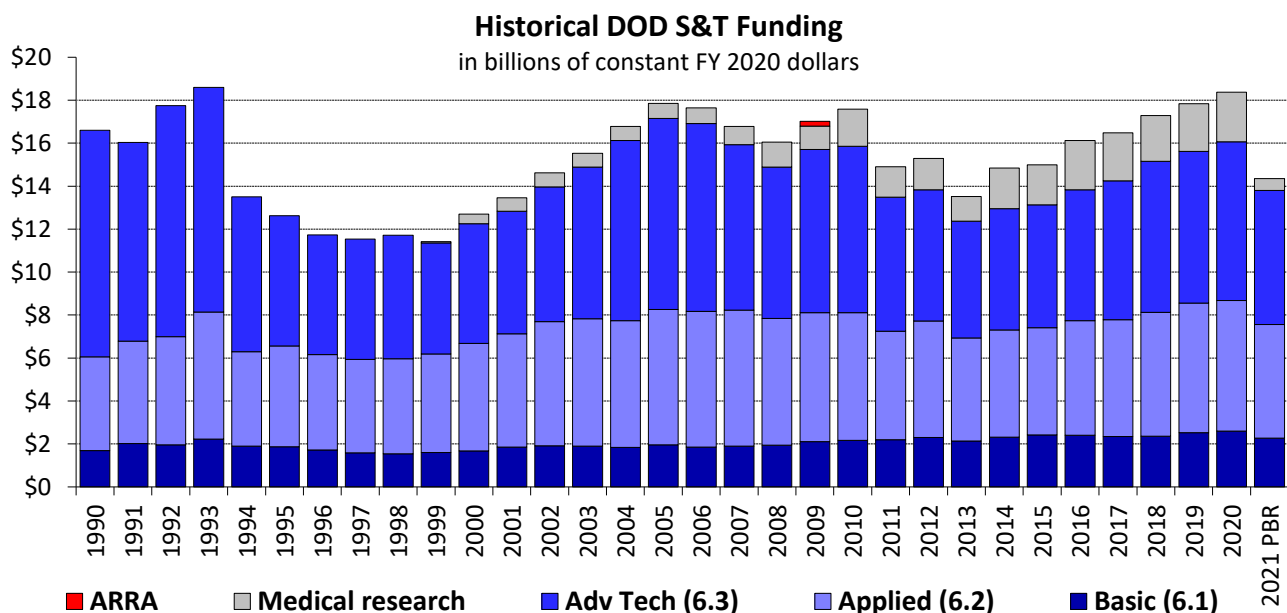
DARPA would also substantially increase investments in network-centric warfare, and in sensor technology. Overall spending on space and aerospace technology areas would decline, though a pair of new projects for advanced missile weapons systems would be established. DARPA would also increase funding for its small-satellite constellation program, Blackjack. Funding for the Experimental Spaceplane and Launch Challenge projects would end. The former project was prematurely terminated after Boeing dropped out, while the Launch Challenge was completed recently but did not produce a winning launch.

Other Science and Technology Programs. DOD would drop support for the eight public-private manufacturing innovation institutes established under the Manufacturing USA program by \$105 million, a 63 percent decline. However, DOD also requests \$15 million for establishment of a *new* institute focusing on synthetic biology manufacturing.

RDT&E funding for the Defense Innovation Unit (DIU), which works with entrepreneurs to prototype and transition novel technologies from the commercial sector for military use, would decline by \$7 million to \$39 million total. Priorities would focus on AI, power and energy, advanced materials, autonomous systems, and other topics.

The newest military branch, the U.S. Space Force, would receive a \$10.3 billion RDT&E budget in FY 2021. Of that, \$131 million would be for applied research into survivability and surveillance, payload technology, spacecraft protection, and vehicle technologies.

In historical terms, DOD basic research and DOD science and technology overall would drop somewhat below FY 2014 levels (see graph).



Source: DOD R-1 and historical data. Medical Research is appropriated outside RDT&E title. © 2020 AAAS

Department of Defense

(Total Obligational Authority [TOA] in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Research, Development, Test, and Evaluation (RDT&E)					
Basic Research (6.1)	2,476	2,603	2,319	-284	-10.9%
Applied Research (6.2)	5,912	6,071	5,397	-675	-11.1%
Total Research	8,388	8,675	7,716	-959	-11.1%
Adv Tech Development (6.3)	6,929	7,387	6,355	-1,032	-14.0%
Total Science & Technology	15,317	16,062	14,070	-1,991	-12.4%
Adv Component Dev (6.4)	21,454	27,207	28,468	1,261	4.6%
System Dev and Demonstr (6.5)	15,447	16,778	16,526	-252	-1.5%
Management Support (6.6)	9,074	7,217	6,987	-230	-3.2%
Total R&D within RDT&E	61,292	67,264	66,052	-1,212	-1.8%
Operational Sys Dev ("6.7")	34,915	38,132	40,504	2,372	6.2%
Total RDT&E 1/	96,206	105,396	106,555	1,159	1.1%
Defense Health Research 2/	2,180	2,306	562	-1,744	-75.6%
Chem Agents Destruction 2/	667	876	782	-94	-10.7%
Other Appropriations 3/	546	2,293	448	-1,845	-80.5%
Total DOD R&D Estimate (TOA)	64,685	72,739	67,844	-4,894	-6.7%
COVID-19 Emergency Spending (Defense Health RDT&E)		415			
	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Science & Technology Programs (6.1 - 6.3)					
Army	3,607	3,365	2,590	-776	-23.0%
Navy	2,496	2,618	2,317	-301	-11.5%
Air Force 4/	2,904	3,272	2,681	-592	-18.1%
Defense Agencies	6,311	6,806	6,353	-454	-6.7%
DARPA (total budget)	3,426	3,458	3,566	108	3.1%

1/ Under recent changes to the official government definition of R&D, the operational systems development account (6.7) is no longer included as R&D spending.

2/ Appropriated outside RDT&E title.

3/ R&D support in military personnel, construction, and other non-RDT&E programs.

4/ Does not include \$131 million for Space Force applied research in FY 2021.

Includes Overseas Contingency Operation funding.

Source: OMB R&D data and documents, DOD R-1, and appropriations bills and reports. All figures rounded to the nearest million. Changes calculated from unrounded figures.

Character of work ("6.x") categories are expressed in total obligatory authority (TOA).

Department of Defense Basic Research (6.1)

(TOA in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Army					
In-House Lab Indep. Research	11	0	0	0	--
Defense Research Science	306	354	303	-51	-14.5%
Univ Research Initiatives	63	88	67	-21	-23.6%
Univ and Industry Res Centers	111	127	88	-39	-30.9%
Cyber Collab Research Alliance	--	5	5	0	1.9%
Total Army	491	574	463	-111	-19.3%
Navy					
In-House Lab Indep. Research	19	19	19	0	0.0%
Defense Research Science	487	464	467	3	0.7%
Univ Research Initiatives	156	168	117	-51	-30.4%
Total Navy	662	651	603	-48	-7.3%
Air Force					
Defense Research Science	374	356	315	-41	-11.4%
Univ Research Initiatives	159	179	162	-17	-9.5%
High Energy Laser Res Init	12	15	15	0	2.0%
Total Air Force	545	550	492	-57	-10.5%
Defense Agencies					
DTRA Basic Research Initiative	36	26	15	-11	-43.8%
Defense Research Sciences 1/	424	432	480	48	11.0%
Basic Research Initiatives	55	71	36	-35	-49.8%
HBCUs / Minority Institutions	39	53	31	-22	-41.2%
Basic Oper Medical Research 1/	50	54	54	0	-0.7%
Nat Def Edu Program	133	144	100	-44	-30.4%
Chem and Bio Def Program	41	48	45	-3	-6.1%
Total Defense Agencies	777	828	760	-68	-8.2%
DOD Totals					
In-House Lab Indep. Research	31	19	19	0	0.0%
Defense Research Sciences	1592	1607	1566	-41	-2.6%
Univ Research Initiatives	377	435	346	-89	-20.4%
All Other	476	543	388	-154	-28.5%
Total DOD Basic Research	2476	2603	2319	-284	-10.9%

1/ DARPA program elements.

Source: DOD R-1.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

Agency Highlights: National Institutes of Health (NIH)

As seen in the tables on the following pages, the NIH budget would drop by 6.1 percent or \$2.6 billion under the White House budget request,⁷ including late amendments released in March to add \$440 million in funding for NIAID novel coronavirus research, fully reversing their original proposal for spending reductions for that institute. Most other individual institutes would drop by 9 percent below FY 2020 levels, however, excluding emergency COVID-19 spending in FY 2020. Another exception is the National Institute on Drug Abuse (NIDA), which would only see a 1.8 percent drop, reflecting the Administration's prioritization of addiction-related research.

The number of competing research project grants would decline by nearly 1,900, a 16.5 percent decline (before factoring in the late NIAID funding amendment). This would push the NIH-wide success rate below 17 percent, whereas recent funding increases – thanks to consistent Congressional support – have lately pushed it above 20 percent for the first time in several years. Funding for training grants, research centers, intramural NIH research, and other activities would also decline.

The Administration would again consolidate the Agency for Healthcare Research and Quality (AHRQ) within NIH as the new National Institute for Research on Safety and Quality. The prior three Trump Administration budgets have each recommended such a move, and Congress has rejected it each time.

The budget includes \$50 million for a trans-NIH initiative to employ artificial intelligence and machine learning “to enhance the collection, integration, analyses, and interpretation of data

related to the onset and progression of chronic diseases,” as part of the White House's broader AI focus. The budget also makes continued investments in influenza research and tickborne disease research, while reducing funding toward the elimination of HIV/AIDS, a purported White House priority.

Select Priorities. The request includes \$1.4 billion for opioids and pain research, including \$532.6 million for the Helping to End Addiction Long-Term (HEAL) Initiative, which involves several NIH institutes in a multi-faceted research strategy on relevant topics. NIDA will continue its efforts to address rural opioid addiction, in partnership with the Appalachian Regional Commission and other agencies, while other institutes under the HEAL Initiative will continue searching for non-addictive pain management alternatives. HEAL will also continue progress toward its long-term study of pregnant women and their children to understand brain development and the potential effects of opioid exposure.

Within the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), the Administration requests renewal of the mandatory Special Type I Diabetes program, which performs research on prevention and cures. The program was set to expire last year, but Congress extended funding of \$96.7 million into May 2020. The Administration wants an additional \$53.4 million to raise the total to \$150 million for the full 2020 fiscal year, and then requests another \$150 million for FY 2021. It does this while recommending a reduction in the underlying appropriation for NIDDK by \$190.9 million or 9.0 percent.

The budget allocates \$100 million for neonatal research in FY 2020 and FY 2021, while continuing a \$50 million annual investment in

⁷ NIH budget request:
<https://officeofbudget.od.nih.gov/br.html>

the Childhood Cancer Data Initiative, established in last year's appropriations.

The request also seeks \$300 million – a \$100 million increase – to address NIH's substantial backlog of Bethesda campus facilities repair and maintenance, which NIH says is up to near \$2.1 billion. The major priority is construction of a new Surgery, Radiology, and Laboratory Medicine facility, which would receive the bulk of the \$300 million request.

One source of fiscal tightening may be scheduled declines in funding for certain programs established in the 21st Century Cures Act, which is not subject to the spending caps. Under current law, FY 2021 funding allowed outside the spending caps for the All of Us precision medicine initiative and the BRAIN

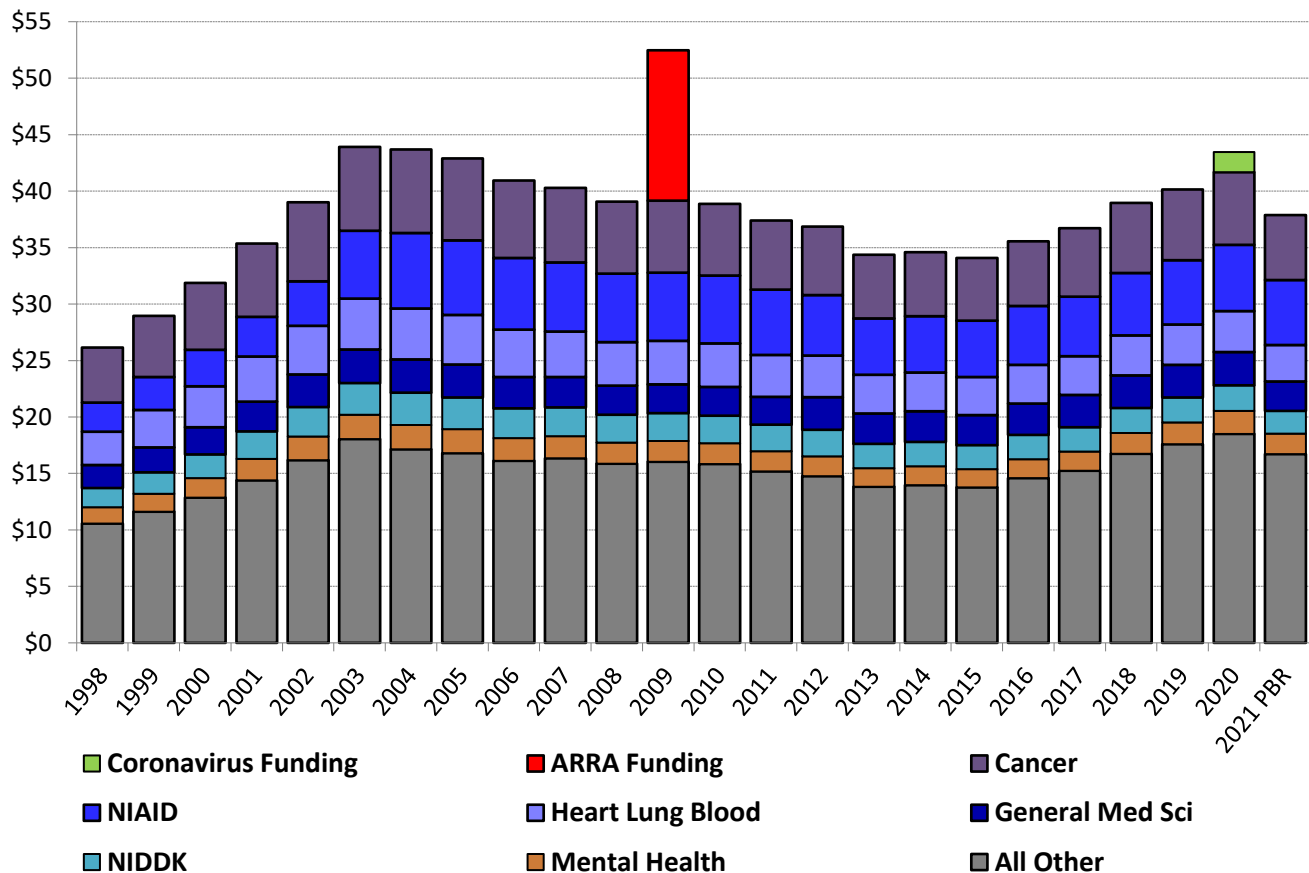
Initiative would each drop by \$40 million.

Congress typically funds these initiatives at much higher levels, but at current levels they will begin to take up somewhat more cap space in FY 2021, which could require tradeoffs elsewhere.

In historical terms, the budget request would drop the NIH budget somewhat below FY 2018 levels in inflation-adjusted dollars (see graph below). The graph reflects \$1.8 billion in emergency research funding for COVID-19 response in FY 2020. \$1.5 billion of this was directed to NIAID, with the remainder divided among several other institutes.

NIH Budget, FY 1998 - 2021

budget authority in billions of constant FY 2020 dollars



Source: Agency budget documents and appropriations. Adjusted for biomedical R&D inflation rate (BRDPI). © 2020 AAAS

National Institutes of Health

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Cancer	6,121	6,440	5,881	-559	-8.7%
Allergy and Infect Diseases 1/	5,545	5,876	5,885	9	0.2%
Heart, Lung, and Blood	3,482	3,625	3,298	-327	-9.0%
General Medical Sciences	2,822	2,937	2,672	-265	-9.0%
Diabetes, Digest, and Kidney 2/	2,176	2,265	2,074	-191	-8.4%
Neurological Disorders	2,246	2,447	2,245	-201	-8.2%
Mental Health	1,872	2,043	1,845	-198	-9.7%
Child Health & Human Dev	1,501	1,557	1,416	-141	-9.0%
Nat Ctr for Adv Translational Sci	816	833	788	-45	-5.4%
Office of the Director 3/	2,104	2,404	2,208	-196	-8.2%
Aging	3,080	3,546	3,226	-320	-9.0%
Drug Abuse	1,408	1,458	1,432	-26	-1.8%
Environmental Health Sci	851	884	804	-80	-9.0%
Eye	794	823	749	-74	-9.0%
Arthritis / Musculoskeletal	603	625	568	-56	-9.0%
Human Genome	575	604	550	-54	-8.9%
Alcohol Abuse and Alcoholism	525	547	497	-49	-9.0%
Deafness and Communication	473	491	446	-44	-9.0%
Dental Research	461	478	435	-43	-9.0%
National Library of Medicine	441	457	416	-41	-9.0%
Biomed / Bioengineering	388	405	368	-37	-9.0%
Minority Health / Disparities	313	336	305	-30	-9.0%
Nursing Research	163	172	157	-16	-9.0%
Complementary and Int Health	146	152	138	-14	-9.0%
Buildings and Facilities	199	200	300	100	50.0%
Fogarty International Center	78	81	74	-7	-9.0%
NIRSQ 4/			355		
Total NIH Budget	39,184	41,685	39,133	-2,552	-6.1%
<i>COVID-19 Emergency Spending</i>		<i>3,587</i>			

1/ FY 2021 request includes coronavirus amendment of additional \$439.6 million.

2/ Includes mandatory diabetes research funds: \$150 million enacted in FY 2019 and \$96.6 million enacted in FY 2020. The Administration requests an additional \$53.4 million in FY 2019 and \$150 million in FY 2021, all of which is included above.

3/ Trans-NIH initiatives are consolidated in OD.

4/ Budget recommends consolidation of Agency for Healthcare Research and Quality within NIH in FY 2021 as National Institute for Research on Safety and Quality.

Source: OMB and agency budget documents and data, and appropriations bills and reports.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

National Institutes of Health Funding by Mechanism

(budget authority in millions of dollars unless otherwise noted)

	FY 2019 Actual	FY 2020 Estimate*	FY 2021 Budget*	FY20 Change	
				Amount	Percent
Research Project Grants	21,316	22,731	21,054	-1,677	-7.4%
Noncompeting	14,565	16,005	15,632	-373	-2.3%
Administrative supplements	437	502	278	-224	-44.7%
Competing	6,314	6,225	5,145	-1,080	-17.4%
[Total # of Research Grants]	38,644	40,887	39,614	-1,273	-3.1%
[# Non-Competing Grants]	27,624	29,508	30,109	601	2.0%
[# Competing Grants]	11,020	11,379	9,505	-1,874	-16.5%
SBIR / STTR Grants 1/	1,052	1,119	1,036	-83	-7.4%
[# of SBIR / STTR Grants]	2,023	2,140	1,993	-147	-6.9%
Research Centers	2,691	2,664	2,406	-258	-9.7%
Other Research	2,574	2,663	2,440	-223	-8.4%
Research Training	865	910	848	-62	-6.8%
R&D Contracts	3,165	3,349	3,077	-272	-8.1%
Intramural Research	4,144	4,446	4,077	-369	-8.3%
Research Management & Support	1,883	2,015	1,926	-89	-4.4%
Office of the Director	1,197	1,477	1,343	-134	-9.1%
The Common Fund /2	619	639	596	-43	-6.7%
Buildings and Facilities	217	230	315	85	37.0%
Superfund Research (NIEHS)	79	81	74	-7	-9.0%
PCORTF 3/			98		
Total NIH Budget*	39,184	41,685	38,694	-2,991	-7.2%

*NOTE: Does not reflect emergency spending or amended budget in FY 2020 or FY 2021.

Source: NIH budget justification.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

Includes mandatory funds for diabetes and patient outcomes research transfers.

1/ Small Business Innovation Research / Small Business Technology Transfer.

2/ Distributed throughout above mechanisms.

3/ Patient Centered Outcomes Research Trust Fund; would fund relocated NIRSQ in FY 2021.

Agency Highlights: Department of Energy (DOE)

Under the White House budget,⁸ the Office of Science would be reduced by \$1.2 billion or 16.6 percent, following strong increases from Congress in recent years (and excluding \$100 million in emergency COVID-19 spending in FY 2020). AI, quantum information science, and other areas continue to be priorities, but in the context of a vastly reduced budget overall.

Applied technology programs continue to be a major cost savings target for the White House, with a renewed call to eliminate the Advanced Research Projects Agency-Energy (ARPA-E) coupled with another round of enormous reductions for the Office of Energy Efficiency and Renewable Energy (EERE). On the other hand, critical infrastructure remains an Administration priority with targeted funding boosts for the Office of Electricity and the Office of Cybersecurity, Energy Security, and Emergency Response (CESER), along with support for the new AI and Technology Office.

Office of Science (SC). Amid the billion-dollar reduction proposed for SC, several priority areas would see some funding increases. Both AI and quantum information science (QIS) funding would benefit from White House plans to double each by FY 2022. The SC quantum initiative would receive a more than \$40 million increase above FY 2020 appropriations, while the AI and machine learning initiative would receive a greater than \$50 million increase according to White House documents. The request also ramps up the next-generation microelectronics initiative to \$45 million and commences modest funding for new initiatives in accelerator technology and rare earths.

Among programs, the major “winners” are Advanced Scientific Computing Research and Basic Energy Sciences, mainly because they would see relatively small changes from FY 2020 compared to other programs (note that in the table that follows this section, the apparently increase in math and computer science research is primarily due to a realignment). However, as can be seen in the table, certain facilities and networks would see sizable reductions, including ESnet, the National Energy Research Scientific Computing Center (NERSC), and SC’s neutron sources, among others. Exascale funding would begin winding down as three SC- and NNSA-supported systems approaching deployment.

Other programs would not fare so well. The Biological and Environmental Research program would see sizable reductions – particularly for earth science and modeling activities. Physics program funding would also decline dramatically nearly across the board, including for U.S. contributions to the international ITER fusion project.

The request would also scale back support for STEM student and educator activities at the national labs and for the Albert Einstein Distinguished Educator fellows.

Energy Technology Offices. The EERE spending reductions – which have been rejected by Congress in three prior rounds of appropriations – would affect all program areas. Funding would be reduced in several cross-cutting areas of purported interest to DOE including AI, advanced manufacturing, critical minerals, cybersecurity, harsh environment materials, and energy storage. On the other hand, several of these crosscutting areas would see moderately increased fiscal

⁸ Dept. of Energy budget documents:

<https://www.energy.gov/cfo/downloads/fy-2021-budget-justification>

attention from the Office of Nuclear Energy and the Office of Fossil Energy. The budget provides \$20 million for a grand challenge area on water security and desalination, in coordination with the fossil and nuclear offices.

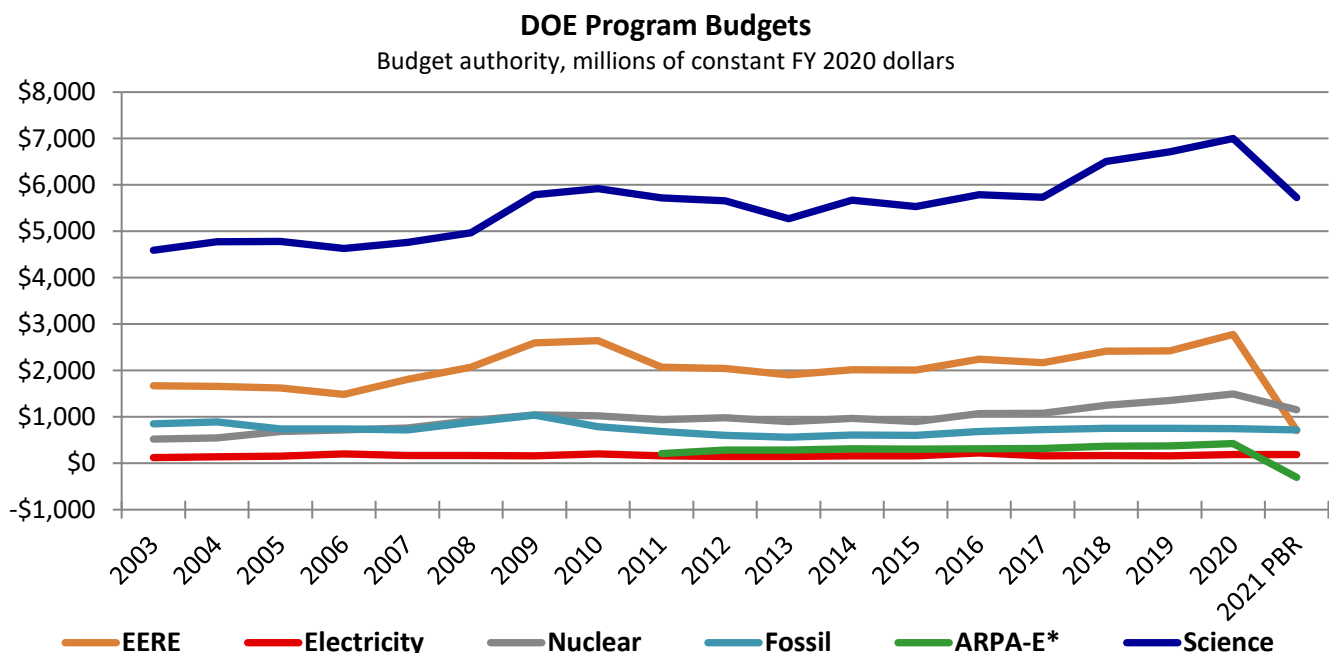
Nuclear Energy would eliminate funding for the Integrated University Program and for Supercritical Transformational Electric Power (STEP) R&D. The major reductions in Reactor RD&D funding are: transition of the Versatile Fast Test Reactor to a separate funding account in FY 2021; a 90 percent reduction in support for Advanced Small Modular Reactor R&D as the program shifts to an early-stage focus; and a \$16 million funding shift from Light Water Reactor Sustainability to other advanced reactor technologies. Enabling technology subprograms would see more limited changes, partly to support DOE-wide priority areas.

Fossil Energy would similarly eliminate STEP R&D. Like prior requests, the FY 2021 budget would scale back other carbon capture, utilization, and storage R&D funding, with technology programs increasingly focused on the Coal FIRST initiative to development a zero

or near-zero emissions coal plant. Several other advanced coal R&D programs would be scaled back to make room for this initiative, including solid oxide fuels, combustion and gasification, and advanced turbines, though improved performance and efficiency of the existing coal fleet remains a focus.

As mentioned above, ARPA-E would be eliminated. The request also includes the cancelation of \$332 million in previously appropriated but unobligated budget authority.

Both the Office of Electricity and the Office of Cybersecurity, Energy Security, and Emergency Response (CESER) would see some funding increases. The Office of Electricity would receive a \$27.5 million or 49.1 percent increase for energy storage systems R&D. This includes increased support of \$40 million for construction of a Grid Storage Launchpad (GSL) for development, testing, and evaluation of battery materials and systems. CESER would receive a \$22 million or 45.8 percent increase for infrastructure security and restoration, primarily for new cyber operational tools and preparedness.



*\$332 million in budget authority proposed for cancellation, leading to negative balance.

Department of Energy: Office of Science

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Advanced Scientific Computing Research (ASCR)					
Math and Computer Science Res	131	155	264	109	70.3%
Comp Partnerships / SciDAC	76	69	75	6	8.5%
HPC and Network Facilities	572	636	555	-81	-12.8%
Argonne LCF	140	150	150	0	0.0%
Oak Ridge LCF	199	225	220	-5	-2.2%
ESnet	84	90	80	-10	-11.1%
NERSC	104	110	85	-25	-22.7%
Exascale Computing	233	189	169	-20	-10.5%
ASCR Total	936	980	988	8	0.8%
Basic Energy Sciences (BES)					
Materials Science and Engineering	396	415	416	1	0.2%
Storage Hub	24	24	24	0	0.0%
EFRCs	56	58	58	0	0.0%
Chemical Sci, Geo Sci, & Bio Sci	359	380	374	-7	-1.8%
Sunlight Hub	15	20	20	0	0.0%
EFRCs	54	58	58	0	0.0%
Scientific User Facilities	1,003	1,057	962	-95	-9.0%
Light Sources	505	519	495	-24	-4.6%
Neutron Sources	282	290	260	-30	-10.2%
Nanoscale Science Centers	135	139	130	-9	-6.3%
Construction*	408	360	184	-176	-48.9%
APS-U ANL	130	170	150	-20	-11.8%
ALS-U LBNL	60	60	13	-47	-78.3%
LCLS-II-HE SLAC	28	50	14	-36	-72.0%
PPU ORNL	60	60	5	-55	-91.7%
BES Total	2,166	2,213	1,936	-277	-12.5%
<i>*not all shown</i>					
Biological and Environmental Research (BER)					
Biological Systems Science	368	405	339	-65	-16.2%
BRCs	100	100	100	0	0.0%
Joint Genome Institute	70	77	60	-17	-22.1%
Earth and Environ Systems Sci	337	345	178	-168	-48.5%
Modeling	97	97	38	-59	-61.2%
BER Total	705	750	517	-233	-31.1%

(continued)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Fusion Energy Sciences (FES)					
Burning Plasma: Foundations	287	280	221	-59	-20.9%
Burning Plasma: Long Pulse	61	70	49	-21	-30.0%
Discovery Plasma	84	65	43	-21	-33.1%
Construction	132	257	112	-145	-56.4%
ITER	132	242	107	-135	-55.8%
MEC	0	15	5	-10	-66.7%
FES Total	564	671	425	-246	-36.6%
High-Energy Physics (HEP)					
Energy Frontier Exper Physics	239	228	180	-48	-21.1%
Projects (LHC)	105	100	78	-22	-22.0%
Intensity Frontier Exper Physics	241	250	205	-46	-18.3%
Cosmic Frontier Exper Physics	101	95	70	-25	-26.3%
Theoretical and Comp Physics	90	116	123	7	6.2%
Advanced Tech R&D	114	107	106	-1	-1.2%
Accelerator Stewardship	16	17	14	-3	-18.7%
Construction	180	231	121	-111	-47.8%
DUNE	130	171	101	-71	-41.2%
Mu2e	30	0	0	0	-
PIP-II	20	60	20	-40	-66.7%
HEP Total	980	1,045	818	-227	-21.7%
Nuclear Physics (NP)					
Medium Energy Physics	184	188	176	-11	-6.1%
Heavy Ion Physics	230	244	228	-16	-6.7%
Low Energy Physics	101	127	111	-16	-12.8%
Nuclear Theory	55	52	54	2	4.6%
Isotope Development	44	50	66	17	33.3%
Construction	75	53	18	-35	-65.5%
FRIB	75	40	5	-35	-86.8%
NP Total	690	713	653	-60	-8.4%
Workforce Development	23	28	21	-8	-26.8%
Science Labs Infrastructure	233	301	174	-127	-42.2%
Other	289	299	306	7	2.3%
Total Science	6,585	7,000	5,838	-1,162	-16.6%
<i>COVID-19 Emergency Spending</i>		100			

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

Figures rounded to nearest million. Changes calculated from unrounded figures.

Department of Energy: Energy Programs

(budget authority in millions of dollars)

	FY 2019	FY 2020	FY 2021	Change FY 20-21	
	Actual	Estimate	Budget	Amount	Percent
Energy Efficiency & Renewable Energy	2,379	2,777	720	-2,058	-74.1%
Hydrogen & Fuel Cell Tech	120	150	42	-108	-72.0%
Bioenergy Technologies	226	260	45	-215	-82.9%
Solar Energy	247	280	67	-213	-76.1%
Wind Energy	92	104	22	-82	-78.8%
Geothermal Technology	84	110	26	-84	-76.4%
Water Power	105	148	45	-103	-69.6%
Vehicle Technologies	344	396	74	-322	-81.2%
Building Technologies	226	285	61	-224	-78.6%
Advanced Manufacturing	320	395	95	-300	-76.1%
Office of Electricity	156	190	195	5	2.7%
R&D Programs	132	165	168	3	2.1%
Nuclear Energy	1,326	1,493	1,180	-313	-21.0%
Reactor Concepts RD&D	324	267	112	-156	-58.2%
Nuclear Enabling Technology	153	113	116	3	2.2%
Fuel Cycle R&D	264	305	187	-118	-38.7%
Fossil Energy R&D	740	750	731	-19	-2.6%
Advanced Coal and CCUS	486	491	546	55	11.3%
CCUS	199	218	123	-95	-43.5%
Other Advanced Coal R&D	287	273	423	150	55.0%
Natural Gas Technologies	51	51	15	-36	-70.6%
Unconventional Technologies	46	46	17	-29	-63.0%
Cybersecurity and Response (CESER)	120	156	185	29	18.3%
ARPA-E 1/	366	425	-311	-736	-173.1%
Energy Information Administration	125	127	129	2	1.5%

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

Figures rounded to nearest million. Changes calculated from unrounded figures.

1/ The Administration recommends cancellation of \$332 million in unobligated balances.

Department of Energy: NNSA

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Atomic Energy Defense Activities					
National Nuclear Security Administration (NNSA)					
Weapons Activities	11,100	12,457	15,602	3,145	25.2%
RDT&E	2,174	2,552	2,782	230	9.0%
Science	469	594	773	179	30.2%
Engineering	251	325	337	12	3.8%
IC Fusion	536	557	555	-2	-0.3%
Adv Sim & Computing	659	768	732	-36	-4.7%
Manufacturing Maturation	185	222	298	76	34.0%
Academic Programs	73	86	87	0	0.5%
Defense Nuclear Nonproliferation	1,930	2,164	2,031	-133	-6.2%
Nonproliferation and Forensics R&D	576	533	572	38	7.2%
Naval Reactors	1,789	1,648	1,684	36	2.2%
Office of the Administrator	410	435	454	19	4.4%
Total NNSA	15,229	16,705	19,771	3,066	18.4%
Def Environmental Cleanup	6,024	6,255	4,984	-1,271	-20.3%
Other Defense Activities	860	906	1,055	149	16.4%
Total Atomic Defense Budget	22,113	23,866	25,809	1,944	8.1%

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

Figures rounded to nearest million. Changes calculated from unrounded figures.

Agency Highlights: National Science Foundation (NSF)

As in prior budget requests, the NSF budget would be scaled back with a \$537 million or 6.5 percent decline from FY 2020,⁹ which would drop the budget to pre-recession levels in inflation-adjusted dollars. This excludes \$76 million provided in the COVID-19 emergency response package in FY 2020, for RAPID research grants.

The request level would fund 10,700 competing awards, 500 fewer than FY 2019 (with FY 2020 numbers not yet available). The agency-wide funding rate would drop to 25 percent from 27 percent in FY 2019.

NSF's Ten Big Ideas and its Convergence Accelerator model remain major agency priorities as aggregate funding would rise to \$432 million, a 33 percent increase above FY 2019 levels. Certain White House priorities like AI and quantum science would also see growth, and obligations from the Directorate for Computer and Information Science and Engineering would accordingly see a \$46 million or 4.5 percent increase above FY 2020 levels owing to its prominent role in these and other areas. However, obligations from other directors would all decline – by as much as \$156 million or 15.7 percent in the case of Geosciences.¹⁰

STEM education programs would also see reductions, but not uniformly. According to summary NSF data, all STEM education programs (including but not limited to the Directorate for Education and Human Resources) would decline by 4.8 percent or \$66.8 million below FY 2019 levels. Within that total, K-12 programs and postdoc programs would each decline by over 20 percent;

undergraduate programs would decline by 15.6 percent; and other programs for graduate and professional support would see smaller reductions in the aggregate. However, within these totals, programmatic changes vary widely. For instance, the Noyce scholarship programs for undergrads would see a 40.9 percent reduction below FY 2019, while funding for the SNF Research Traineeship for graduates would nearly double.

Among other programs, the Innovation Corps program would be reduced by 4.3 percent below FY 2019; EPSCoR funding would be reduced by 6.8 percent; and the Secure and Trustworthy Cyberspace initiative would be reduced by 7.1 percent. Nanotechnology and climate change research, both subject to major long-standing interagency initiatives, would also see large reductions.

Research and Infrastructure Priority Areas.

Support for the Convergence Accelerator, which focuses on rapid use-inspired research, would rise to \$70 million, a 69 percent increase, primarily for new projects in FY 2021. Support for the six research thrusts in NSF's Ten Big Ideas will also increase.

NSF also continues its focus on mid-scale research infrastructure, support for which would increase by \$22 million or 23.6 percent above FY 2019. Other research infrastructure support would generally decline dramatically, however.

As mentioned above, a major focus in this year's request is on so-called "Industries of the Future," in accord with general White House objectives. This includes a nearly 90 percent increase above FY 2019 levels for artificial intelligence research including fundamental science, education and workforce activities, and

⁹ NSF budget request:
<https://www.nsf.gov/about/budget/fy2021/index.jsp>

¹⁰ According to OMB's budget appendix for NSF:
<https://www.whitehouse.gov/omb/appendix/>

data and research infrastructure. As part of the initiative, NSF is partnering with other federal agencies to establish several multidisciplinary, multi-institutional research institutes focused on AI topics. These institutes will include industry, university, and other partners.

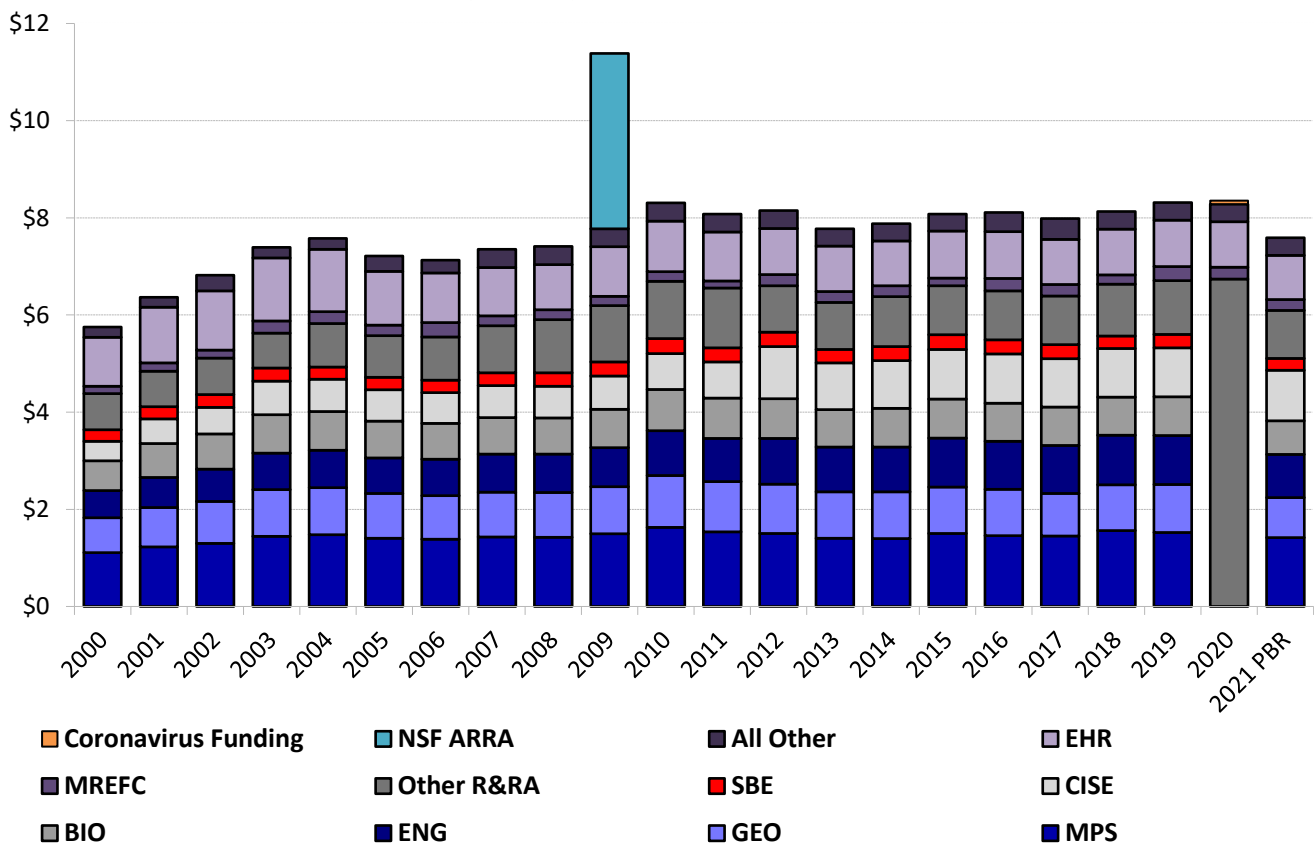
Quantum information science funding would more than double above FY 2019 levels to \$226 million in FY 2021. Like NSF's AI activities, this initiative includes several basic research topics; workforce development investments; and continued support for Quantum Leap Challenge Institutes.

The FY 2021 request would also initiate a \$17 million interdisciplinary Spectrum Innovation Initiative to explore more efficient and effective use of the electromagnetic spectrum.

A fourth Industry of the Future, advanced manufacturing research, would only see a modest increase above FY 2019 funding levels.

National Science Foundation Budget

Budget authority in billions of constant FY 2020 dollars



Source: NSF budget requests. © 2020 AAAS

National Science Foundation

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate*	FY 2021 Budget	Change* FY 19-21	
				Amount	Percent
Biological Sciences (BIO)					
Molecular and Cellular Biosciences	145	--	131	-14	-9.5%
Integrative Organismal Systems	194	--	176	-19	-9.5%
Environmental Biology	154	--	150	-3	-2.2%
Biological Infrastructure	181	--	158	-23	-12.6%
Emerging Frontiers	110	--	90	-20	-18.5%
Total BIO	784	--	705	-79	-10.1%
Computer and Information Science and Engineering (CISE)					
Advanced Cyberinfrastructure	222	--	233	11	4.9%
Computing & Communications Foundations	194	--	203	9	4.9%
Computer & Network Systems	229	--	240	11	4.8%
Information & Intelligent Systems	208	--	240	32	15.2%
Information Technology Research	132	--	146	14	10.9%
Total CISE	985	--	1,062	77	7.8%
Engineering (ENG)					
Chem, Bioeng, Enviro & Transport Systems	190	--	160	-30	-15.8%
Civil, Mechanical & Manuf Innovation	238	--	201	-37	-15.7%
Electrical, Communications & Cyber Systems	118	--	104	-14	-12.1%
Industrial Innovation & Partnerships	269	--	258	-11	-4.0%
Engineering Education & Centers	103	--	89	-13	-12.9%
Emerging Frontiers & Multidisc Activities	73	--	98	25	33.5%
Total ENG	991	--	910	-81	-8.2%
Geosciences (GEO)					
Atmospheric and Geospace Sciences	303	--	234	-69	-22.7%
Earth Sciences	182	--	168	-14	-7.5%
Integrative & Collaborative Edu & Research	114	--	95	-19	-16.8%
Ocean Sciences	371	--	339	-32	-8.5%
Total GEO	970	--	837	-133	-13.7%
(continued)					

	FY 2019 Actual	FY 2020 Estimate*	FY 2021 Budget	Change* FY 19-21	
				Amount	Percent
Mathematical and Physical Sciences (MPS)					
Astronomical Sciences	287	--	242	-45	-15.6%
Chemistry	247	--	219	-29	-11.6%
Materials Research	303	--	280	-23	-7.5%
Mathematical Sciences	237	--	215	-22	-9.4%
Physics	285	--	258	-27	-9.6%
Multidisciplinary Activities	131	--	235	104	79.0%
Total MPS	1,491	--	1,448	-42	-2.8%
Social, Behavioral, and Economic Sciences (SBE)					
Social & Economic Sciences	96	--	87	-10	-10.1%
Behavioral & Cognitive Sciences	94	--	85	-9	-9.8%
National Ctr for Science and Eng Statistics	54	--	52	-2	-3.9%
Office of Multidisciplinary Activities	26	--	23	-3	-12.3%
Total SBE	271	--	247	-24	-9.0%
Integrative Activities	547	--	539	-9	-1.6%
EPSCoR	176	--	164	-12	-6.8%
Major Research Instrumentation (MRI)	75	--	62	-13	-17.9%
Convergence Accelerator	41	--	70	29	69.1%
Office of Polar Programs	489	--	420	-69	-14.1%
Office of International Science and Eng	49	--	44	-5	-10.2%
Arctic Research Commission	1	--	2	0	8.1%
Total Research and Related Activities	6,578	6,737	6,213	-524	-7.8%
Education & Human Resources (EHR)					
Learning in Formal and Informal Settings	228	--	224	-5	-2.1%
Undergraduate Education	265	--	237	-28	-10.7%
Graduate Education	253	--	282	29	11.3%
Human Resource Development	188	--	189	1	0.4%
Total EHR	935	940	931	-9	-1.0%
Major Equip & Facilities Construction	285	243	230	-13	-5.5%
Agency Operations & Award Mgmt.	333	337	346	9	2.6%
National Science Board	4	5	4	0	-6.4%
Inspector General	15	17	18	1	8.2%
NSF Total	8,150	8,278	7,741	-537	-6.5%
<i>COVID-19 Emergency Funding</i>		76			

*FY 2020 details are not yet available. FY 2019 used as base for comparison where FY 2020 is missing.

Source: Agency budget justification and Quantitative Data Tables.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

Agency Highlights: National Aeronautics and Space Administration (NASA)

Continuing the Trump Administration's recent preferences and prioritization of space exploration, the NASA budget would see a marked increase in the FY 2021 request at 11.9 percent or \$2.7 billion – its largest increase yet.¹¹ However, as can be seen in the following table, this increase is concentrated in exploration activities, with both the Deep Space Exploration Systems account and the Space Technology Mission Directorate receiving increases of over 40 percent in the request. Other areas would see much smaller increases, while the Science Mission Directorate would see declines across all science programs.

The STEM education and engagement office would again be slated for elimination, with Space Grant, the Established Program to Stimulate Competitive Research (EPSCoR), and the Minority University Research and Education Project all terminated. Congress has saved these repeatedly.

NASA's flagship Moon to Mars campaign, dubbed the Artemis program, would receive an aggregate \$3.5 billion increase above FY 2020 to \$12.4 billion total with the stated goal of returning U.S. astronauts to the moon by 2024. The funding rise in FY 2021 would be distributed throughout the agency, with the Human Exploration and Operations Directorate receiving most of the increase.

As part of the lunar campaign, the Space Technology Mission Directorate would also receive a sizable increase, as seen in the following table (via the Exploration Technology account). The directorate's lunar surface portfolio includes technologies for in-situ resource utilization and construction, surface

power, and lunar dust mitigation. The directorate will also establish a separate \$100 million Space Nuclear Technology portfolio in FY 2021, to develop power and propulsion systems for space exploration. NASA expects to complete testing and initiate a flight demonstration of the Laser Communications Relay Demonstration mission in FY 2021.

With its more modest budget increase in FY 2021, the Aeronautics Research Mission Directorate will continue progress toward the Low-Boom Flight Demonstration, to develop a quiet supersonic aircraft in partnership with Lockheed Martin. The X-59 demonstrator is expected to be delivered to NASA in the 2021 calendar year.

Science Mission Directorate (SMD).

Unsurprisingly, lunar exploration activities are prioritized in the FY 2021 budget request amid an overall funding decline. The Planetary Science Program's lunar program would increase by 50% above its enacted FY 2020 funding to \$452 million in FY 2021. The increase is primarily for commercial services to deliver lunar payloads.

The Trump Administration replicates several controversial proposals from years past, with the recommended cancellation of the PACE and CLARREO Pathfinder earth observation missions, and two astrophysics projects: the Wide Field Infrared Survey Telescope (WFIRST) and the Stratospheric Observatory for Infrared Astronomy (SOFIA). All have been saved in prior Congresses.

Mars exploration funding ramps down as the Mars 2020 rover transitions from development to launch and operation. The James Webb Space Telescope was scheduled to launch in March 2021 but will be delayed due to the

¹¹ NASA budget materials:
<https://www.nasa.gov/news/budget/index.html>

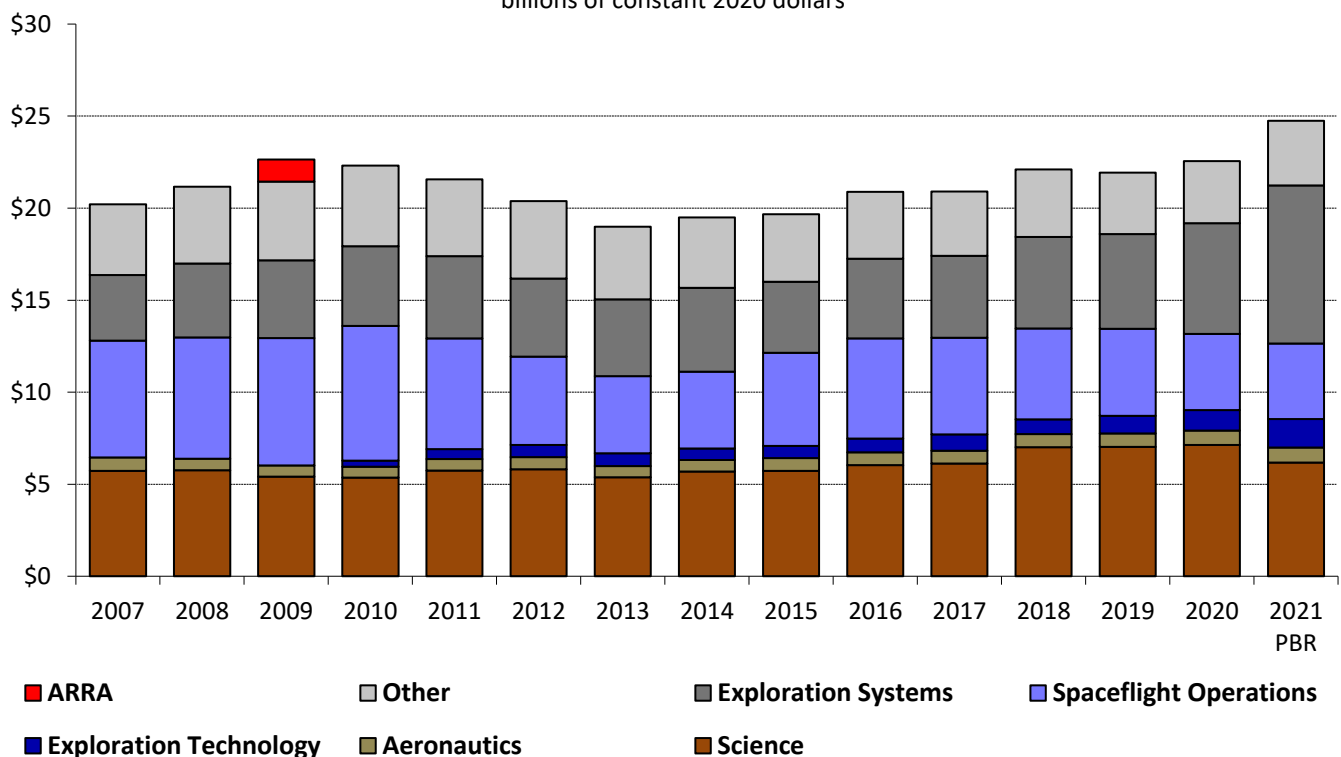
coronavirus emergency. Meanwhile, the Europa Clipper mission will be delayed by one year to 2024 and will be launched via a commercial vehicle, while no funding is provided for a lander, which has been of Congressional interest. The Heliophysics IMAP mission also remains on track for a 2024 launch. New mission selections in FY 2021 will include up to two Planetary Science Discovery missions, a Heliophysics Medium Explorer, and the next Earth Venture Instrument. New opportunity announcements will include a Heliophysics Small Explorer and an Astrophysics Medium Explorer.

Deep Space Exploration Systems. As can be seen in the following table, the Deep Space Exploration Systems account would see a sizable increase. Concentrated in Exploration R&D, this increase provides \$3.4 billion for development of a human lunar landing system,

as well as a 64 percent increase above FY 2020 to \$739 million for the Lunar Gateway.

NASA exploration systems development funding for the Orion crew capsule and the Space Launch System (SLS) heavy lift rocket will ramp down somewhat in FY 2021. The launch date for the Artemis 1 mission, the first crewed flight and integrated test of the Artemis system including Orion and SLS, is currently under review but expected for the 2021 calendar year.

NASA Budgets, FY 2007-FY 2021
billions of constant 2020 dollars



Based on historical and current NASA data. Note program and account names have changed over time. © 2020 AAAS

National Aeronautics and Space Administration

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate*	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Earth Science					
Earth Science Research	454	--	447	--	--
Earth Science Data Systems	202	--	245	--	--
Earth Systematic Missions	933	--	608	--	--
Earth System Science Pathfinder	224	--	339	--	--
Earth Science Technology	63	--	74	--	--
Total Earth Science	1,931	1,972	1,768	-204	-10.3%
Heliophysics					
Heliophysics Research	249	--	231	--	--
Living with a Star	135	--	128	--	--
Solar Terrestrial Probes	181	--	126	--	--
Heliophysics Explorer Program	148	--	148	--	--
Total Heliophysics	713	725	633	-91	-12.6%
Planetary Science					
Mars Exploration	713	570	529	-42	-7.3%
Discovery	410	--	484	--	--
New Frontiers	93	--	179	--	--
Radioisotope Power	123	--	146	--	--
Planetary Science Research	277	--	305	--	--
Outer Planets and Ocean Worlds	794	--	414	--	--
Planetary Defense	150	--	150	--	--
Lunar Discovery and Exploration	188	300	452	152	50.5%
Total Planetary Science	2,747	2,713	2,660	-54	-2.0%
Astrophysics					
Astrophysics Research	223	--	270	--	--
Cosmic Origins	223	--	124	--	--
SOFIA 1/	85	85	12	-73	-85.9%
Hubble Space Telescope	98	--	88	--	--
Physics of the Cosmos	151	--	144	--	--
Exoplanet Exploration	368	--	47	--	--
Astrophysics Explorer	227	--	246	--	--
Total Astrophysics	1,191	1,306	831	-475	-36.4%
James Webb Space Telescope	305	423	415	-8	-2.0%
Total Science	6,887	7,139	6,307	-832	-11.7%
(continued)					

	FY 2019 Actual	FY 2020 Estimate*	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Aeronautics					
Airspace Operations and Safety	106	--	90	--	--
Advanced Air Vehicles	272	--	213	--	--
Integrated Aviation Systems	210	--	269	--	--
Transformative Concepts	137	--	130	--	--
Total Aeronautics	725	784	819	35	4.5%
LEO and Spaceflight Operations					
International Space Station	1,490	--	1,401	--	--
Space and Flight Support	1,000	--	759	--	--
Space Transportation 2/	2,110	--	1,878	--	--
Commercial LEO Development	40	--	150	--	--
Total LEO and Spaceflight Operations	4,640	4,140	4,187	47	1.1%
Deep Space Exploration Systems					
Exploration Systems Development	4,087	4,583	4,042	-540	-11.8%
Orion Program	1,350	1,407	1,401	-6	-0.4%
Space Launch System (SLS)	2,144	2,586	2,257	-329	-12.7%
Ground Systems	593	590	385	-205	-34.8%
Exploration R&D	958	1435	4719	3,284	228.9%
Advanced Exploration Systems	349	245	258	13	5.4%
Total Deep Space Exploration Systems	5,045	6,018	8,762	2,744	45.6%
Exploration Technology					
SBIR/STTR	207	--	403	--	--
Early Stage Innovation and Partnerships	102	--	169	--	--
Technology Maturation	201	--	469	--	--
Technology Demonstration	417	--	537	--	--
Total Exploration Technology	927	1,100	1,578	478	43.5%
STEM Engagement	110	120	0	-120	-100.0%
Safety, Security, Mission Services	2,755	2,913	3,010	97	3.3%
Construction and Environ Compliance	372	373	539	166	44.4%
Inspector General	39	42	44	3	6.0%
NASA Total	21,500	22559	25246	2,687	11.9%
<i>COVID-19 Emergency Funding</i>		<i>60</i>			

*Not all figures are available.

Source: OMB R&D data and agency budget justification. All figures rounded to the nearest million.

1/ Stratospheric Observatory for Infrared Astronomy.

2/ Includes Crew and Cargo Program as well as Commercial Crew Program.

Agency Highlights: Department of Agriculture (USDA)

In FY 2021, the White House again would reduce funding for most USDA research offices and programs, with extramural competitive grants one of the few exceptions, as seen in the following table.¹² Funding for most staff of the Economic Research Service (ERS) and the National Institute of Food and Agriculture (NIFA) is now outside the Washington, D.C. region, following these agencies' relocation to Kansas City in 2019.

The \$23 million decrease below FY 2020 for ERS stems from the discontinuation of research and certain data products related to farm, conservation, and trade policy; returns on investment in agricultural R&D; food consumption and nutrition; food safety, access, and consumer choices; and the prosperity of rural households.

The National Agricultural Statistics Service requests \$10 million for a data and imagery pilot study for enhanced harvest prediction, but reduced funding for the Acreage, Crop Production and Grain Stocks reports and elimination of the fruit chemical use survey.

Agricultural Research Service (ARS). ARS research is funded through the Salaries and Expenses account, which funds research programs on the production and protection of livestock and crops, food safety, human nutrition, and environmental stewardship. All but the Livestock Protection research program would see some funding decline under the FY 2021 request. Livestock Protection, focused on disease detection and response, would receive an extra \$8 million for research associated with the National Bio and Agro-Defense Facility (NBAF), an under-construction research facility

recently brought under USDA stewardship. NBAF would receive a separate amount of \$81 million for operations and maintenance, \$15 million above FY 2020.

The \$1.4 billion budget request eliminates \$109 million in lower-priority research projects across all program areas. The budget also includes \$35 million for new precision agriculture research in automation, data management, artificial intelligence, and excess water and erosion control.

The Buildings and Facilities budget would decline from FY 2020 as several construction projects were fully funded in prior years. The FY 2021 request sets aside \$25 million for renovation of the Beltsville Agricultural Research Center in Maryland and would fund programming and design of other such projects at ARS facilities in Nebraska, Florida, Georgia, and Mississippi.

National Institute of Food and Agriculture (NIFA). As can be seen in the following table, large capacity grant programs like Hatch Act experiment stations, McIntire-Stennis cooperative forestry, and Evans-Allen research grants for minority-serving land grants would all see some declines. The budget request would also eliminate funding for several other smaller research and education topics such as aquaculture and animal disease research.

The sizable increase for the competitive extramural Agriculture and Food Research Initiative (AFRI), \$175 million or 41 percent above FY 2020, includes \$100 million for AI-related research across AFRI program areas. These include Sustainable Agricultural Systems, Foundational and Applied Science, and Education and Workforce Development.

¹² USDA budget materials: <https://www.usda.gov/our-agency/about-usda/budget>

U.S. Department of Agriculture

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Agricultural Research Service (ARS)					
Salaries and Expenses	1,303	1,414	1,368	-46	-3.3%
Buildings and Facilities	381	193	50	-143	-74.1%
Total ARS	1,684	1,607	1,418	-189	-11.8%
National Institute of Food and Agriculture (NIFA)					
Research and Education	928	963	1,068	105	10.9%
Agri Food Res Initiative (AFRI)	415	425	600	175	41.2%
Hatch Act	259	259	243	-16	-6.1%
1890s Research	58	67	54	-13	-19.7%
Cooperative Forestry	36	36	29	-7	-19.8%
Extension Activities	506	527	485	-42	-7.9%
Integrated Activities	38	38	38	0	0.0%
Total NIFA	1,471	1,527	1,591	63	4.2%
Economic Research Service	87	85	62	-23	-26.7%
Nat'l Agricultural Stats Service	175	180	177	-3	-1.6%
Census of Agriculture	45	45	46	1	2.2%
Other Programs	129	135	131	-4	-2.8%
Forest Service 1/					
Forest and Rangeland Research	300	305	249	-56	-18.3%

1/ The Forest Service is funded in the Interior and Environment appropriations bill. Also received \$3 million in emergency COVID-19 spending in FY 2020.

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

Agency Highlights: Department of Commerce

The FY 2021 request for the Commerce Department includes a ramp-down in funding following the 2020 Census.

National Institute of Standards and Technology (NIST). Not for the first time, the White House budget recommends reductions for NIST lab programs, and even larger reductions and terminations for Industrial Technology Services programs.

As can be seen in the following table, most NIST labs and user facilities would see some decline in the President's budget request. The agency's stated lab program priorities in FY 2021 align with the Administration's advanced industry priorities including AI, quantum, advanced manufacturing and communications, biotechnology, and the Internet of Things. The request includes \$27 million "to create measurement tools and testbeds to support deploying, at scale, the technologies that will power the Industries of the Future."

However, this prioritization also comes with across-the-board reductions in every research subprogram. These include \$38 million or 31 percent less for materials measurements and research, including termination of NIST's beam-line partnerships with Brookhaven National Lab; \$18 million or nine percent less for fundamental measurement and calibration activities; \$36 million or 52 percent less for network and data systems activities resulting in termination of multiple IT and data programs; and other terminations in synthetic biology measurements, energy efficiency, and infrastructure resilience.

The budget requests extra Manufacturing USA funding in FY 2021 to establish a new public-private manufacturing innovation institute via an open topic competition. However, the

request again seeks to eliminate the Hollings Manufacturing Extension Partnership.

National Oceanic and Atmospheric Administration (NOAA). As in past years, the White House remains focused on reducing NOAA climate research, as seen in the following table within the Office of Oceanic and Atmospheric Research (OAR). Competitive climate research grants would be eliminated, and arctic and climate research at OAR labs would also be terminated.

Within weather and air chemistry, the multi-state Air Resources Lab and the Vortex-Southeast tornado forecasting project would be closed, while the budget increases support for the Earth Prediction Innovation Center. Funding is requested to establish a Tornado Warning Improvement and Extension Program.

The request again would terminate NOAA's Sea Grant College program, and would reduce funding for ocean exploration grants, the Integrated Ocean Acidification Program, and oceanic monitoring activities.

It would also terminate a supercomputing partnership with Mississippi State University, and other related high-performance computing activities.

The next geostationary weather satellite in the GOES-R series is expected to launch in December 2021, more than 18 months past its original launch date amid technical setbacks. NOAA reports the proposed reduction for polar satellites – which includes Suomi NPP and JPSS – would not affect the launch cadence while the Polar Follow On mission is baselined. The Space Weather Follow On mission, meanwhile, would receive a \$44 million increase to \$108 million total.

Funding for National Ocean Service and National Marine Fisheries Service science programs would also be reduced.

Department of Commerce

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Bureau of the Census	3,821	7,558	1,672	-5,886	-77.9%
Periodic Censuses and Programs	3,551	7,284	1,393	-5,892	-80.9%
National Institute of Standards and Technology (NIST)					
Scientific & Tech Research and Services	725	754	652	-102	-13.5%
Physical Measurement Lab	157	173	160	-13	-7.2%
Material Measurement Lab	122	127	99	-27	-21.6%
Engineering Lab	97	97	78	-19	-19.3%
Information Technology Lab	126	126	117	-9	-6.9%
NIST Center for Neutron Research	47	47	44	-3	-6.7%
Innovation in Measurement Science	22	21	21	1	3.6%
Industrial Technology Services	155	162	25	-137	-84.4%
Manufacturing USA / NNMI	15	16	25	9	57.8%
Manufacturing Extension Partnership	140	146	0	-146	-100.0%
Construction of Research Facilities	106	118	60	-58	-48.9%
NIST Total	986	1,034	738	-296	-28.7%
<i>COVID-19 Emergency Spending</i>		66			
National Oceanic and Atmospheric Administration (NOAA) 1/					
National Ocean Service	680	606	381	-225	-37.2%
National Marine Fisheries Service	906	948	842	-106	-11.2%
Oceanic and Atmospheric Research	568	590	353	-238	-40.3%
Climate Research	158	170	84	-86	-50.5%
Ocean, Coastal, Great Lakes Research	218	229	113	-116	-50.7%
Weather and Air Chemistry Research	139	134	115	-19	-14.1%
High Performance Computing	53	59	41	-17	-29.7%
National Weather Service	1,191	1,169	1,120	-48	-4.1%
NESDIS 2/	1,689	1,513	1,504	-9	-0.6%
GOES-R	407	304	335	30	10.0%
Polar Weather Satellites	869	745	658	-87	-11.7%
Office of Marine and Aviation Ops	323	342	332	-10	-3.0%
<i>COVID-19 Emergency Spending</i>		20			

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

1/ Line office figures include ORF and PAC funding.

2/ National Environmental Satellite, Data, and Information Service

Other Select Agency Highlights

Tables for the Environmental Protection Agency, the U.S. Geological Survey, the Department of Homeland Security, and the Department of Veterans Affairs follow this section.

Environmental Protection Agency (EPA). As seen in the following FY 2021 EPA table, the White House would again dramatically reduce the EPA science and technology budget, which is the primary funding account for EPA's assorted research programs. This year's request includes terminated funding for the Science to Achieve Results (STAR) Program, and for EPA climate change research (in the Air and Energy research area). Lead exposure issues and PFAS research would see some modest increases, but these would be more than offset by reductions elsewhere.

Within the Clean Air program area, the budget would eliminate EPA's Atmospheric Protection Program, which is responsible for ensuring compliance with federal vehicle emissions and fuel economy standards.

In Safe and Sustainable Water research, several other areas would see streamlining and reduction including technical support, translation of nutrient modeling and monitoring data, water system and treatment technology, monitoring technology, and other topics.

In the Sustainable Communities area, the request would eliminate support for the Ecotox database and EPA's indicator-focused Report on the Environment (ROE) and reduce provision of web-based tools like EnviroAtlas.

The request also reduces funding for the Health and Environmental Risk Assessment research program, development of high-throughput toxicity testing and methods of chemical evaluation, and other topics.

U.S. Geological Survey (USGS). The White House request for USGS recommends an agency restructuring. Under the new approach, if accepted by Congress, the Land Resources mission area's National Land Imaging Program to the Core Science Systems mission area, while climate research and the Climate Adaptation Science Centers would move into a restructured Ecosystems mission area. Climate research would be reduced by \$37 million or 64 percent below FY 2020 levels, while land imaging would be reduced by \$21 million or 20 percent. Land Resources would cease to exist as a separate mission area (seen in the following USGS table).

Similarly, Environmental Health activities, which cover the Contaminant Biology and Toxic Substances Hydrology programs, would also be folded into the Ecosystems mission area. Relevant Ecosystems funding for species research reduced by \$37 million or 48 percent.

Energy and mineral resources programs would remain essentially flat, as would the National Geospatial Program. The National Cooperative Geologic Mapping Program would be reduced as the Trump Administration has not requested funds for Phase 3 of the National Geologic Map Database project.

Most of the Natural Hazards mission area reduction, seen in the following table, is via a \$25 million funding reduction for earthquake hazards, which in turn is due to a \$17 million reduction in support for the ShakeAlert program. Volcano, landslide, and coastal and marine hazard programs would all see reductions of roughly nine to ten percent.

In a restructured Water Resources mission area, funding would be reduced for both water availability and observing systems, each cutting across several project areas. The administration requests no funding for the Water Resources

Research Act program, funded at \$10 million in FY 2020.

Department of Homeland Security (DHS). As seen in following table, in FY 2021 the Science & Technology Directorate (S&T) seeks to prioritize the Innovative Research and Foundational Tools thrust, which pursues gap analyses to develop and provide priority tools for other DHS components. In FY 2021 the thrust would increase funding for technology centers and partnerships, establishing and consolidating programs in advanced computing, threat detection and prediction, and innovative systems.

Several other research areas in the remaining thrusts would be reduced, however. These include ground, maritime, and port of entry border technologies; canine explosive detection; homemade explosive detection; biothreat characterization; and natural disaster resiliency.

The FY 2021 request halves support for the university-based Centers of Excellence program to \$18.4 million, thereby reducing the number of supported centers from ten to five.

The decline in S&T Mission Support seen in the following DHS table is due to the transfer of Working Capital Fund activities out of S&T to the DHS Management Directorate.

The FY 2021 request continues to support construction of the nearly complete National Bio and Agro-Defense Facility (NBAF), which will transfer to the Department of Agriculture upon completion, and the closure of NBAF's predecessor, the Plum Island Animal Disease Center. DHS requests \$19 million in FY 2021 for the Plum Island facility closure and sale, while NBAF construction was fully funded in prior years' appropriations.

Within the Countering WMD Office, support for technical nuclear forensics (\$7 million in FY

2020) is shifted out of DHS and to the National Nuclear Security Administration in FY 2021. The Detection Capability Development program, which focuses on late-stage technology, would be reduced by \$8.7 million with funding for a handful of projects reduced or ended. The Transformational R&D program – which funds basic and applied research into CBRN threat detection and analytics – would receive an additional \$2.8 million in FY 2021.

Cybersecurity and Infrastructure Security Agency R&D declines as support for the Technology Development and Deployment Program and the National Infrastructure Simulation and Analysis Center is reduced.

Department of Veterans Affairs (VA). With a 4.9 percent funding increase requested in FY 2021, priorities for VA health research include exoskeleton use; reduced uses of canines in research; prosthetic needs for women veterans; and increased public access to VA-funded research and data.

Environmental Protection Agency

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Science and Technology	695	716	485	-232	-32.3%
Clean Air	120	116	90	-26	-22.1%
Homeland Security	29	33	34	1	2.1%
Air and Energy	86	94	34	-61	-64.5%
Safe and Sustainable Water	100	111	79	-32	-28.8%
Sustainable Communities	135	132	59	-74	-55.8%
Chem Safety and Sustainability	124	126	92	-35	-27.4%
Superfund	1,210	1,185	1,079	-106	-9.0%
Research: Chemical Safety	3	13	6	-7	-52.0%
Research: Sustainable Communities	11	16	11	-5	-30.5%
Oil Spill Response	17	20	17	-3	-15.1%
Research: Sustainable Communities	1	1	1	0	-21.4%
Leaking Underground Storage Tanks	98	92	48	-44	-47.6%
Environmental Programs and Mgmt.	2,596	2,663	2,236	-427	-16.0%
State and Tribal Assistance Grants	4,069	4,246	2,848	-1,398	-32.9%
Buildings and Facilities	27	34	40	6	17.7%
Inspector General	40	41	40	-2	-4.0%
Total Budget	8,800	9,057	6,658	-2,399	-26.5%
<i>COVID-19 Emergency Spending</i>		2			

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

Figures rounded to nearest million. Changes calculated from unrounded figures.

U.S. Geological Survey

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Budget	Change FY 20-21	
				Amount	Percent
Ecosystems	229	252	127	-124	-49.4%
Land Resources 1/	0	0	0	0	- -
Energy and Minerals	89	90	91	1	1.3%
Natural Hazards	166	171	138	-33	-19.2%
Water Resources	226	234	181	-53	-22.8%
Core Science Systems	227	247	212	-35	-14.0%
Science Support	103	97	94	-3	-2.7%
Facilities	120	181	128	-53	-29.4%
Total Budget	1,161	1,271	971	-300	-23.6%

1/ Renamed from Climate and Land Use Change; eliminated in requested FY 2021 restructuring.

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

Figures rounded to nearest million. Changes calculated from unrounded figures.

Department of Homeland Security

(budget authority in millions of dollars)

	FY 2019	FY 2020	FY 2021	Change FY 20-21	
	Actual	Estimate	Budget	Amount	Percent
Science & Technology Directorate	820	737	644	-94	-12.7%
Operations and Support	309	315	285	-30	-9.6%
Mission Support	138	144	108	-35	-24.6%
Lab Facilities	122	123	123	0	0.3%
Acquisition and Ops Analysis	49	49	53	5	10.2%
Research and Development	511	422	340	-82	-19.5%
Research, Dev, and Innovation	471	382	318	-64	-16.7%
Foundational Tools	66	55	75	19	35.2%
Border Security	119	114	90	-25	-21.5%
Chem/Bio/Explosives	74	67	45	-22	-32.4%
Counterterrorism	48	45	31	-13	-29.8%
Cybersecurity	71	30	24	-5	-18.3%
Disaster Resilience	93	72	53	-18	-25.3%
University Programs	41	41	22	-19	-46.3%
Countering WMD Office	435	432	377	-55	-12.8%
Operations and Support	187	179	173	-7	-3.7%
Procurement and Construction	100	119	87	-32	-26.5%
Research and Development	83	69	58	-11	-15.9%
Federal Assistance	65	65	59	-6	-9.3%
Other					
Coast Guard: RDT&E	20	5	5	0	6.6%
Secret Service: R&D	3	12	12	-1	-4.2%
Cybersecurity and Infrastructure					
Security Agency (CISA) R&D	13	14	6	-8	-55.4%
Transp. Security Agency (TSA) R&D	21	23	30	7	28.9%

Source: OMB R&D data and agency budget justification.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

Department of Veterans Affairs

(budget authority in millions of dollars)

	FY 2019	FY 2020	FY 2021	Change FY 20-21	
	Actual	Estimate	Budget	Amount	Percent
Medical and Prosthetic Research	779	750	787	37	4.9%
Biomedical Laboratory Science	215	191	209	18	9.6%
Clinical Science	73	73	85	12	15.7%
Health Services	110	118	125	7	5.6%
Rehabilitation	106	105	106	0	0.5%
Coop Studies	86	88	90	2	1.8%
Million Veterans Program (MVP)	84	83	83	0	0.1%
DOE Big Data Initiative	27	--	--	--	--
Research Administration	78	92	90	-1	-1.6%

Source: OMB R&D data, agency budget documents, and appropriations bills and reports.

All figures rounded to the nearest million. Changes calculated from unrounded figures.

Appendix: Total R&D in the White House Request by Agency

(estimated budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense*	55,905	65,750	60,869	-4,881	-7.4%
S&T (6.1-6.3)	15,317	16,062	14,070	-1,991	-12.4%
All Other DOD	40,588	49,688	46,798	-2,890	-5.8%
Health and Human Services	38,459	40,750	37,825	-2,926	-7.2%
National Institutes of Health	37,094	39,485	36,915	-2,571	-6.5%
All Other HHS	1,365	1,265	910	-355	-28.1%
Energy	18,223	19,217	16,793	-2,424	-12.6%
Atomic Energy Defense	7,306	7,752	8,627	875	11.3%
Office of Science	6,517	6,923	5,760	-1,163	-16.8%
Energy Programs	4,400	4,542	2,406	-2,136	-47.0%
NASA	10,698	14,057	13,334	-723	-5.1%
National Science Foundation	6,648	6,752	6,327	-425	-6.3%
Agriculture	3,025	2,940	2,769	-171	-5.8%
Commerce	1,957	1,940	1,498	-442	-22.8%
NOAA	1,064	972	670	-302	-31.0%
NIST	763	805	652	-153	-19.0%
Transportation	1,033	1,097	590	-506	-46.2%
Homeland Security	600	534	462	-72	-13.5%
Veterans Affairs	1,370	1,313	1,351	38	2.9%
Interior	958	974	726	-248	-25.5%
US Geological Survey	640	661	461	-200	-30.3%
Environ Protection Agency	489	492	318	-174	-35.4%
Others	1,830	1,250	1,041	-209	-16.7%
Total R&D	141,196	157,066	143,902	-13,164	-8.4%
Defense R&D**	63,224	73,517	69,502	-4,015	-5.5%
Nondefense R&D	77,972	83,549	74,400	-9,150	-11.0%
By Type					
Basic Research	39,394	43,405	40,623	-2,782	-6.4%
Applied Research	45,673	46,872	40,469	-6,403	-13.7%
Development	60,551	67,773	65,968	-1,805	-2.7%
Facilities & Equipment	4,358	6,004	3,817	-2,187	-36.4%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

*Defense Dept. R&D is converted from total obligational authority.

**Includes Dept. of Defense, National Nuclear Security Administration, and DHS Cybersecurity and Infrastructure Security Agency.

FY 2021 Basic Research by Agency

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense	2,481	2,607	2,323	-284	-10.9%
Health and Human Services	19,056	20,457	19,128	-1,329	-6.5%
National Institutes of Health	18,994	20,352	19,023	-1,329	-6.5%
All Other HHS	62	105	105	0	0.0%
Energy	5,145	5,514	5,480	-34	-0.6%
Atomic Energy Defense	132	139	172	33	23.6%
Office of Science	4,965	5,325	4,734	-591	-11.1%
Energy Programs	49	51	575	524	1032.5%
NASA	4,948	6,880	6,110	-770	-11.2%
National Science Foundation	5,212	5,322	5,018	-304	-5.7%
Agriculture	1,213	1,264	1,256	-8	-0.6%
Commerce	233	242	208	-34	-14.0%
NIST	233	242	208	-34	-14.0%
Transportation	0	16	18	2	12.5%
Homeland Security	42	47	27	-20	-42.6%
Veterans Affairs	600	559	576	17	3.0%
Interior	80	82	65	-18	-21.5%
Education	60	70	70	0	0.0%
Smithsonian	269	276	281	5	1.8%
Justice	10	10	10	0	0.0%
Housing and Urban Dev	42	54	50	-4	-7.4%
Corps of Engineers	2	2	1	-1	-50.0%
Appalachian Regional Comm.	2	2	2	0	0.0%
Total Basic Research	39,394	43,405	40,623	-2,782	-6.4%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

FY 2021 Applied Research by Agency

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense	8,892	9,297	6,784	-2,514	-27.0%
Health and Human Services	19,084	19,993	18,311	-1,682	-8.4%
National Institutes of Health	17,883	18,903	17,576	-1,327	-7.0%
All Other HHS	1,201	1,090	735	-355	-32.6%
Energy	8,252	8,351	6,937	-1,414	-16.9%
Atomic Energy Defense	5,030	5,464	5,754	291	5.3%
Energy Programs	3,222	2,887	1,183	-1,704	-59.0%
NASA	2,743	3,002	3,409	407	13.6%
National Science Foundation	784	807	787	-20	-2.5%
Agriculture	1,125	1,154	1,150	-4	-0.3%
Commerce	979	1,037	801	-236	-22.7%
NOAA	542	576	379	-197	-34.3%
NIST	384	393	337	-57	-14.4%
Transportation	684	710	321	-389	-54.7%
Homeland Security	203	165	71	-94	-57.0%
Veterans Affairs	738	725	745	20	2.8%
Interior	710	717	533	-184	-25.6%
US Geological Survey	459	476	323	-153	-32.1%
Environ Protection Agency	415	416	250	-166	-39.9%
Education	118	126	117	-9	-7.1%
Intl Assistance Programs	130	120	10	-110	-91.7%
Patient-Centered Outcomes Res	563	0	0	0	-
Justice	6	6	6	0	0.0%
Nuclear Reg Comm	63	69	75	6	8.7%
State	40	40	40	0	0.0%
Housing and Urban Dev	22	14	18	4	28.6%
Social Security	101	101	86	-15	-14.9%
Tennessee Valley Authority	6	6	6	0	0.0%
Corps of Engineers	15	14	10	-4	-28.6%
Consumer Prod Safety Comm	1	1	1	0	0.0%
Total Applied Research	45,673	46,872	40,469	-6,403	-13.7%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

FY 2021 Total Research by Agency

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense	11,373	11,905	9,107	-2,798	-23.5%
Health and Human Services	38,140	40,450	37,440	-3,011	-7.4%
National Institutes of Health	36,877	39,255	36,600	-2,656	-6.8%
All Other HHS	1,263	1,195	840	-355	-29.7%
Energy	13,397	13,865	12,417	-1,448	-10.4%
Atomic Energy Defense	5,162	5,602	5,926	323	5.8%
Office of Science	4,965	5,325	4,734	-591	-11.1%
Energy Programs	3,270	2,938	1,757	-1,181	-40.2%
NASA	7,691	9,882	9,519	-363	-3.7%
National Science Foundation	5,996	6,129	5,804	-325	-5.3%
Agriculture	2,338	2,418	2,406	-12	-0.5%
Commerce	1,211	1,279	1,010	-270	-21.1%
NOAA	542	576	379	-197	-34.3%
NIST	616	636	545	-90	-14.2%
Transportation	684	726	339	-387	-53.3%
Homeland Security	245	212	98	-114	-53.8%
Veterans Affairs	1,338	1,284	1,321	37	2.9%
Interior	790	800	598	-202	-25.2%
US Geological Survey	459	476	323	-153	-32.1%
Environ Protection Agency	415	416	250	-166	-39.9%
Education	178	196	187	-9	-4.6%
Smithsonian	269	276	281	5	1.8%
Intl Assistance Programs	130	120	10	-110	-91.7%
Patient-Centered Outcomes Res	563	0	0	0	- -
Justice	16	16	16	0	0.0%
Nuclear Reg Comm	63	69	75	6	8.7%
State	40	40	40	0	0.0%
Housing and Urban Dev	64	68	68	0	0.0%
Social Security	101	101	86	-15	-14.9%
Tennessee Valley Authority	6	6	6	0	0.0%
Corps of Engineers	17	16	11	-5	-31.3%
Consumer Prod Safety Comm	1	1	1	0	0.0%
Appalachian Regional Comm	2	2	2	0	0.0%
Total Research	85,067	90,277	81,092	-9,185	-10.2%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

FY 2021 Development by Agency

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense	53,290	58,981	58,738	-243	-0.4%
Health and Human Services	76	35	35	0	0.0%
All Other HHS	76	35	35	0	0.0%
Energy	2,625	2,981	2,061	-919	-30.8%
Atomic Energy Defense	1,535	1,519	1,777	258	17.0%
Energy Programs	1,089	1,462	284	-1,177	-80.6%
NASA	2,890	4,121	3,767	-354	-8.6%
Agriculture	165	176	172	-4	-2.3%
Commerce	263	264	199	-65	-24.7%
NOAA	177	150	95	-55	-36.6%
NIST	9	20	15	-5	-23.3%
Transportation	310	332	220	-112	-33.6%
Homeland Security	355	322	341	19	5.9%
Veterans Affairs	32	29	30	1	3.4%
Interior	162	172	126	-46	-26.8%
Environ Protection Agency	74	76	68	-8	-10.5%
Others	309	285	211	-74	-26.0%
Education	70	63	43	-20	-31.7%
Intl Assistance Programs	45	46	3	-43	-93.5%
Justice	34	13	13	0	0.0%
State	20	20	20	0	0.0%
Tennessee Valley Authority	4	2	1	-1	-50.0%
Postal Service	27	27	27	0	0.0%
Corps of Engineers	15	14	10	-4	-28.6%
Appalachian Regional Comm	94	100	94	-6	-6.0%
Total Development	60,551	67,773	65,968	-1,805	-2.7%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

FY 2021 R&D Equipment and Facilities by Agency

(budget authority in millions of dollars)

	FY 2019 Actual	FY 2020 Estimate	FY 2021 Request	FY20 Change	
				Amount	Percent
Defense	22	1,853	0	-1,853	-100.0%
Health and Human Services	243	265	350	85	32.1%
National Institutes of Health	217	230	315	85	37.0%
All Other HHS	26	35	35	0	0.0%
Energy	2,201	2,371	2,314	-57	-2.4%
Atomic Energy Defense	608	631	924	293	46.4%
Office of Science	1,552	1,598	1,026	-572	-35.8%
Energy Programs	41	142	364	222	156.2%
NASA	117	54	48	-6	-11.1%
National Science Foundation	652	623	523	-101	-16.2%
Agriculture	522	347	191	-156	-44.9%
Commerce	483	396	289	-107	-27.1%
NOAA	345	247	197	-50	-20.1%
NIST	138	150	92	-58	-38.6%
Transportation	40	39	31	-8	-20.9%
Homeland Security	0	0	23	23	--
Interior	6	2	2	0	0.0%
Smithsonian	70	54	47	-7	-13.0%
Justice	1	0	0	0	--
Total R&D Equip. and Facilities	4,358	6,004	3,817	-2,187	-36.4%

Source: OMB R&D data, agency budget justifications, and other agency documents and data.

Does not include emergency FY 2020 or amended FY 2021 spending for COVID-19.

Note: The projected GDP inflation rate between FY 2020 and FY 2021 is 2.0 percent.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.