AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

AAAS

GUIDE TO THE PRESIDENT'S BUDGET

Research & Development FY 2018

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Matt Hourihan and David Parkes
AAAS R&D Budget and Policy Program

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PREFACE

Welcome to the 42nd edition of AAAS' annual report on research and development in the President's proposed budget. Since 1976, AAAS has published this series to provide timely, accurate information and analysis to policymakers and the scientific and engineering communities. The report was originally created under the auspices of the AAAS Committee on Science, Engineering and Public Policy (see Appendix 4).

The organization of this report is straightforward. We begin with an overview of spending levels and priorities in the President's FY 2018 budget, issued in full on May 23, 2017. We then present brief summaries of R&D budget submissions for some of the largest R&D departments and agencies. We also include data tables for these agencies, and the report concludes with appendices on the federal budget process, methodology and definitions, along with additional data tables.

The timing of this year's report – and, indeed, the budget cycle – is rather unusual. With the presidential transition, the President's budget was not released until late May, a late date even for a transition year. Further, Congress began introducing appropriations a matter of weeks later, and has made rapid progress since. Most R&D spending proposals in the President's budget have been rejected. We thus offer this somewhat abbreviated report only as a historical record.

We're grateful for contributions from Joanne Carney, Sean Gallagher and Josh Shiode to this report. Lastly, we are very grateful to individuals in the White House Office of Management and Budget, in agency budget offices, on congressional staffs and elsewhere who aided us in collecting the information and advised us on its interpretation.

Matt Hourihan

July 2017

INTRODUCTION AND CONTEXT

When President Donald Trump stunned the political world with a surprise victory in November 2016, the victory came with no clear positions on matters of science and technology funding – and, indeed, somewhat limited fiscal detail in general, especially regarding discretionary spending.[1] On the campaign trail, candidate Trump did float the idea of a "penny plan" to reduce federal agency spending,[2] while favoring some level of infrastructure investment. On science-specific questions, Trump seemed to favor NASA's exploration mission while stopping short of pledging robust funding; on the other hand, he referred to the National Institutes of Health (NIH) as "terrible."

Some clarity emerged regarding the new administration's intentions with President Trump's selection of Rep. Mick Mulvaney, R-S.C., to serve as Office of Management and Budget director. In his time on Capitol Hill, Mulvaney developed a reputation as a staunch foe of federal spending and was co-founder of the fiscally conservative House Freedom Caucus.[3] In addition, the conservative Heritage Foundation, which has regularly advocated for sharp cuts to many federal science and technology programs, also played a big role in the presidential campaign and transition.[4]

While signs increasingly pointed to a difficult FY 2018 budget for science, the budget that was finally revealed – first through release of a budget blueprint in March, followed by the full detailed request in late May – stunned many in the science and engineering community. In the aggregate, the White House's proposed funding reductions for scientific research were the largest of any administration in at least 40 years. Some elements of the budget might have been predicted: Certainly a scaling back of federal climate research programs was expected, given administration rhetoric. The administration also emphasized reductions in federal technology programs in energy and manufacturing. But particularly surprising was the administration's targeting of basic science programs at agencies like the NIH and the Department of Energy Office of Science. While fiscal conservatives have often been critical of federal environmental science programs (which can underpin regulatory efforts) and federal technology programs (which they argue can lead to waste or industrial favoritism), basic discovery science has long been more widely regarded as an appropriate function for government.[5] By targeting discovery science, the FY 2018 budget thus charted new ideological territory in the Oval Office.

Of course, as with any presidential budget, the real question is not what it proposes, but what Congress thinks of it. While one would expect Democrats to reject the budget, as they did, the early reaction from many congressional Republicans was similarly negative.[6] Not long after the release of the March blueprint, Congress largely rejected the administration's call for immediate cuts in FY 2017 spending and instead passed an omnibus with targeted science program increases.[7] At the time of this writing, the House of Representatives had already begun unveiling FY 2018 appropriations bills with mixed increases and decreases for assorted science and technology programs – a very different course than the deep cuts envisioned by the administration. While these early signs suggest Congress will ultimately carve out its own take on science funding for FY 2018, two major X factors remain: the lack of agreement on ultimate discretionary spending levels, and the presidential veto.

[1] http://www.crfb.org/papers/promises-and-price-tags-fiscal-guide-2016-election
[2] https://www.bloomberg.com/news/articles/2016-08-09/ Trump-revisits-penny-plan-after-campaign-floats-2-trillion-in-tax-cuts
[3] https://www.aaas.org/news/notes-president-elect- Trump-s-pick-budget-director
[4] https://www.washingtonpost.com/news/wonk/wp/2017/03/27/ Trumps-budget-owes-a-huge-debt-to-this-right-wing-washington-think-tank/?utm_term=.59837586c29a
[5] https://www.aaas.org/news/ Trump-administrations-science-budget-toughest-apollo
[6] https://www.washingtonpost.com/powerpost/capitol-hill-republicans-not-on-board-with- Trump-budget/2017/03/16/9952d63e-0a6b-11e7-b77c-0047d15a24e0_story.html?utm_term=.52101d009516
[7] https://www.aaas.org/news/congress-rejects-white-house-approach-pursues-targeted-science-technology-boosts

THE FY 2018 BUDGET: AN OVERVIEW

See Figure 1 and appendix Tables A-2 and A-3 for overall budget totals. On the discretionary front, the White House proposes very large reductions to the nondefense discretionary spending cap in FY 2018, cutting that portion of the budget by $54 billion or 10.9 percent below FY 2017 levels in order to boost defense spending (see Figure 2 and Figure 3). The White House budget would continue cutting nondefense spending beyond FY 2018 by over 2 percent annually before inflation. As a result, the nondefense discretionary budget in 2027 would be 41.9 percent less than in 2017, adjusted for purchasing power. Over the decade, total nondefense spending would decline by 29 percent in the aggregate. This would take nondefense discretionary spending into uncharted territory, pushing it below 2 percent of U.S. GDP for the first time in at least half a century (Figure 4).

This matters for R&D funding because every science and technology agency and program outside the Department of Defense and the National Nuclear Security Administration is housed in the nondefense budget. Most programs generally move in accord with this budget: When it declines, most science agencies decline to varying degrees, and the same is true when it increases.[8] Bringing the nondefense budget to the historically low levels proposed would almost certainly have substantial ripple effects on even popular science programs.

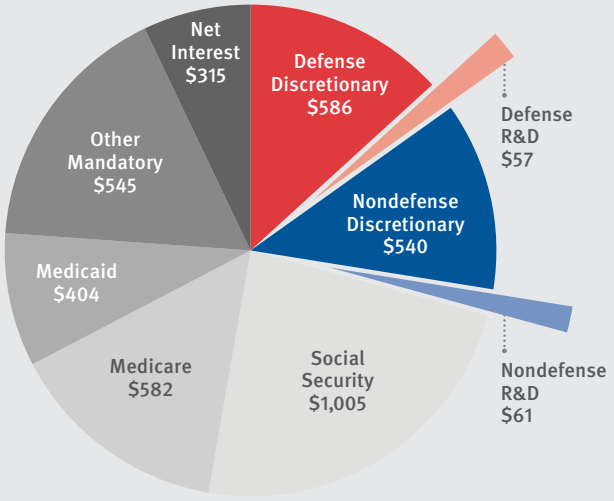
R&D IN THE REQUEST

In accord with these shifts away from nondefense to defense, the White House budget proposes a major increase for defense R&D coupled with a steep cut to research activities, primarily funded through nondefense dollars (Figure 5). Appendix Table A-5 contains the R&D breakdown by character. Of particular note are the reductions in nondefense basic and applied research of over 17 percent each, larger than any administration has proposed in over 40 years.

Under these reductions, total federal R&D would drop to 0.76 percent of gross domestic product, whereas research funding specifically would drop to 0.31 percent of GDP. Both metrics would represent 40-year lows.

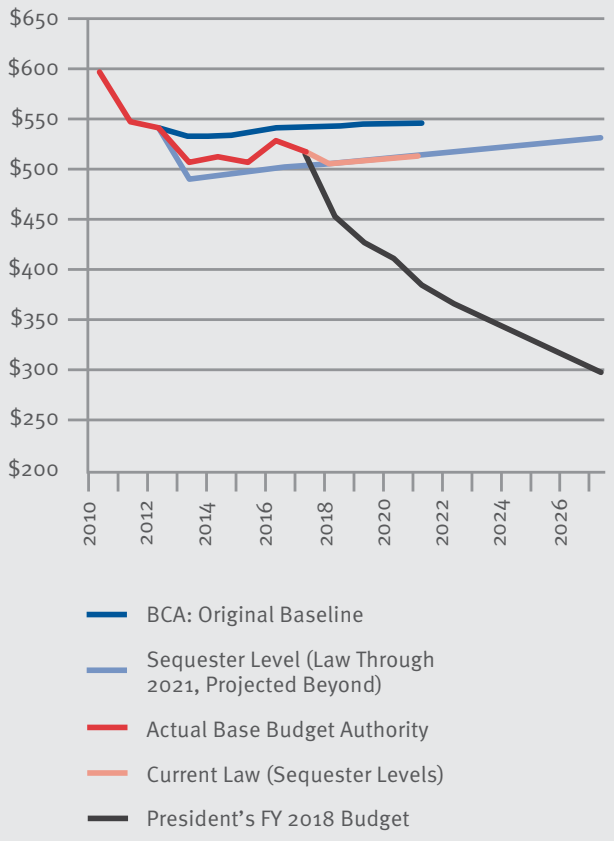
[8] https://www.aaas.org/news/federal-rd-budget-trends-summary

Figure 1: Composition of the FY 2018 Budget
Total Outlays = $4.1 trillion
(outlays in billions of dollars)



Source: Budget of the United States Government FY 2018. © 2017 AAAS

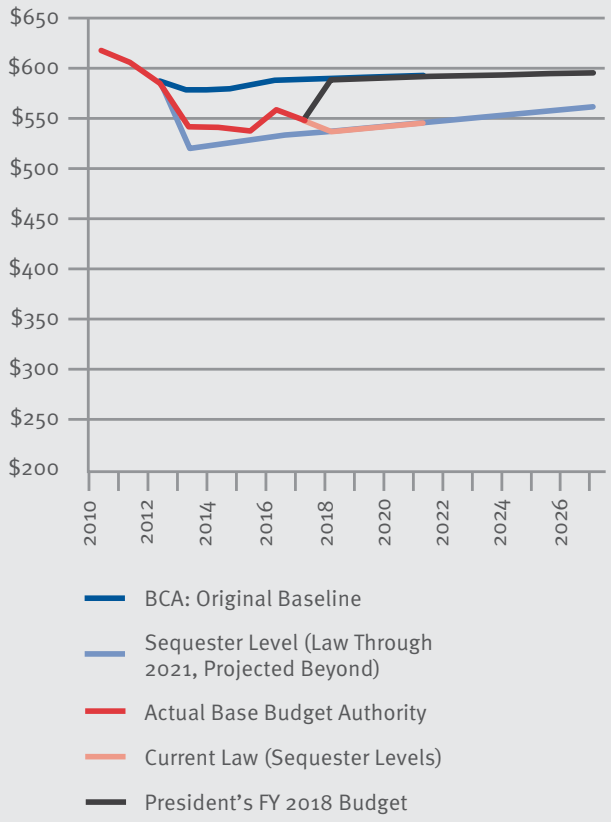
Figure 2: Limits on Nondefense Spending in the FY 2018 Request
(billions of constant 2017 dollars)



Based on past budget resolutions, the Budget Control Act and subsequent legislation. © AAAS 2017

Figure 3: Limits on Defense Spending in the FY 2018 Request

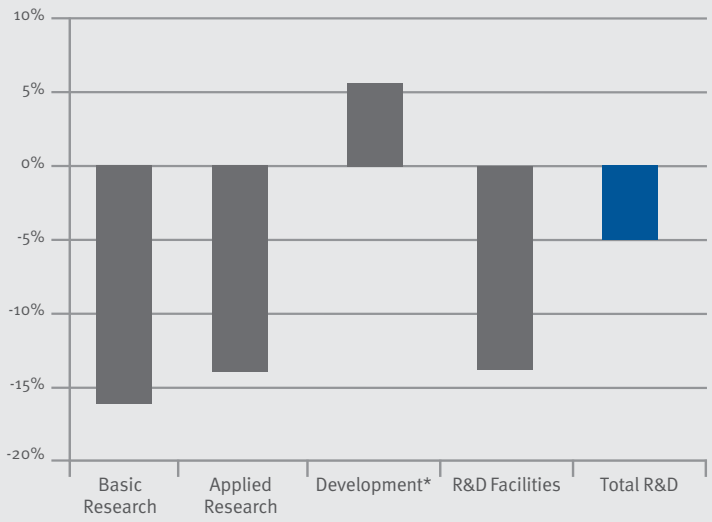
(billions of constant 2017 dollars)



Based on past budget resolutions, the Budget Control Act and subsequent legislation. © AAAS 2017

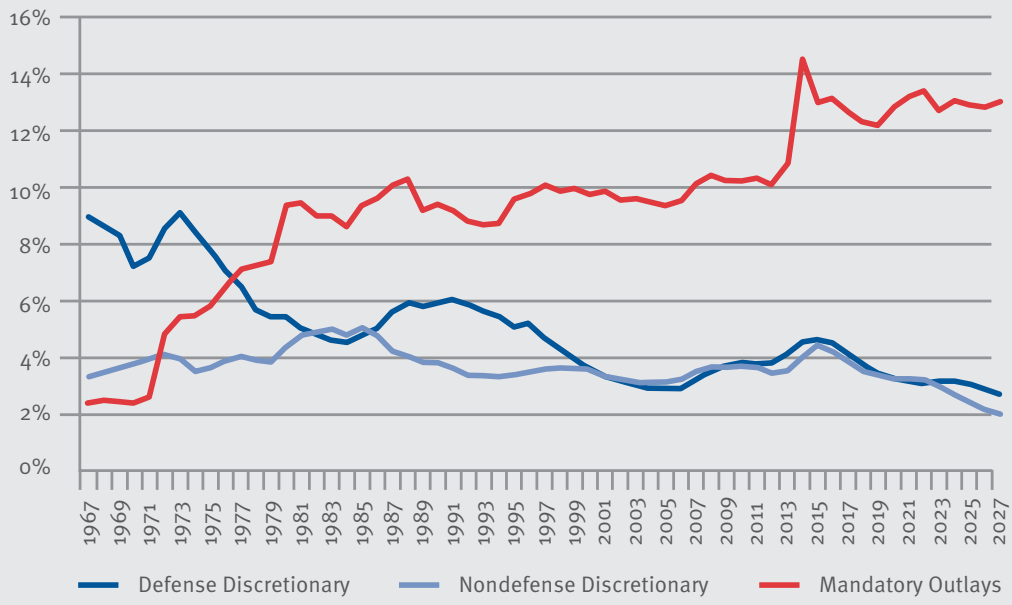
Figure 5: R&D by Character in the FY 2018 Request

(percent change from estimated R&D in the FY 2017 omnibus, nominal dollars)



**Using old definition, including DOD 6.7 account as R&D. Based on OMB data from the request and AAAS estimates of R&D in the FY 2017 omnibus. © 2017 AAAS*

Figure 4: Federal Outlays as a Share of GDP



Source: Budget of the United States Government, FY 2018. © 2017 AAAS

DEPARTMENT OF DEFENSE SCIENCE & TECHNOLOGY

While the administration proposes a $54 billion increase in the base defense spending cap – and an additional $65 billion in overseas defense funding outside the cap – much of this increase would not filter down to DOD's science and technology accounts, which cover basic and applied research and early-stage technology activities (S&T; the "6.1" through "6.3" accounts in the DOD nomenclature). Even with a base defense spending increase of 9.4 percent, S&T programs would decline by approximately 5.4 percent below funding levels enacted in the FY 2017 omnibus, though this is also a 3.5 percent increase above FY 2016 levels (see Tables I-2 through I-5 for DOD figures).

Reductions in applied research and advanced technology across most military departments are the biggest drivers of this overall decline, although basic science would also decline by 2.1 percent. This latter reduction is achieved largely through cuts to intramural and extramural basic science activities, including university and industry programs, under the Army and Air Force. The Army would also see a 27.1 percent reduction to applied research below omnibus levels. On the other end of the spectrum, the Defense Advanced Research Projects Agency (DARPA) would receive an approximate 9.7 percent increase above FY 2017 enacted levels, with assorted boosts for electronics, space technology and other programs.

Elsewhere, the Department of Defense's Third Offset Strategy – a touted effort initiated under President Barack Obama to maintain and accelerate superiority in advanced technology areas like hypersonics and human-machine collaboration – makes scant appearance in this year's budget request, even though Deputy Defense Secretary Bob Work, a key architect of the strategy in the prior administration, has so far stayed on at the Pentagon.[9] Still, certain elements of that strategy, which is more focused on later-stage technology than early-stage research, would receive some plus-ups – including DOD's Strategic Capabilities Office, which would receive a more than 30 percent increase. Other Obama-era initiatives fared somewhat differently in the request. The Defense Innovation Unit Experimental (DIUx), a new office established to build bridges with innovators in Silicon Valley and elsewhere, would receive $54 million, moderately above last year's request. On the other hand, funding for DOD's eight manufacturing innovation institutes would decline by approximately 18 percent below FY 2017 levels.

In inflation-adjusted dollars, the FY 2018 request would leave DOD science and technology (excluding medical research) 0.4 percent below FY 2016 funding levels. Congress will likely add several hundred million dollars for peer-reviewed medical research to the defense health budget, as it does every year.

[9] https://www.dodbuzz.com/2017/01/16/pentagon-deputy-stay-job-transition/

NATIONAL INSTITUTES OF HEALTH

Following a $2 billion increase for NIH in the 2017 omnibus, the FY 2018 request would allocate only $26.9 billion for the agency, representing a 21.5 percent reduction below omnibus levels. As seen in Table I-6, most individual institutes would receive reductions on the order of 22-23 percent. The National Institute on Aging would receive a 36.4 percent reduction below 2017 levels, owing to a large 2017 increase for Alzheimer's research in the omnibus. On the other end of the spectrum, the National Library of Medicine would receive an 8.3 percent reduction, with some databases, services and outreach programs for access and training scaled back. In the aggregate, these reductions represent the toughest NIH budget proposed by any administration in over 40 years, and would return the NIH budget nearly to its pre-doubling level in constant dollars. As part of the effort to control costs, NIH is also proposing an agency-wide cap of 10 percent on indirect costs. The administration believes this will lead to more efficient spending by ensuring a greater share of dollars go to research activities rather than overhead, while many outside government fear such a cap would make NIH-funded research unaffordable for some performers, and exceedingly costly for most.

These spending changes would also come with some major structural changes. The Fogarty International Center, a hub for international research activities, would be eliminated, with certain activities amounting to $25 million of its $72 million budget folded into the NIH Director's Office going forward. According to the Fogarty budget justification, these would be limited to NIH visa and passport services, and certain foreign and intra-agency partnerships and collaborations. The elimination of Fogarty makes room for the consolidation of the Agency for Healthcare Research and Quality (AHRQ) within NIH. Renamed the National Institute for Research on Safety and Quality (NIRSQ), the new institute would receive a 12.5 percent reduction from FY 2017 spending from all sources as a separate agency, with several programs eliminated. The new institute would reduce support for the U.S. Preventive Services Task Force and for investigator-initiated grants, while moderately increasing support for the Medical Expenditure Panel Survey and patient safety research above 2017 omnibus levels. It would zero out the AHRQ/NIRSQ health IT portfolio.

Naturally, the overall cuts for NIH would mean sizable reductions in funding awards, as seen in Table I-7. NIH-wide, competing research awards in 2018 would decline by over 1,600, or at least 18 percent. Most other funding mechanisms would also see double-digit reductions. Bear in mind, the official mechanism figures for FY 2017 don't actually reflect the increase NIH received in the omnibus, as the May omnibus happened too late to be factored into the executive branch budget process. Instead, like other agencies, NIH assumed a full-year continuing resolution as its FY 2017 baseline. That means the number of awards to be issued in FY 2017 will be larger than predicted, and thus the actual reductions proposed in FY 2018 from FY 2017 levels are in reality larger than those shown in these initial figures.

Under the FY 2018 request, NIH also projects a success rate of 13.7 percent in FY 2018, the lowest funding rate since at least 1970.

In most years, individual NIH institutes provide more detailed breakdowns of funding by mechanism and specify program spending changes. Such detail is not available in this year's institute justifications, though narrative descriptions of institute priorities are provided.

The 2018 budget also includes the full $496 million authorized by the 21st Century Cures Act for major initiatives. This breaks down to $300 million for the Cancer Moonshot, $86 million for the BRAIN Initiative, $100 million for the Precision Medicine Initiative's "All of Us" program and $10 million for Regenerative Medicine. Beyond these Cures-authorized ventures, several other cross-agency initiatives would see at least some reduction in the request, including, for instance, the Big Data to Knowledge (BD2K) and Stimulating Peripheral Activity to Relieve Conditions (SPARC) programs.

One set of programs not apparently slated for large reductions is the High-Risk program pool, comprising four programs: the Pioneer Award, New Innovator Award, Transformative Research Award and Early Independence Award. These awards are generally geared to young investigators and/or unconventional research directions. A continuing focus on younger researchers was also evident in NIH's controversial proposal to cap awards for individual awardees; that proposal was dropped barely a month after it was unveiled.[10]

[10] http://www.sciencemag.org/news/2017/06/updated-nih-abandons-controversial-plan-cap-grants-big-labs-creates-new-fund-younger

DEPARTMENT OF ENERGY

The Department of Energy budget presents a good distillation of the administration's general approach to science and technology funding: a particular skepticism of federal technology programs and hostility to climate research; a general interest in scaling back even fundamental science; and a desire to increase investment in defense-related activities. See Table I-8 for proposed DOE funding.

Starting with basic research, the **Office of Science (SC)** budget would receive a 17.1 percent reduction from FY 2017 omnibus levels, returning its budget to pre-COMPETES 2006 levels. The sole program within SC to receive an increase is **Advanced Scientific Computing Research (ASCR)**, at 11.6 percent above omnibus levels. This is largely due to a 19.9 percent increase for ASCR's exascale computing activities, while other program activities would be scaled back. Most research areas within **Basic Energy Sciences (BES)**, including materials science, physics and chemical science, appear slated for at least some reduction. The budget eliminates funding for BES' two innovation hubs, on energy storage and artificial photosynthesis, and for the Established Program to Stimulate Competitive Research. BES user facilities would also see a scaling back from omnibus funding levels. For instance, compared to omnibus funding, BES' five synchrotron radiation light sources would see a 12.4 percent reduction, with two (the Center for Functional Nanomaterials at Brookhaven and the Center for Integrated Nanotechnologies at Sandia and Los Alamos National Laboratories) shut down; the Nanoscale Science Research Centers would see a 41.8 percent reduction.

Unsurprisingly given its past focus on climate, **Biological and Environmental Research (BER)** would receive the largest relative reduction of any SC program area, with its environmental research branch rebranded away from climate and renamed "Earth and Environmental Systems Sciences." While biological sciences would be trimmed (including a 46.6 percent reduction for the Bioenergy Research Centers), the administration proposes much sharper cuts for environmental science. That side of BER would drop from an overall budget of $314.7 million in FY 2016 to $123.6 million in FY 2018. In what may have been an unplanned twist, the administration has proposed an increase for the International Thermonuclear Experimental Reactor, the troubled international project supported via **Fusion Energy Sciences**. The 26 percent increase, to $63 million in FY 2018, may have been locked in prior to the low appropriation for ITER in the recent omnibus. Non-ITER funding for domestic research activities would be reduced by 25.2 percent in total, with particular reductions for fundamental plasma research. Neither **High Energy Physics (HEP)** nor **Nuclear Physics** were given much detail in the omnibus package, but both would be subject to general reductions below FY 2016 levels in multiple areas. Within HEP, the Long Baseline Neutrino Facility would see a near 10 percent increase above the 2017 omnibus, while the Muon to Electron Conversion Experiment would see a slight decline. Within Nuclear Physics, Michigan State's Facility for Rare Isotope Beams would see a 20 percent reduction.

While these would be sizable cuts for the Office of Science, DOE's applied technology programs would receive deeper cuts still, reflecting the administration's interest in tightening the scope of government's role in science and technology, and relying instead on industry to bring new technologies (if any) to fruition. Perhaps the biggest decision is the proposed elimination of the **Advanced Research Projects Agency-Energy (ARPA-E)**, which funds high-risk technology projects. The **Office of Energy Efficiency and Renewable Energy (EERE)** would also see severe reductions to its assorted programs, ranging from 55.4 percent (for hydrogen and fuel cells) to 82 percent (for geothermal). The budget would zero out EERE's innovation hubs on advanced materials and desalination, the latter of which just received its first funding in the omnibus, and its manufacturing innovation institutes. The **Fossil Energy R&D** program would substantially scale back most activities, including carbon capture and storage pilot projects and R&D on advanced combustion systems, refocusing exclusively on exploratory technology activities in hopes that industry will take on greater responsibility across the board. The **Office of Nuclear Energy** would similarly see a reduction in several activities, with its innovation hub on modeling and simulation zeroed out. R&D related to advanced reactor technology and fuel cycle sustainability, efficiency and safety would be scaled back and shifted to earlier-stage technology. The office would, however, pursue a $10 million plan to build a new fast test reactor.

Lastly, the **National Nuclear Security Administration** – benefiting from the proposed 10 percent increase in defense spending overall in the request – would see a mix of increases for its research, development, test and evaluation (RDT&E) accounts. The primary accounts providing funding for the National Ignition, Z and Omega facilities would see only modest changes, while exascale-related activities would increase in accord with DOE's prioritization of exascale.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

The past four appropriations cycles have seen NASA's total discretionary budget climb almost all the way back to its recent FY 2010 peak, thanks to strong support in Congress. The space agency received a full $1.3 billion increase in FY 2016 and a smaller but substantial boost in the recent omnibus. With the same chairmen at the helm of the House and Senate Commerce, Justice, Science Appropriations subcommittees, the agency is similarly poised to do well again this year.

The election of President Trump changed many of the dynamics in the NASA budget. Gone are past battles between the White House and Congress over prioritization of Earth Science versus Planetary Science (though debates persist between parties in Congress). This was a major flashpoint during the Obama administration. Between FY 2010 and FY 2016, Earth Science funding grew by 21.5 percent in inflation-adjusted dollars, by far the largest increase out of the four SMD divisions (excluding the James Webb Space Telescope development account, which was separated from Astrophysics in FY 2012).

In the President's FY 2018 budget, NASA would fare better than most other federal nondefense science agencies, but would still see an overall decrease of 2.9 percent below FY 2017 enacted. Underneath that small top-line reduction, different parts of the agency would see very different fates.

Within NASA's **Science Mission Directorate**, the budget provides Planetary Science with a 4.5 percent increase, including a $150 million boost above FY 2017 omnibus funding, to $425 million total, for a planned mission to Jupiter's moon Europa – a priority among House Republican appropriators. The FY 2018 proposal would bolster the Discovery missions and Research and Analysis grants, while continuing Mars activities at a funding level slightly below the omnibus. Although the New Frontiers mission line, which funds midsized missions based on a competitive proposal process, appears to take a large cut, the program is in a natural lull between missions and will be selecting the next potential missions for early design and development in FY 2018.

The **Earth Science** portfolio would decrease by 8.7 percent below last year's enacted levels, with cuts below FY 2016 levels to core earth science research and computing systems. Also slated for cuts are four missions or major instruments in early development phases: Orbiting Carbon Observatory-3 (OCO-3); Plankton, Aerosols, Clouds, ocean Ecosystem (PACE); Climate Absolute Radiance and Refractivity Observatory (CLARREO) Pathfinder; and the Radiation Budget Instrument (RBI) that was to fly on the Joint Polar Satellite System 2 (JPSS-2) mission. The budget further proposes shutting down the Earth-facing instruments on the Deep Space Climate Observatory (DSCOVR) mission launched in early 2015. The budget does, however, maintain support for Landsat 9 development.

The **Astrophysics** division would see a total 8.9 percent increase to continue funding development of the Wide-Field Infrared Survey Telescope (WFIRST), the next major flagship mission expected for the division. NASA recently announced the selection of an independent review committee to examine cost and schedule issues with WFIRST, following the recommendations of a National Academies panel last year concerned about growing cost estimates for WFIRST and its impact on other NASA astrophysics programs.[11] The budget also includes significant increases for the cost-capped, competed Explorer mission line for new missions selected for continued development in FY 2017.

NASA's **Heliophysics** program would be flat-funded from FY 2017 enacted, supporting all current missions and providing support for enhanced research lines recommended in the most recent decadal survey for the field.

The President's budget provides the full level of funding to keep the **James Webb Space Telescope** on schedule for a 2018 launch.

Overall, the **Human Exploration and Operations Mission Directorate** would be cut by 6.5 percent below FY 2017. The Space Launch System (SLS) and Orion Multipurpose Crew Vehicle, which both receive strong support in Congress, would be trimmed below FY 2017 enacted levels. For the past several years, Congress has restored and increased funding for these programs following proposed cuts by the White House. NASA

[11] See coverage on WFIRST: http://spacenews.com/nasa-begins-independent-review-of-wfirst-mission/?utm_medium=email&utm_source=FYI&dm_i=1ZJN,50M41,LWISQD,J4SQU,1

recently confirmed it will not add astronauts to the first flight of SLS and Orion, and pushed back the launch to 2019; the first crewed mission is tentatively scheduled for 2021.[12]

The budget confirms plans to cancel the Asteroid Redirect Mission (ARM), an Obama administration priority, but continues efforts toward developing solar-electric propulsion capabilities, which were considered part of the suite of enabling technologies for the ARM mission. NASA's Commercial Crew Program would see a substantial funding reduction of $453 million or 38.2 percent below FY 2017 enacted.

Within the **Space Technology Mission Directorate (STMD)**, the administration provides no funding for RESTORE-L, which aims to demonstrate the servicing of a government satellite in low Earth orbit; RESTORE-L was funded at $130 million in the FY 2017 omnibus. There is also a concurrent satellite servicing program funded by DARPA, though obviously with some different mission goals, and some, including this administration, view the two as duplicative though others see them as complementary. NASA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs within STMD would fall below FY 2016 levels.

NASA **Aeronautics** would decline by an overall 5.4 percent but receive continued support for the New Aviation Horizons initiative, which is carrying out a series of experimental X-Plane demonstration activities. The cut would come from the Airspace Operations and Safety and Advanced Air Vehicles programs, though specific areas of reduction within these programs are not spelled out in the request.

The President's budget proposes the termination of NASA's **Office of Education**, responsible for the Space Grant consortia and other STEM activities, requesting $37 million to wind down office activities. This closure does not affect the STEM activities funded out of the Science Mission Directorate, which would receive sufficient funding for all planned activities for FY 2018.

[12] See SLS/Orion launch update: http://spacenews.com/nasa-decides-not-to-place-a-crew-on-first-slsorion-mission/

NATIONAL SCIENCE FOUNDATION

The President's FY 2018 budget proposes a substantial $819 million or 11 percent reduction to NSF, the nation's principal basic science research agency. This would bring NSF's inflation-adjusted budget down to FY 2002 levels, erasing the recent funding gains fueled by the America COMPETES Act, which set an ultimately unrealized budget-doubling goal for NSF in 2007. The President's request follows relatively unambitious spending proposals from the Obama White House and Congress last year; NSF was flat-funded in the FY 2017 omnibus.

The administration's proposed budget downsizing comes at a time when NSF seeks to scale up investments through its 10 Big Ideas, an envisioned long-term research agenda unveiled last spring.[13] The 10 big ideas comprise six research areas ranging from quantum mechanics to multi-messenger astrophysics, as well as four process ideas, including convergent research. NSF Director France Córdova has said that advancing these bold, long-term research ideas will require future investments from both the public and private sectors.[14]

In FY 2018, NSF expects to evaluate approximately 50,500 competitive proposals and make approximately 10,800 new competitive awards, which include 8,000 new research grants. The number of new research grants decreases by roughly 11 percent from FY 2016 levels, according to the most recent data published by the agency. NSF's annual budget provides about a quarter of the total federal budget for basic research conducted at U.S. colleges and universities. Over 90 percent of NSF's projects are funded using grants or cooperative agreements, of which three-fourths go to academic institutions.

FY 2018 funding for NSF's cross-foundation investments, including Innovations at the Nexus of Food, Energy and Water Systems (INFEWS); Risk and Resilience; and Understanding the Brain (UtB) – which includes contributions to the interagency BRAIN Initiative – would fall below FY 2016 levels in accord with the overall NSF budget reduction. The Experimental Program to Stimulate Competitive Research (EPSCoR), which seeks to broaden the geographic distribution of NSF dollars, would also see an acute funding reduction of $60 million or 37.5 percent below the FY 2016 amount of $160 million.

The Research & Related Activities (R&RA) account, made up of NSF's core research programs across multiple disciplines, would see a cut of $672 million or 11.1 percent below FY 2017 enacted. The six research directorates within R&RA would see roughly equal percentage reductions of around 10 percent each (see funding table).

Biological Sciences (BIO): The Biological Sciences Directorate funds research around environmental biology, organismal systems and molecular and cellular biosciences. The FY 2018 budget would cut base research funding for all divisions within BIO, dropping the funding rate for new awards to 23 percent. Funding would be prioritized for the Plant Genome Research Program, as well as BIO contributions to the cross-foundation BRAIN Initiative. BIO will also assume full responsibility for operations and maintenance of the National Ecological Observatory Network (NEON), expected to be completed by the spring of 2018.

Computer and Information Science and Engineering (CISE): CISE funds computer and information science and engineering research and education, advanced cyberinfrastructure and high-performance computing (HPC). All divisions within CISE would be reduced by around 10 percent, with the funding rate for new awards dropping to 20 percent. The FY 2018 budget establishes a new Harnessing the Data Revolution activity as part of NSF's 10 Big Ideas noted previously, and supports the existing National Strategic Computing Initiative (NSCI) outlined in 2015.[15] CISE serves as the principal federal funder of basic research at academic institutions in the computer sciences, accounting for approximately 83 percent of such funding.

Engineering (ENG): NSF's Engineering Directorate funds research in advanced materials and manufacturing, systems science, engineering biology, the food-energy-water nexus, electronic devices, circuits, and systems. The FY 2018 budget maintains funding for Engineering Research Centers (ERCs), though all ENG divisions are reduced by at least 7 percent; the overall funding rate for new awards drops to 18 percent.

Geosciences (GEO): The budget proposes reductions of around 10 percent to GEO divisions covering atmospheric and geospace

[13] For more on NSF's 10 Big Ideas: https://www.nsf.gov/about/congress/115/10bigideas.jsp
[14] See Science coverage: http://www.sciencemag.org/news/2016/05/nsf-director-unveils-big-ideas-eye-next-president-and-congress
[15] See NSCI Strategic Plan (July 2016): https://www.whitehouse.gov/sites/whitehouse.gov/files/images/NSCI%20Strategic%20Plan.pdf

sciences, Earth science and ocean sciences. GEO facilities funding would be scaled back. Additionally, the budget proposes to move the Office of Polar Programs to a separate funding account in FY 2018. Overall, the funding rate for new awards within GEO would drop to 28 percent next fiscal year.

Mathematical and Physical Sciences (MPS): MPS supports a wide range of disciplinary and multidisciplinary programs in astronomical sciences, chemistry, materials research, mathematical sciences and physics. All divisions within MPS would be reduced by at least 9 percent. A large reduction is proposed to the Cyber-Enabled Materials Manufacturing and Smart Systems (CEMMSS) activity. MPS facilities funding is a mixed bag in the proposed budget. Funding rates for new awards within MPS would drop to 23 percent in FY 2018.

Social, Behavioral and Economic Sciences (SBE): SBE funds research on human behavior and social organization and economics, and is a significant partner in cross-directorate programs. All divisions within SBE would be cut by at least 10 percent next fiscal year, with the funding rate for new awards dropping to 21 percent. SBE also funds the National Center for Science and Engineering Statistics (NCSES), which would see a 5 percent cut. There are also some broad reductions to research infrastructure funding. For FY 2018, SBE is slated to lead a new Work at the Human-Technology Frontier (HTF) activity as part of NSF's 10 Big Ideas, discussed previously.

The **Education and Human Resources Directorate (EHR)** funds STEM education research activities for pre-K through 12th grade and teachers, workforce development programs, and fellowships and scholarships at the undergraduate and graduate levels. Total EHR funding would be reduced by $119 million or 13.6 percent below last year enacted, with a particularly sharp cut to graduate research fellowships. In FY 2018, NSF would support 1,000 new fellows, equal to the number supported in FY 2008; NSF has supported 2,000 new fellows annually since 2011, according to the agency budget request. The administration would reduce funding for other EHR programs and activities, including the Robert Noyce Teacher Scholarship Program and STEM Learning Environments research within the Division of Undergraduate Education.

For **Major Research Equipment and Facilities Construction (MREFC)** in FY 2018, NSF requests funding to continue construction on three research facilities projects: the Daniel K. Inouye Solar Telescope (DKIST) and the Large Synoptic Survey Telescope (LSST), as well as the Regional Class Research Vessel (RCRV) project. Funding for DKIST in the amount of $20 million supports the continued ramp-up of construction with completion planned for no later than June 2020. A decrease in the amount of $9.3 million is slated for LSST, a nine-year project in Chile that began in August 2014. The FY 2018 request for the RCRV project, a major component in the plan for modernizing the U.S. Academic Research Fleet, totals $105 million for the construction of two ships; last year's omnibus provided additional funding for construction of a third RCRV.

In FY 2018, the primary driver of the decrease for **Agency Operations and Awards Management** is the completion of the NSF headquarters relocation from Arlington, VA., to Alexandria, VA., by Oct. 1, 2017.

U.S. DEPARTMENT OF AGRICULTURE

See Table I-11 for USDA funding figures. In the FY 2018 request, the **Agricultural Research Service (ARS)** – USDA's intramural research arm – would see a reduction of 29.2 percent below funding levels enacted in the FY 2017 omnibus. This includes a 15.2 percent or $177.9 million reduction for ARS' primary research account, which would result in the closure of 17 laboratories and other work sites, representing nearly a fifth of all locations. Ongoing projects in all areas would see some level of reduction or elimination, with particular reductions targeted at research programs in biobased products and biofuels (by at least 29.5 percent) and human nutrition (by at least 48.5 percent). In addition, the administration recommends rescinding all budget authority for facilities construction granted by Congress in FY 2017. ARS had originally intended to use that funding for construction at the Agricultural Research Technology Center in Salinas, Calif., and at Foreign Disease-Weed Science Research Lab at Ft. Detrick, Md.

The **National Institute of Food and Agriculture (NIFA)** would see an 8.1 percent reduction below enacted omnibus funding. The institute would keep the largest formula fund programs nearly flat in FY 2018, save for a $5 million or 15 percent reduction to McIntire-Stennis state forestry research. NIFA would also eliminate several smaller activities, including capacity grants at non-land-grant universities; research programs on alfalfa, animal disease and aquaculture; and multiple education programs. Sustainable agriculture grant funding would decline by at least 22.8 percent. **The Agriculture and Food Research Initiative (AFRI)**, USDA's competitive extramural research program, would decline to $349.3 million in FY 2018, 6.8 percent below omnibus levels. The administration had originally estimated a $349.3 million budget for AFRI in FY 2017 under a hypothetical full-year continuing resolution prior to completion of the omnibus, and thus proposed simply matching that estimate in FY 2018. The administration would allow the small Biomass R&D Initiative, a mandatory multiagency program authorized through FY 2017 in the most recent farm bill, to expire.

The Economic Research Service would see an 11.6 percent reduction below omnibus levels in the request. Several work areas would see reductions, including program evaluation, analysis of drought resilience, bioenergy data modeling, and other data acquisition and access. The **National Agricultural Statistics Service (NASS)** would receive an overall 8.4 percent reduction above omnibus levels, including a 5.6 percent reduction to NASS' core statistical activities achieved by reducing the sample sizes of several survey series. These cuts would be offset by a more than 50 percent increase for Census of Agriculture funding, to $63.9 million in FY 2018.

The **Forest Service's Forest & Rangeland Research** funding account would be reduced by 10.2 percent. Several research program areas would be affected, including invasive species, air quality research, clean water and resource management. The Forest Service's other fire-related R&D activities would be reduced by a similar amount, and efforts to understand the social and economic elements of wildfire would be terminated.

According to agency and historical data, total USDA R&D funding in FY 2018 would drop to its lowest point since 1989, in inflation-adjusted dollars.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

As one of three agencies slated for budget boosts in America COMPETES legislation, NIST has fared relatively better than other science agencies in recent years, weathering the government-wide sequestration cuts first imposed in 2013. The Obama administration prioritized funding for NIST, particularly the agency's research laboratories, which grew by a substantial $168.5 million or 31.6 percent between FY 2009 and FY 2016, after adjusting for inflation.

The Trump administration's proposed budget would roll back much of the funding growth in NIST's core research laboratories, and would almost completely eliminate the agency's industrial services account, which includes federal support for manufacturing R&D.

The **Scientific and Technical Research Services (STRS)** account, which funds NIST's seven research laboratories, would be subject to a large $90 million or 13 percent cut below last year's enacted level. This would result in a 10 percent reduction in NIST's scientific workforce, according to the agency request. The physical measurement, materials measurement, engineering and information technology laboratories would all see around 13 percent reductions, while the smaller Communications Technology Laboratory, the Center for Neutron Research and Center for Nanoscale Science and Technology would see smaller reductions of between 5 and 9 percent.

The STRS cut would reduce funding for many program areas: advanced materials manufacturing, semiconductor measurements, cybersecurity and quantum science, among other research topics. The budget would eliminate NIST's extramural Fire Research Grants Program and the Nanomaterial Environment, Health and Safety (nano-EHS) Program, which studies the potential environmental or health impacts of engineered nanomaterials such as silicon.

Forensic science research is slated for a 30 percent cut in the request, including a reduction of $2.7 million for Forensic Science Program Management and support of the Organization of Scientific Area Committees (OSACs) charged with setting standards for forensic science. The budget would maintain a $4.5 million transfer from the Department of Justice to NIST that in part supports managing the OSACs. The budget proposes that NIST continue managing the OSACs while working to transition them to a community-operated model. The Forensic Science Center of Excellence led by Iowa State University, one of three NIST Centers of Excellence on different topics, would be eliminated.

Within NIST's Industrial Technology Services account, the **Hollings Manufacturing Extension Partnership** (MEP) would be eliminated, with $6 million requested for MEP to cover costs associated with winding down the program. The MEP elimination would affect over 2,500 partners and approximately 9,400 client firms, according to agency budget documents.

Manufacturing USA, formerly known as the National Network for Manufacturing Innovation (NNMI), would receive $15 million, a $10 million reduction from the FY 2017 enacted omnibus level. NIST funding in this area supports specific institutes and program coordination of this multiagency effort to support public-private manufacturing innovation institutes that will collectively boost U.S. advanced manufacturing innovation and competitiveness. With the reduction, NIST would cancel a planned competition for a new institute previously set for FY 2018.

NIST's **research facilities construction** would be less impacted by the overall budget downsizing, with renovations set to continue for Radiation Physics Building 245 at the Gaithersburg, Md., headquarters.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NOAA's total discretionary budget would decrease by $900 million or 15.9 percent below last year's enacted level. Steep cuts would be levied on the National Ocean Service and climate, weather and air chemistry research programs. Development would continue on NOAA's flagship weather satellites, while funding would be cut for a polar follow-on satellite program. Funding for research vessels would be preserved at last year's level.

The **Office of Oceanic and Atmospheric Research (OAR)**, the primary research and development arm of NOAA, would face a steep 31.9 percent cut below FY 2017 enacted levels. A 19 percent cut to NOAA **Climate Research** would reduce funding for Cooperative Institutes, universities, NOAA laboratories and other partners. The 25.4 percent proposed cut to NOAA **Weather and Air Chemistry Research** would terminate the Air Resources Laboratory, which studies air pollution and climate variability, and the Unmanned Aircraft Systems (UAS) Program Office. The budget would also eliminate the Joint Technology Transfer Initiative, recently established to quickly transition the latest research into weather forecasting products, and Vortex-Southeast, an effort to better understand tornado formation in the U.S. Southeast.

Funding for OAR's **Ocean, Coastal and Great Lakes Research** Program would be cut by nearly half below last year enacted, with a proposed elimination of the National Sea Grant College Program. The budget recommends a large cut to ocean mapping and exploration as well as proposed terminations of the autonomous underwater vehicle demonstration test bed and the environmental genomics program, which studies genetic materials to better understand how organisms are affected by changing ocean conditions. The recommended funding level for High Performance Computing (HPC) Infrastructure would allow the agency to complete the recapitalization of Gaea, a NOAA R&D supercomputer located in Oak Ridge, Tenn. For the **National Ocean Service**, the budget proposes to terminate $23 million in federal funding support to states for the management of the National Estuarine Research Reserve System, a network of 29 coastal sites designated to protect and study estuarine systems.

Within the **National Environmental Satellite, Data and Information Service (NESDIS)**, the Geostationary Operational Environmental Satellite-R Series (GOES-R) and the Joint Polar Satellite System (JPSS) would see funding reductions in line with planned launch preparation activities; the next satellite in the GOES-R series is nearing completion and scheduled for launch in spring 2018, while JPSS-1 is on track to launch in summer 2017 and JPSS-2 is anticipated for a 2021 launch date. The Polar Follow-On (PFO) program, currently funded at $369 million for the development of JPSS-3 and -4, would be cut in half and a re-plan would be initiated to seek cost efficiencies and leverage partnerships. The budget proposes to eliminate NOAA funding for the interagency Big Earth Data Initiative, which aims to improve the interoperability of civil Earth-observing data across the federal government, while the agency's Regional Climate Centers would see reductions.

The **National Weather Service's** Science and Technology Integration (STI) Office, which oversees weather forecasting modeling and research-to-operations transition programs, would see several program terminations. The budget would reduce or eliminate components of NOAA's Tsunami Research and Operational Warning program, and would terminate the aviation science research-to-operations (R2O) effort that supports the FAA's Next Generation Air Transportation System (NextGen). The FY 2018 request would consolidate National Centers for Environmental Prediction functions of the Climate Prediction Center into the Weather Prediction Center.

NOAA's **ship fleet recapitalization** efforts would be flat-funded from the FY 2017 omnibus level of $75 million, which would support construction of a second NOAA vessel Class A.

DEPARTMENT OF THE INTERIOR

U.S. Geological Survey (USGS). USGS, the scientific arm of the Department of the Interior, is often caught up in fierce policy debates during the appropriations cycle. One of the more controversial developments within Interior has centered around conservation of the greater sage-grouse, a species of bird in the Western United States that was a candidate for listing under the Endangered Species Act. The U.S. Fish and Wildlife Service made a decision not to grant the sage-grouse endangered species status in September 2015, following extended analysis and land conservation efforts. However, Interior Secretary Ryan Zinke has announced that the incoming administration will review the current protection plans across 11 states.[16]

Along with the long-running debates over climate change and other environmental issues, USGS funding has declined and stagnated over the past decade. In FY 2018, USGS would see a total discretionary funding reduction of $163 million or 15 percent below FY 2017 enacted levels; estimated R&D would fall by 18.4 percent. The Trump administration would sharply curtail funding for climate R&D and land use change activities, and would scale back investments in ecosystems research and natural hazards science, among other areas.

All core research budgets within USGS would fall below FY 2017 enacted levels. The administration proposes to restructure the current Climate and Land Use Change program, eliminating $11.1 million in climate research and development activities and reducing Interior's Climate Science Centers (CSCs) by $8.5 million, halving the number of regional CSCs from eight to four. President Trump's FY 2018 budget would also reduce funding for geologic carbon sequestration activities and eliminate biological carbon sequestration projects that inventory and track carbon stored in ecosystems across the United States. The proposed budget includes an additional $22.4 million required for the continued development of Landsat 9, but shrinks USGS remote sensing research. It eliminates support for the National Civil Applications Center, which uses satellite imagery to investigate climate change and other Earth dynamics, and to improve land and resource management.

Within the Ecosystems Mission Area, the FY 2018 budget proposes a $10.7 million cut in wildlife research and related programs as well as a combined $8 million reduction to Greater Everglades and Chesapeake Bay research and monitoring. The Trump administration budget would eliminate funding for research on ecological effects of unconventional oil and gas development. Contaminant biology research funded by the Environmental Health Program is slated for reductions, and the Toxic Substances Hydrology Program would see funding eliminated for radioactive waste disposal and municipal wastewater science. Broad cuts to the USGS National Research Program (NRP), part of the Water Mission Area, would reduce research at the 32 Water Science Centers across the United States. The FY 2018 budget would eliminate the $6.5 million Water Resources Research Act Program, ending USGS involvement and support for all grants to Water Resource Research Institutes (WRRI), located at land grant universities in each of the 50 states.

Lastly, the Trump administration's proposed budget would eliminate funding for implementation of both the Earthquake Early Warning System for the West Coast and the National Volcano Early Warning System (NVEWS). The Geomagnetism Program would be terminated, which would reduce the accuracy of NOAA and U.S. Air Force forecasting of the magnitude and impact of geomagnetic storms, according to agency budget documents. The National Geospatial Program, funded through Core Science Systems, would see an elimination of funding for the Center of Excellence for Geospatial Information Science (CEGIS) and its associated research grants.

U.S. Fish and Wildlife Service (FWS). The principal FWS operating account, Resource Management, would see a $107.6 million or 8.6 percent decrease below FY 2017 enacted levels. Ecological Services, Habitat Conservation, and Fish and Aquatic Conservation would all be subject to funding reductions under the administration's request. The National Wildlife Refuge System is also slated for a cut in the proposed budget. Funding for Interior's network of Landscape Conservation Cooperatives would be eliminated. Science Support activities, which include funding for habitat conservation strategy development and tools for on-the-ground resources managers, would also be zeroed out by the administration.

[16] See recent coverage: https://www.eenews.net/stories/1060055707

DEPARTMENT OF VETERANS AFFAIRS

Despite longstanding support for VA medical research, the President's budget proposes a $35 million or 5.2 percent cut to VA's **Medical and Prosthetic Research** account. With additional funds requested from the VA Medical Care Program in support of research, and estimated services and grants from other federal and private sources totaling $1.4 billion, the combined total estimated VA research and development programs would exceed $1.9 billion.

The proposed FY 2018 budget would make reductions across VA's four intramural research accounts: (1) Biomedical Laboratory Science, (2) Rehabilitation, (3) Health Services and (4) Clinical Science. VA estimates that it will support 2,132 projects during 2018, a decrease from the current 2017 estimate of 2,156. This would impact a range of funding areas, including research on kidney and lung disorders, digestive diseases, central nervous system injuries and sensory loss.

Amid the proposed budget downsizing, VA would prioritize research around pain management and opioid addiction, mental health and suicide, and Gulf War Veterans Illness. Additionally, the agency would continue efforts to advance precision medicine and cancer genomics in support of the Million Veteran Program (MVP), which aims to collect blood samples and health information from 1 million veteran volunteers to study how genes affect health. As of mid-February 2017, more than 544,000 veterans have provided DNA specimens, military exposure information, and access to health records to facilitate studies on topics ranging from the biological underpinnings of Gulf War illness and PTSD to schizophrenia and bipolar disorder.

CENTERS FOR DISEASE CONTROL AND PREVENTION

CDC's Chronic Disease Prevention and Health Promotion account would see a large decrease as part of a new administrative effort to focus more narrowly on leading causes of death and disability such as heart disease. As a result, the budget would eliminate funding for epilepsy research, lupus studies and the Prevention Research Center (PRC) Program, which works with academic institutions to study how individuals and communities can prevent chronic illnesses. The FY 2018 request also terminates Education and Research Centers (ERCs) investments, including funding to academic programs focusing on industrial hygiene, occupational health nursing, occupational medicine and occupational safety. The proposed budget provides no funding for the Academic Centers for Public Health Preparedness, established in 2000 to strengthen bioterrorism and emergency preparedness by linking academic expertise to state and local health agencies.

Within the Emerging and Zoonotic Infections account, the budget would eliminate funding for prion disease activities as well as chronic fatigue syndrome research. Funding to support the ongoing Antibiotic Resistance initiative would be reduced, including investments in research, according to agency budget documents. The FY 2018 budget would zero out funding for the Injury Control Research Centers (ICRCs) and research to address elderly falls. Within CDC's Environmental Health Program, the administration proposes to terminate both the Climate and Health Program and the Amyotrophic Lateral Sclerosis (ALS) research program. CDC's Environmental Health Laboratory would essentially be flat-funded at last year's enacted levels.

ENVIRONMENTAL PROTECTION AGENCY

The proposed elimination of EPA's role in climate change-related programs reflects a broader vision within the new administration to roll back policies, regulations and U.S. participation in international efforts to tackle climate change. President Trump promised during his campaign to withdraw the United States from the Paris Climate Accord and made the official announcement in early June. The Paris Climate Accord was signed during the Obama administration, and as a signatory of the accord, the United States pledged to cut its greenhouse gas emissions 26 to 28 percent below 2005 levels by 2025.

To reach the goals of the accord, the Obama administration developed a Clean Power Plan that would reduce emissions from power plants and set other regulations to control methane leaks. Within the first few months of the new administration, President Trump signed an executive order directing the EPA to begin the lengthy process of withdrawing and rewriting the various parts of the Clean Power Plan.

Both the rollback of U.S. participation in the Paris Climate Accord and the unraveling of the Clean Power Plan will take time – up to four years for the accord – and will likely be met with legal challenges from environmental groups. This means that the topic of addressing climate change will likely become a subject of continued discussion in the next presidential election.

On a more positive note, the EPA will continue to fund – albeit at reduced levels – two programs that track and report greenhouse gas emissions. Both the Greenhouse Gas Inventory (GHGI) and Greenhouse Gas Reporting Program (GHGRP) will continue to receive some funding from EPA, and both programs are important for providing an inventory of emission levels throughout the United States that is also utilized by states.

In addition to the dramatic cuts to EPA's Science and Technology (S&T) account, its Office of Research and Development has drawn media attention for not renewing the membership of half of the Board of Scientific Counselors (BOSC). The BOSC provides oversight and guidance on EPA's R&D program and is primarily, but not solely, composed of scientists from academia. The agency has argued that past administrations have not allowed sufficient diversity of stakeholders on the board and will consider nominations from industry as well as academia.

Overall Funding. For FY 2018, EPA's total discretionary budget would be subject to a substantial cut of $2.4 billion or 30 percent below last year's enacted levels. Steep reductions would be levied across the agency's S&T portfolio, with outright elimination of activities including EPA's climate change research program.

President Trump's request would eliminate EPA contributions to the Global Change Research Program (GCRP), a multiagency effort to better understand climate change impacts and adaptation options, resilience and mitigation solutions; EPA funding for GCRP was $19.4 million in FY 2016.

EPA Science and Technology (S&T). EPA's core S&T account would see an overall $317 million or 44.4 percent decline in its discretionary budget. All five major S&T programs would drop by at least 30 percent or more (see funding table). The Trump administration would eliminate funding for EPA climate change research within the Air, Climate and Energy (ACE) Program, which has been renamed to the Air and Energy Program in the FY 2018 budget. EPA's Sustainable and Healthy Communities Program would face cuts and streamlining of health-related activities, such as research into the environmental component of children's asthma. Within the Chemical Safety and Sustainability Program, the budget proposes a $14 million cut to development of virtual tissue models that could reduce the use of animal testing in chemical toxicity screenings. The Critical Infrastructure Protection Program within S&T Homeland Security would be eliminated. EPA's Science to Achieve Results (STAR) program, which funds competitive research grants and graduate fellowships, would be terminated across all four S&T research missions.

While EPA's S&T budget has already been on a steady decline over the past decade, the President's request would lead to a sharp plummet. The total estimated EPA S&T budget would fall by $484 million or 65.2 percent below FY 2005 levels, after adjusting for inflation.

FOOD AND DRUG ADMINISTRATION

The Trump administration proposes significant funding reductions to field activities and research centers across FDA's programs, including Foods, Human Drugs, Biologics, Animal Drugs and Feeds, and Devices and Radiological Health. The Center for Biological Evaluation and Research (CBER) would reduce its applied scientific research and cut back the number of research fellows hired to support the regulatory science program. FDA's Center for Drug Evaluation and Research (CDER) would reduce contracts that promote drug safety and research studies. A large proposed cut to the Center for Veterinary Medicine (CVM) could impact applied research and the level of engagement in international activities, according to agency budget documents. The requested cut to the Center for Food Safety and Applied Nutrition (CFSAN) may include the elimination of support for the Centers of Excellence, which partner with several academic institutions to conduct research on protecting the food supply. FDA's National Center for Toxicological Research (NCTR) would see a small $3.1 million decrease below last year's level of $63.3 million.

BIOMEDICAL ADVANCED RESEARCH AND DEVELOPMENT AUTHORITY

BARDA and its Project BioShield initiative would see essentially no change from FY 2017 omnibus funding levels, with each funded at or just above $510 million.

AGENCY TABLES

Table I-1. R&D in the FY 2018 Budget by Agency
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Total R&D (Conduct of R&D and R&D Facilities)**					
Defense 1/	72,801	76,653	**85,171**	8,518	11.1%
S&T (6.1-6.3)	*12,779*	*13,979*	***13,224***	*-755*	*-5.4%*
All Other DOD	*60,022*	*62,674*	***71,947***	*9,273*	*14.8%*
Health and Human Services	32,243	34,122	**26,144**	-7,978	-23.4%
National Institutes of Health	*30,843*	*32,802*	***25,093***	*-7,709*	*-23.5%*
All Other HHS	*1,400*	*1,320*	***1,051***	*-269*	*-20.4%*
Energy	15,007	15,958	**13,436**	-2,522	-15.8%
Atomic Energy Defense	*6,307*	*7,099*	***7,306***	*207*	*2.9%*
Office of Science	*5,305*	*5,344*	***4,433***	*-911*	*-17.1%*
Energy Programs	*3,394*	*3,515*	***1,697***	*-1,817*	*-51.7%*
NASA	13,273	13,586	**10,332**	-3,254	-24.0%
National Science Foundation	6,022	6,051	**5,370**	-681	-11.3%
Agriculture	2,657	2,590	**2,102**	-488	-18.8%
Commerce	1,675	1,813	**1,563**	-249	-13.7%
NOAA	*675*	*804*	***671***	*-133*	*-16.5%*
NIST	*762*	*775*	***652***	*-123*	*-15.8%*
Transportation	948	974	**945**	-29	-2.9%
Homeland Security	582	623	**564**	-59	-9.5%
Veterans Affairs	1,222	1,346	**1,357**	11	0.8%
Interior	973	1,006	**798**	-208	-20.7%
U.S. Geological Survey	*677*	*688*	***561***	*-127*	*-18.4%*
Environ Protection Agency	513	496	**277**	-220	-44.2%
Education	254	257	**246**	-11	-4.3%
Smithsonian	251	265	**304**	39	14.7%
Intl Assistance Programs	248	266	**73**	-193	-72.5%
Patient-Centered Outcomes Res	469	463	**533**	70	15.1%
Justice	51	47	**68**	21	43.2%
Nuclear Reg Comm	86	75	**67**	-8	-10.7%
State	40	40	**37**	-3	-7.5%
Housing and Urban Development	63	47	**58**	11	23.0%
Social Security	101	101	**101**	0	0.0%
Tennessee Valley Authority	10	13	**16**	3	23.1%

(continued)

Table I-1. R&D in the FY 2018 Budget by Agency (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Postal Service	19	31	**32**	1	3.2%
Corps of Engineers	9	9	**11**	2	16.7%
Consumer Product Safety Commission	2	2	**1**	-1	-50.0%
Total R&D	**149,520**	**156,834**	**149,606**	**-7,229**	**-4.6%**
Defense R&D 1/	79,109	83,752	**92,477**	8,725	10.4%
Nondefense R&D	70,411	73,082	**57,129**	-15,954	-21.8%

1/ Total includes DOD RDT&E prior-year budget authority adjustments.
*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.
**The official definition of development has changed, excluding some previously counted funding in NASA and the 6.7 account in DOD. These figures keep DOD 6.7 included for comparability.
Source: OMB R&D data, agency budget justifications, and other agency budget documents and data.
Note: The projected GDP inflation rate between FY 2017 and FY 2018 is 2 percent.
All figures are rounded to the nearest million. Changes calculated from unrounded figures.

Table I-2. Department of Defense R&D
(total obligational authority in millions of dollars)

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Research, Development, Test and Evaluation (RDT&E)					
Basic Research ("6.1")	2,223	2,276	**2,229**	-48	-2.1%
Applied Research ("6.2")	4,922	5,296	**4,973**	-323	-6.1%
Total Research	7,146	7,573	**7,202**	-371	-4.9%
Advanced Technology Development ("6.3")	5,633	6,456	**6,022**	-434	-6.7%
Total Science and Technology 1/	12,779	13,979	**13,224**	-755	-5.4%
Advanced Component Development ("6.4")	14,082	15,376	**17,510**	2,134	13.9%
System Dev and Demon ("6.5")	12,801	12,781	**14,728**	1,947	15.2%
Management Support ("6.6")	5,579	4,597	**6,085**	1,488	32.4%
Operational Sys Development ("6.7")*	8,370	8,816	**11,383**	2,567	29.1%
Classified Programs ("999")*	17,021	18,149	**20,398**	2,248	12.4%
BA Adjustment	*-1,093*		***-283***		
Total RDT&E	69,540	73,699	**83,045**	9,346	12.7%
Medical Research 2/	2,121	2,102	**823**	-1,279	-60.9%
Other Appropriations 3/	1,140	852	**1,303**	451	52.9%
Total DOD R&D	72,801	76,653	**85,171**	8,518	11.1%

* Due to definitional changes, the 6.7 and classified accounts are not included as R&D in the official FY 2018 figures. These accounts are included here for comparability.
Source: OMB R&D data, *Budget of the U.S. Government, Fiscal Year 2018*, and DOD "RDT&E Programs" (R-1).
Includes Overseas Contingency Operation funding.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
Character of work ("6.x") categories are expressed in total obligational authority (TOA).
BA Adjustment converts TOA into budget authority.
1/ Includes unspecified $50 million reduction to DARPA enacted in FY 2017.
2/ Medical research is appropriated in Defense Health Programs, not RDT&E.
3/ R&D support in military personnel, construction, chemical agents and munitions destruction, and other programs. AAAS estimates based on FY 2017 omnibus.

Table I-3. DOD R&D by Military Departments and Agencies
(total obligational authority in millions of dollars)

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Research, Development, Test and Evaluation (RDT&E)					
Army	7,862	8,597	**9,545**	948	11.0%
Navy	18,333	17,541	**17,805**	264	1.5%
Air Force	25,244	28,154	**35,050**	6,896	24.5%
Defense Agencies 1/	19,007	19,218	**20,717**	1,499	7.8%
Missile Defense Agency	*6,211*	*6,051*	***6,201***	*149*	*2.5%*
Defense Adv Res Projects Agency	*2,868*	*2,889*	***3,170***	*281*	*9.7%*
Office of Secretary of Defense	*3,382*	*3,638*	***4,066***	*428*	*11.8%*
Chem and Bio Defense	*978*	*1,037*	***1,096***	*59*	*5.7%*
Defense Threat Reduction	*503*	*461*	***470***	*9*	*1.9%*
Operational Test and Evaluation	187	190	***211***	21	11.2%
BA Adjustment	*-1,093*		***-283***	*-283*	*- -*
Total RDT&E	69,540	73,699	**83,045**	9,346	12.7%
Medical Research 2/	2,121	2,102	**823**	-1,279	-60.9%
Other Appropriations 3/	1,140	852	**1,303**	451	52.9%
Total DOD R&D	72,801	76,653	**85,171**	8,518	11.1%

Source: OMB R&D data, *Budget of the U.S. Government, Fiscal Year 2018*, and DOD "RDT&E Programs" (R-1).
Includes Overseas Contingency Operation funding.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ Agency figures are expressed in total obligational authority (TOA). Includes unspecified $50 million reduction to DARPA enacted in FY 2017 omnibus.
2/ Medical research is appropriated in Defense Health Programs title.
3/ R&D support in military personnel, construction, chemical agents and munitions destruction, and other programs. AAAS estimates based on FY 2017 omnibus.

Table I-4. Department of Defense Basic Research ("6.1")
(total obligational authority in millions of dollars)

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Army					
In-House Lab Independent Research	13	12	**12**	0	-3.0%
Defense Research Science	272	293	**264**	-30	-10.1%
University Research Initiatives	67	69	**67**	-2	-3.1%
University and Industry Research Centers	99	112	**87**	-25	-22.2%
Total Army	451	487	**430**	-57	-11.7%
Navy					
In-House Lab Indep Research	19	19	**19**	1	5.0%
Defense Research Science	489	423	**458**	36	8.4%
University Research Initiatives	141	122	**118**	-4	-2.9%
Total Navy	649	563	**596**	33	5.8%
Air Force					
Defense Research Science	365	381	**343**	-38	-10.0%
University Research Initiatives	133	150	**148**	-2	-1.4%
High-Energy Laser Research Initiative	13	14	**14**	0	1.8%
Total Air Force	511	545	**505**	-40	-7.3%
Defense Agencies					
DTRA Basic Research Initiative	38	35	**37**	2	5.0%
Defense Research Sciences	317	362	**432**	70	19.3%
Basic Research Initiatives	70	68	**41**	-28	-40.4%
Gov/Industry University Research	35	34	**26**	-8	-23.0%
Basic Oper Medical Research Science	53	58	**43**	-15	-25.4%
National Defense Education Program	53	79	**74**	-5	-6.4%
Chemical and Biologial Defense Program	47	45	**44**	-1	-2.0%
Total Defense Agencies	613	681	**697**	16	2.3%
DOD Totals					
In-House Labratory Independent Research	32	31	**31**	1	1.8%
Defense Research Sciences	1,443	1,459	**1,497**	38	2.6%
University Research Initiatives	341	341	**333**	-8	-2.3%
All Other	408	446	**367**	-79	-17.7%
Total DOD Basic Research	2,223	2,276	**2,229**	-48	-2.1%

Source: DOD "RDT&E Programs" (R-1).
All figures rounded to the nearest million. Changes calculated from unrounded figures.

Table I-5. Department of Defense S&T ("6.1"-"6.3")

(total obligational authority in millions of dollars)

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Science and Technology ("6.1" through "6.3" plus medical research)					
Army	2,635	3,081	**2,390**	-690	-22.4%
Basic Research ("6.1")	*451*	*487*	***430***	*-57*	*-11.7%*
Applied Research ("6.2")	*1,070*	*1,220*	***889***	*-331*	*-27.1%*
Advanced Technology Development ("6.3")	*1,114*	*1,373*	***1,071***	*-302*	*-22.0%*
Navy	2,281	2,367	**2,168**	-199	-8.4%
Basic Research ("6.1")	*649*	*563*	***596***	*33*	*5.8%*
Applied Research ("6.2")	*952*	*980*	***886***	*-94*	*-9.6%*
Advanced Technology Development ("6.3")	*681*	*824*	***686***	*-138*	*-16.7%*
Air Force	2,428	2,678	**2,583**	-95	-3.5%
Basic Research ("6.1")	*511*	*545*	***505***	*-40*	*-7.3%*
Applied Research ("6.2")	*1,242*	*1,326*	***1,284***	*-42*	*-3.1%*
Advanced Technology Development ("6.3")	*676*	808	***794***	*-14*	*-1.7%*
Defense Agencies 1/	5,435	5,853	**6,082**	230	3.9%
Basic Research ("6.1")	*613*	*681*	***697***	*16*	*2.3%*
Applied Research ("6.2")	*1,659*	*1,770*	***1,914***	*144*	*8.1%*
Advanced Technology Development ("6.3")	*3,163*	*3,451*	***3,471***	*19*	*0.6%*
Total "6.1" through "6.3"	12,779	13,979	**13,224**	-755	-5.4%
Medical Research 2/	2,121	2,102	**823**	-1,279	-60.9%

Source: DOD "RDT&E Programs" (R-1) and *Budget of the U.S. Government, Fiscal Year 2018*.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ Includes unspecified $50 million reduction to DARPA enacted in FY 2017.
2/ Medical research is appropriated in Defense Health Program title.

Table I-6. National Institutes of Health by Institute
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Total by Institute (including non-R&D components)					
Cancer	5,206	5,689	**4,474**	-1,215	-21.4%
Allergy and Infect Diseases	4,750	4,907	**3,783**	-1,124	-22.9%
Heart, Lung and Blood	3,109	3,207	**2,535**	-672	-21.0%
General Medical Sciences	2,509	2,651	**2,186**	-465	-17.6%
Diabetes, Digestive and Kidney 1/	1,964	2,021	**1,600**	-421	-20.8%
Neurological Disorders	1,693	1,784	**1,356**	-428	-24.0%
Mental Health	1,517	1,602	**1,245**	-357	-22.3%
Child Health and Human Dev	1,338	1,380	**1,032**	-348	-25.2%
National Center for Adv Translational Science	684	706	**557**	-149	-21.0%
Office of the Director 2/	1,571	1,730	**1,452**	-277	-16.0%
Aging	1,596	2,049	**1,304**	-745	-36.4%
Drug Abuse	1,049	1,091	**865**	-226	-20.7%
Environmental Health Science	*693*	*714*	***534***	*-181*	*-25.3%*
Superfund 3/	*77*	*77*	***60***	*-18*	*-22.9%*
NIEHS Grand Total	770	792	**593**	-198	-25.1%
Eye	707	733	**550**	-183	-24.9%
Arthritis/Musculoskeletal	541	558	**418**	-140	-25.1%
Human Genome	513	529	**400**	-129	-24.4%
Alcohol Abuse and Alcoholism	467	483	**361**	-122	-25.2%
Deafness and Communication	422	437	**326**	-111	-25.4%
Dental Research	413	426	**321**	-105	-24.7%
National Library of Medicine	395	407	**373**	-34	-8.3%
Biomed/Bioengineering	343	357	**283**	-74	-20.9%
Minority Health/Disparities	280	289	**215**	-74	-25.7%
Nursing Research	146	150	**114**	-37	-24.3%
Complementary and Int Health	130	135	**102**	-33	-24.4%
Buildings and Facilities	129	129	**99**	-30	-23.5%
NIRSQ 4/	- -	- -	**379**		
Fogarty International Center	70	72	**0**	-72	-100.0%
Total NIH Programs	**32,311**	**34,311**	**26,920**	-7,391	-21.5%
Total NIH R&D*	30,843	32,802	**25,093**	-7,709	-23.5%
Conduct of R&D*	30,698	32,634	**24,984**	-7,650	-23.4%
R&D Facilities and Equipment*	145	168	**109**	-59	-35.1%

*FY 2017 R&D figures are unofficial AAAS estimates based on FY 2017 omnibus legislation.
Source: OMB R&D data, FY 2017 omnibus bill, and agency budget justification and documents.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ Includes up to $150 million each year in mandatory diabetes research funds.
2/ Trans-NIH initiatives are consolidated in OD.
3/ Transfer from Interior and Environment spending bill.
4/ National Institute for Research on Safety and Quality; reflects consolidation of AHRQ within NIH for FY 2018. AHRQ received $426 million from all sources in FY 2017. FY 2018 figure includes $106.5 million transfer from the Patient Centered Outcomes Research Trust Fund.

Table I-7. National Institutes of Health by Funding Mechanism
(budget authority in millions of dollars unless otherwise noted)

	FY 2016 Actual	FY 2017 CR*	**FY 2018 Budget**	Change FY 17-18*	
				Amount	Percent
Total by Mechanism (including non-R&D components)					
Research Project Grants	17,027	17,059	**13,486**	-3,573	-20.9%
Noncompeting	*11,727*	*12,535*	***10,532***	*-2,003*	*-16.0%*
Administrative supplements	*281*	*173*	***101***	*-73*	*-41.9%*
Competing	*5,019*	*4,351*	***2,853***	*-1,498*	*-34.4%*
{Total # of Research Grants}	*33,892*	*33,569*	***31,824***	*-1,745*	*-5.2%*
{# Noncompeting Grants}	*23,528*	*24,595*	***24,499***	*-96*	*-0.4%*
{# Competing Grants}	*10,364*	*8,974*	***7,326***	*-1,648*	*-18.4%*
SBIR/STTR Grants 1/	810	868	**703**	-165	-19.1%
{# of SBIR/STTR Grants}	*1,689*	*1,780*	***1,578***	*-202*	*-11.3%*
Research Centers	2,575	2,496	**2,080**	-417	-16.7%
Other Research	2,020	2,151	**1,732**	-420	-19.5%
Research Training	804	843	**738**	-106	-12.5%
R&D Contracts	2,915	2,912	**2,489**	-423	-14.5%
Intramural Research	3,685	3,673	**3,064**	-609	-16.6%
Research Management and Support	1,653	1,718	**1,577**	-142	-8.2%
Office of the Director	599	650	**777**	127	19.5%
The Common Fund /2	*676*	*674*	***455***	*-220*	*-32.6%*
Buildings and Facilities	145	145	**109**	-36	-24.9%
Superfund Research (NIEHS)	77	77	**60**	-18	-22.9%
PCORTF 3/			**107**		
Total NIH Budget	32,311	32,593	**26,920**	-5,674	-17.4%

*The FY 2018 budget assumes a full-year continuing resolution in 2017, and does not reflect actual 2017 spending included in the omnibus, which was roughly $2 billion higher. In reality, funding through most mechanisms in FY 2017 will be higher than what is shown here.

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. Note: All of Us project moved out of Fund in FY 2018.

3/ Patient Centered Outcomes Research Trust Fund; funds NIRSQ in FY 2018.

Table I-8. Department of Energy R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Research and Development Spending					
Total DOE R&D	15,007	15,958	**13,436**	-2,522	-15.8%
Conduct of R&D	13,850	14,850	**12,459**	-2,391	-16.1%
R&D Facilities	1,157	1,108	**977**	-131	-11.8%
DOE R&D by Function					
Defense	6,307	7,099	**7,306**	207	2.9%
General Science	5,305	5,344	**4,433**	-911	-17.1%
Energy	3,394	3,515	**1,697**	-1,817	-51.7%

Select DOE Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Energy Efficiency and Renew Energy	2,069	2,090	**636**	-1,454	-69.6%
Hydrogen & Fuel Cell Tech	101	101	**45**	-56	-55.4%
Bioenergy Technologies	225	205	**57**	-148	-72.4%
Solar Energy	242	208	**70**	-138	-66.4%
Wind Energy	95	90	**32**	-58	-64.8%
Geothermal Technology	71	70	**13**	-57	-82.0%
Water Power	70	84	**20**	-64	-75.7%
Vehicle Technologies	310	307	**82**	-225	-73.3%
Building Technologies	201	199	**68**	-132	-66.1%
Advanced Manufacturing	229	258	**82**	-176	-68.2%
Facilities and Infrastructure	62	92	**92**	0	- -
Elect Deliv and Energy Reliability	206	230	**120**	-110	-47.8%
Research & Dev Progs	162	185	**78**	-107	-57.8%
Nuclear Energy	986	1,017	**703**	-314	-30.8%
Reactor Concepts RD&D	142	132	**94**	-38	-28.8%
Nuc Energy Enabling Tech	112	115	**105**	-10	-8.5%
Fuel Cycle R&D	204	208	**89**	-119	-57.3%
SMR Licensing Support	63	95	**0**	-95	-100.0%
Fossil Energy R&D	632	668	**335**	-333	-49.8%
CCS and Advanced Power Syst	377	424	**115**	-309	-72.9%
Natural Gas Tech	43	27	**6**	-21	-79.2%
Unconventional Technologies	20	21	**15**	-6	-28.6%
ARPA-E 1/	291	306	**20**	-286	-93.5%
Uranium Enrichment D&D	674	768	**753**	-15	-2.0%
Energy Information Admin	122	122	**118**	-4	-3.3%
Nondefense Environ Cleanup	255	247	**218**	-29	-11.6%

(continued)

Table I-8. Department of Energy R&D (continued)
(budget authority in millions of dollars)

Select DOE Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Science					
Adv Sci Computing Res					
Math and Comp Sci Res	143	--	**112**	--	--
High Perf Comp and Net	478	--	**414**	--	--
Exascale Computing	--	164	**197**	33	19.9%
Total ASCR	621	647	**722**	75	11.6%
Basic Energy Sciences (BES)					
Mat Sci and Engineering	370	--	**307**	--	--
Chem Sci, Geosci and Biosci	312	--	**266**	--	--
Sci User Facilities	967	--	**780**	--	--
Construction	200	--	**202**	--	--
Total BES	1,849	1,872	**1,555**	-317	-16.9%
Biological and Environmental Research (BER)					
Biological Systems Sci	294	--	**225**	--	--
Earth and Environ Syst Sci	315	--	**124**	--	--
Total BER	609	612	**349**	-263	-43.0%
Fusion Energy Sciences (FES)					
Burning Plasma Foundations	218	--	**178**	--	--
Burning Plasma Long Pulse	40	--	**35**	--	--
Discovery Plasma	65	--	**34**	--	--
Construction (ITER)	115	50	**63**	13	26.0%
Total FES	438	380	**310**	-70	-18.4%
High-Energy Physics (HEP)					
Energy Frontier	154	--	**144**	--	--
Intensity Frontier	247	--	**193**	--	--
Cosmic Frontier	131	--	**77**	--	--
Theoretical and Comp Physics	62	--	**59**	--	--
Advanced Tech R&D	125	--	**88**	--	--
Accel Stewardship	10	--	**13**	--	--
Construction	66	--	**99**	--	--
Total HEP	795	825	**673**	-152	-18.5%

(continued)

Table I-8. Department of Energy R&D (continued)
(budget authority in millions of dollars)

Select DOE Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Nuclear Physics					
Medium Energy Phys	153	--	**130**	--	--
Heavy Ion Phys	208	--	**186**	--	--
Low Energy	82	--	**52**	--	--
Nuclear Theory	46	--	**33**	--	--
Isotopes	22	--	**21**	--	--
Construction	108	--	**80**	--	--
Total Nuclear Physics	617	622	**503**	-119	-19.2%
Science Labs Infrastructure	114	130	**76**	-54	-41.4%
Other	308	305	**286**	-19	-6.2%
Adjustments	-3	0	**0**		
Total Science	5,347	5,392	**4,473**	-919	-17.1%
Atomic Energy Defense Activities					
National Nuclear Security Administration (NNSA)					
Weapons Activities	8,847	9,246	**10,239**	994	10.7%
Science Campaign	423	437	**488**	51	11.7%
Engineering Campaign	131	132	**193**	61	45.8%
Inertial Confn Fusion	511	523	**533**	10	1.9%
Adv Sim and Computing	623	663	**734**	71	10.7%
Advanced Manufacturing	130	87	**81**	-7	-7.5%
Defense Nuclear Nonprolif	1,940	1,883	**1,793**	-90	-4.8%
Nonproliferation R&D	419	470	**446**	-24	-5.0%
Naval Reactors	1,375	1,420	**1,480**	60	4.2%
Office of the Administrator	364	390	**419**	29	7.3%
Total NNSA	12,527	12,938	**13,931**	993	7.7%
Def Environmental Cleanup	5,290	5,405	**5,537**	132	2.4%
Other Defense Activities	776	1,347	**816**	-531	-39.5%
Total Atomic Defense Budget	18,593	19,690	**20,284**	593	3.0%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.
**Based on the 2017 omnibus; figures not available for all accounts and subprograms.
1/ The budget seeks $20 million in net authority for wind-down in advance of program elimination.
Source: OMB R&D data, agency budget justification and agency budget documents.
All figures rounded to the nearest million. Changes calculated from unrounded figures.

Table I-9. National Aeronautics and Space Administration R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Research and Development Spending					
Space Operations	2,700	2,565	**2,140**	-425	-16.6%
Science	5,532	5,721	**5,652**	-70	-1.2%
Exploration	3,600	3,773	**964**	-2,810	-74.5%
Aeronautics	462	545	**502**	-43	-7.9%
Safety, Security, Mission Svcs	272	259	**269**	10	3.8%
Const, Env Compl and Remediation	22	36	**128**	91	250.3%
Space Technology	686	686	**679**	-8	-1.1%
Total NASA R&D*	13,273	13,586	**10,332**	-3,254	-24.0%

Select NASA Discretionary Budgets (including non-R&D components)					
	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Earth Science					
Earth Science Research	478	--	**407**	--	--
Applied Sciences	48	--	**48**	--	--
Earth Sci Multi-Mission Ops	192	--	**197**	--	--
Earth Systematic Missions	915	--	**778**	--	--
Earth System Sci Pathfinder	234	--	**265**	--	--
Earth Science Technology	61	--	**60**	--	--
Total Earth Science	1,927	1,921	**1,754**	-167	-8.7%

(continued)

Table I-9. National Aeronautics and Space Administration R&D (continued)
(budget authority in millions of dollars)

Select NASA Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Heliophysics					
Heliophysics Research	160	- -	**200**	- -	- -
Living With a Star	337	- -	**381**	- -	- -
Solar Terrestrial Probes	50	- -	**38**	- -	- -
Heliophysics Explorer Prog	101	- -	**59**	- -	- -
Total Heliophysics	647	679	**678**	-1	-0.1%
Planetary Science					
Mars Exploration	513	647	**585**	-62	-9.6%
Discovery	189	225	**306**	81	36.2%
New Frontiers	194	137	**82**	-54	-39.9%
Technology	197	190	**207**	17	9.1%
Planetary Science Research	274	285	**292**	7	2.4%
Outer Planets	261	363	**458**	95	26.1%
Total Planetary Science	1,628	1,846	**1,930**	84	4.5%
Astrophysics					
Astrophysics Research	193	- -	**204**	- -	- -
Cosmic Origins	196	- -	**192**	- -	- -
SOFIA 1/	84	- -	**80**	- -	- -
Hubble Space Telescope	98	- -	**83**	- -	- -
Physics of the Cosmos	125	- -	**100**	- -	- -
Exoplanet Exploration	141	- -	**176**	- -	- -
Astrophysics Explorer	108	- -	**145**	- -	- -
Total Astrophysics	763	750	**817**	67	8.9%
James Webb Space Telescope	620	569	**534**	-36	-6.3%
Total Science	5,584	5,765	**5,712**	-53	-0.9%

(continued)

Table I-9. National Aeronautics and Space Administration R&D (continued)
(budget authority in millions of dollars)

Select NASA Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Aeronautics					
Airspace Ops and Safety	147	169	**109**	-61	-35.8%
Advanced Air Vehicles	255	--	**233**	--	--
Integrated Aviation Systems	128	--	**174**	--	--
Transformative Concepts	104	--	**109**	--	--
Total Aeronautics	634	660	**624**	-36	-5.4%
Space Operations					
Space Shuttle	5	--	**--**	--	--
International Space Station	1,436	--	**1,491**	--	--
Space and Flight Support	923	--	**835**	--	--
Space Transportation 2/	2,668	2,213	**2,415**	202	9.1%
Total Space Operations	5,032	4,951	**4,741**	-210	-4.2%
Exploration					
Exploration Systems Development	3,641	3,929	**3,584**	-345	-8.8%
Orion Program	1,270	1,350	**1,186**	-164	-12.1%
Space Launch Systems (SLS)	1,972	2,150	**1,938**	-212	-9.9%
Ground Systems	399	429	**460**	31	7.3%
Exploration R&D	355	395	**350**	-45	-11.4%
Human Research Program	145	--	**140**	--	--
Adv Exploration Systems	210	--	**210**	--	--
Total Exploration	3,996	4,324	**3,934**	-390	-9.0%

(continued)

Table I-9. National Aeronautics and Space Administration R&D (continued)
(budget authority in millions of dollars)

Select NASA Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Space Technology					
SBIR/STTR	201	--	**180**	--	--
Agency Technology and Innovation	32	--	**32**	--	--
Space Tech Research & Development	454	--	**467**	--	--
Total Space Technology	686	687	**679**	-36	5.4%
Safety, Security, Mission Svcs					
Center Management & Ops	1,988	--	**1,993**	--	--
Agency Management & Ops	785	--	**838**	--	--
Total Safety, Security, Mission Svcs	2,772	2,769	**2,830**	62	2.2%
Const and Environ Compliance					
Construction of Facilities	353	--	**408**	408	--
Environ Compl and Restoration	75	--	**88**	--	--
Total Const and Environ Compl	427	361	**496**	135	37.5%
Education	115	100	**37**	-63	-62.7%
Inspector General	37	38	**39**	1	3.7%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation. Note: The large drop in FY 2018 R&D funding is due to NASA's new Experimental Development definition starting in FY 2018, and the transition of several large Exploration and Space Operations programs from development to operations, according to OMB.

**Based on the 2017 omnibus; figures not available for all accounts and subprograms.

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

All figures rounded to the nearest million.

1/ Stratospheric Observatory for Infrared Astronomy.

2/ Includes Commercial Crew and Cargo Program.

Table I-10. National Science Foundation R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Total NSF R&D	6,022	6,051	**5,370**	-681	-11.3%
Conduct of R&D	5,589	5,588	**4,950**	-638	-11.4%
R&D Facilities	433	463	**420**	-43	-9.3%

Select NSF Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Biological Sciences (BIO)					
Molecular and Cellular Bioscis	135	--	**123**	--	--
Integrative Organismal Sys	214	--	**111**	--	--
Environmental Biology	144	--	**131**	--	--
Biological Infrastructure	145	--	**170**	--	--
Emerging Frontiers	86	--	**137**	--	--
Total BIO	724	744	**672**	-72	-9.7%
Computer and Information Science and Engineering (CISE)					
Advanced Cyberinfrastructure	222	--	**199**	--	--
Computing & Communic Foun	194	--	**174**	--	--
Computer & Network Sys	231	--	**207**	--	--
Info & Intelligent Sys	195	--	**175**	--	--
Information Tech Research	93	--	**84**	--	--
Total CISE	935	936	**839**	-97	-10.4%
Engineering (ENG)					
Chem, Bioeng, Env & Trans	184	--	**168**	--	--
Civil, Mech & Manuf Innov	216	--	**202**	--	--
Electl Commun & Cyber Sys	114	--	**103**	--	--
Industrial Innov Prtnrshp	240	--	**223**	--	--
SBIR/STTR	*189*	--	***176***	--	--
Engineering Edu & Centers	108	--	**100**	--	--
Emerging Front in Res Innov	54	--	**37**	--	--
Total ENG	916	916	**833**	-83	-9.0%
Geosciences (GEO)					
Atmospheric and Geospace Sci	254	--	**228**	--	--
Earth Sciences	180	--	**161**	--	--
Integrative & Collab Edu & Res	83	--	**72**	--	--
Ocean Sciences	360	--	**323**	--	--
Polar Programs 1/	449	--	**409**	--	--
Total GEO	1,325	1,320	**1,192**	-128	-9.7%

(continued)

Table I-10. National Science Foundation R&D (continued)
(budget authority in millions of dollars)

Select NSF Discretionary Budgets (including non-R&D components)

	FY 2016 Actual	FY 2017 Enacted**	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Mathematical and Physical Sciences (MPS)					
Astronomical Sciences	247	--	**221**	--	--
Chemistry	247	--	***221***	--	--
Materials Research	*310*	--	***283***	--	--
Mathematical Sciences	234	--	**210**	--	--
Physics	277	--	**253**	--	--
Multidisciplinary Activities	35	--	**31**	--	--
Total MPS	1,349	1,362	**1,219**	-143	-10.5%
Social, Behavioral and Economic Sciences (SBE)					
Social & Economic Scis	98	--	**87**	--	--
Behavioral & Cognitive Scis	95	--	**85**	--	--
Natl Ctr for Sci and Eng Stats	51	--	**48**	--	--
Office of Multidiscip Act	28	--	**23**	--	--
Total SBE	272	272	**244**	-28	-10.3%
International and Integrative Activities (IIA)	427	--	**316**	--	--
EPSCoR	160	--	**100**	--	--
Major Res Instrument (MRI)	76	--	**75**	--	--
Ofc of Internatl Sci and Engineering	49	--	**44**	--	--
Arctic Research Commission	1	--	**1**	--	--
Total Research and Related Activities	5,998	6,034	**5,362**	-672	-11.1%
Education & Human Resources (EHR)					
Research on Learning in Formal and Informal Settings	224	--	**200**	--	--
Undergraduate Education	232	--	**204**	--	--
Graduate Education	278	--	**221**	--	--
Human Resource Development	149	--	**135**	--	--
Total EHR	884	880	**761**	-119	-13.6%
Major Research Equip & Facils	242	209	**183**	-26	-12.5%
Agency Ops & Award Mgmt	351	330	**329**	-1	-0.5%
National Science Board	4	4	**4**	0	0.0%
Inspector General	15	15	**15**	0	-1.3%
Total NSF Budget	7,494	7,472	**6,653**	-819	-11.0%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.
**R&RA Directorate totals based on FY 2017 CR levels.
Source: OMB R&D data, agency budget justification and Quantitative Data Tables.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ The FY 2018 budget proposes to move Polar Programs out of the Geosciences Directorate.

Table I-11. Department of Agriculture R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Enacted*	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Agricultural Research Service (ARS)					
Salaries and Expenses	1,144	1,170	**992**	-177.9	-15.2%
Trust Funds	24	24	**24**	0	0.0%
Buildings and Facilities 1/	212	100	**-100**	-199	-200.0%
Total ARS R&D	1,380	1,293	**916**	-377	-29.2%
National Institute of Food and Agriculture (NIFA)					
Biomass R&D 2/	3	3	**0**	-3	-100.0%
All Other	836	866	**806**	-60	-6.9%
Agri Food Res Init (AFRI)	350	375	**349**	-26	-6.8%
Total NIFA R&D	839	869	**806**	-63	-7.2%
Economic Research Service	85	87	**77**	-10	-11.6%
Forest Service	304	289	**253**	-36	-12.5%
Foreign Agricultural Service	1	1	**1**	0	0.0%
Nat Agricultural Stats Service	9	9	**9**	0	3.2%
Animal & Plant Inspection Srv	39	42	**40**	-2	-4.7%
Total USDA R&D	2,657	2,590	**2,102**	-488	-18.8%
Select Discretionary Budgets (including non-R&D components)					
Forest Service					
Forest and Rangeland Research	291	289	**259**	-30	-10.2%
Wildland Fire R&D	20	20	**18**	-2	-11.1%
Joint Fire Science Program 3/	7	0	**0**	0	- -
Research, Education and Economics	2,936	2,891	**2,409**	-482	-16.7%
Agri Research Service (ARS)	1,356	1,270	**894**	-376	-29.6%
Nat Inst Food Agri (NIFA)	1,326	1,363	**1,253**	-110	-8.1%
Hatch Act	244	244	**243**	0	-0.2%
1890 Research	54	54	**54**	0	-0.2%
Cooperative Forestry	34	34	**29**	-5	-15.0%
Economic Research Service	85	87	**77**	-10	-11.6%
Nat Agriculture Stats Serv	168	171	**186**	14	8.4%

*R&D figures are unofficial AAAS estimates based on FY 2017 omnibus legislation. All other FY 2017 figures reflect omnibus enacted levels.
Source: OMB R&D data, agency budget justification and agency budget documents.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ Administration proposes rescinding all funding appropriated for Buildings & Facilities in FY 2017.
2/ Mandatory program in Farm Bill. Mandatory authorization expires after FY 2017.
3/ Support shifts to Forest and Rangeland Research appropriation beginning in FY 2017.

Table I-12. Department of Commerce R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Total NOAA R&D	675	804	**671**	-133	-16.5%
Total NIST R&D	762	775	**651**	-124	-16.0%
Nat'l Telecomm and Info Admin	11	10	**13**	3	29.1%
Bureau of the Census	227	224	**228**	4	1.8%
Total Commerce R&D	1,675	1,813	**1,563**	-250	-13.8%
Discretionary Budgets (including non-R&D)					
National Oceanic and Atmospheric Administration (NOAA)					
Natl Ocean Service**	503	521	**387**	-134	-25.7%
Natl Marine Fisheries Service**	848	852	**821**	-30	-3.5%
Oceanic and Atmos Res**	481	514	**350**	-164	-31.9%
Climate Research	158	158	**128**	-30	-19.0%
Weather and Air Chemistry Research	103	114	**85**	-29	-25.4%
Ocean, Coastal, Great Lakes Research	188	193	**99**	-94	-48.7%
Natl Weather Service**	1,122	1,122	**1,058**	-64	-5.7%
NESDIS** 1/	2,345	2,204	**1,815**	-388	-17.6%
GOES-R	870	753	**519**	-234	-31.1%
JPSS	807	787	**776**	-11	-1.5%
Office of Marine and Aviation Ops**	302	298	**301**	3	1.0%
Total NOAA	5,774	5,675	**4,775**	-900	-15.9%
National Institute of Standards and Technology (NIST)					
Sci & Tech Research and Serv	690	690	**600**	-90	-13.0%
Industrial Technology Services 2/	155	153	**21**	-132	-86.3%
Manufacturing USA	25	25	**15**	-10	-40.0%
Hollings Manuf Ext Partnership	130	130	**6**	-124	-95.4%
Construction of Res Facilities	119	109	**104**	-5	-4.6%
Total NIST	964	952	**725**	-227	-23.8%

*R&D figures are unofficial AAAS estimates based on FY 2017 omnibus legislation. Discretionary figures are based on the FY 2017 omnibus.

**ORF and PAC funding.

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

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

1/ National Environmental Satellite, Data and Information Service.

2/ Includes funding for Manufacturing USA, formerly National Network for Manufacturing Innovation (NNMI).

Table I-13. Department of Transportation R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Dept of Transportation R&D					
Federal Highway Administration	321	330	**333**	3	1.0%
Federal Aviation Administration	425	439	**408**	-32	-7.2%
Research, Engineer and Development	166	177	**150**	-27	-15.0%
Facilities and Equipment	203	206	**203**	-4	-1.8%
Federal Transit Administration	28	28	**28**	0	0.0%
Federal Railroad Administration	44	45	**44**	-1	-2.3%
Natl Highway Traffic & Safety	87	86	**86**	-1	-1.0%
Office of the Secretary	14	16	**17**	1	5.0%
Pipeline and Hazardous Mats	21	21	***21***	1	4.0%
Fed Motor Carrier Safety Admin	8	9	**9**	0	0.1%
Total DOT R&D	948	974	**945**	-29	-2.9%

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Select Department of Transportation Agency Budgets (including non-R&D components)					
Federal Highway Administration					
Research, Tech and Ed Program	415	418	**418**	0	0.0%
Highway R&D	119	125	**125**	0	0.0%
Intelligent Transportation Sys	95	100	**100**	0	0.0%
State Planning and Research	195	200	**204**	4	2.2%
University Transp Centers	69	75	**75**	0	0.0%
Federal Aviation Administration					
Research, Engineer and Development	166	177	**150**	-27	-15.0%
NextGen	980	1,034	**988**	-46	-4.4%
Federal Railroad Administration					
Railroad R&D	39	40	**39**	-1	-2.5%
Natl Highway Traffic Safety Admin					
Operations and Research	296	326	**302**	-24	-7.5%
Office of the Secretary					
Planning, Res, Development	9	12	**9**	-4	-29.2%
Asst Sec, Research and Tech	13	13	**8**	-5	-34.9%

*FY 2017 R&D figures are unofficial AAAS estimates based on FY 2017 omnibus legislation.
Source: OMB R&D data and DOT budget justification.
All figures rounded to nearest million. Changes calculated from unrounded figures.

Table I-14. Department of Homeland Security R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Domestic Nuc Detection	78	76	**73**	-3	-3.4%
Science and Technology	484	493	**437**	-56	-11.4%
Coast Guard 1/	20	38	**20**	-18	-46.9%
Other 2/	0	17	**34**	17	100.4%
Total DHS R&D	582	623	**564**	-59	-9.5%

	FY 2016 Actual	FY 2017 Enacted	**FY 2018 Budget**	Change FY 17-18 Amount	Change FY 17-18 Percent
Discretionary Budget (including non-R&D components)					
Coast Guard					
RDT&E	18	36	**19**	-18	-48.7%
Science & Technology	777	782	**627**	-154	-19.8%
Ops and Support	*302*	*311*	***255***	*-57*	*-18.2%*
Mission Support	121	129	**120**	-9	-7.0%
Lab Facilities	134	134	**92**	-42	-31.1%
Acq and Ops Analysis	47	48	**43**	-6	-12.1%
Research and Development	475	471	**373**	-98	-20.8%
Res, Dev and Innov	435	430	**343**	-87	-20.3%
Apex R&D**	- -	79	**53**	-26	-32.5%
Border Security**	- -	57	**48**	-8	-14.7%
Chem/Bio/Expl**	- -	58	**53**	-6	-9.8%
Counterterrorist R&D**	- -	100	**81**	-18	-18.5%
Cybersecurity**	- -	66	**46**	-20	-30.4%
Disaster Resilience**	- -	73	**61**	-12	-16.0%
University Programs	40	41	**30**	-11	-26.6%
Domestic Nuclear Detection Office	347	352	**330**	-22	-6.3%
Ops and Support	51	50	**55**	5	9.2%
Mission Support	51	50	**55**	5	9.2%
Procurement and Construction	88	101	**87**	-14	-13.8%
Research and Development	160	155	**144**	-11	-7.0%
Architecture Planning and Analysis	16	15	**16**	1	5.7%
Transformational R&D	65	62	**61**	-1	-2.3%
Detection Capability Development	21	20	**15**	-4	-22.6%
Detection Capability Assessment	40	39	**34**	-5	-13.1%
Nuclear Forensics	19	19	**18**	0	-2.5%
Federal Assistance	47	46	**45**	-2	-3.9%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.
**Thrust areas shown at annualized continuing resolution levels for FY 2017.
Source: OMB R&D data and agency budget justification.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ Includes contributions from the Oil Spill Liability Trust Fund.
2/ Includes small amounts from Secret Service, TSA and other DHS offices.

Table I-15. Department of Veterans Affairs R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Medical and Prosthetic Research 1/					
Biomedical Laboratory Science	211	- -	**186**	- -	- -
Rehabilitation	102	- -	**102**	- -	- -
Health Services	112	- -	**102**	- -	- -
Clinical Science	225	- -	**250**	- -	- -
Adjustments and Transfers	-39				
Total Medical and Prosthetic Research	611	673	**640**	-33	-5.0%
Research Support 2/	611	673	**717**	44	6.5%
Total VA R&D	1,222	1,346	**1,357**	11	0.8%
Federal Grants and Nonfederal Resources 3/	581	595	**570**	-25	-4.2%
Total VA-Performed R&D	1,803	1,941	**1,927**	-14	-0.7%

Source: OMB R&D data and agency budget justification.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
BA adjustment converts obligations to budget authority.
1/ Subaccounts reflect obligations.
2/ Includes funding for lab facilities, support services and some investigator salaries from other VA accounts under Medical Services.
3/ Funding for VA investigators originating from other agencies (NIH, DOD, etc.) and nongovernment sources (foundations, etc.). Agency funds are included in R&D totals for the sponsoring agencies.

Table I-16. Department of the Interior R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
U.S. Geological Survey (USGS)					
Ecosystems	160	160	**132**	-28	-17.3%
Land Resources**	102	104	**73**	-31	-30.2%
Energy, Minerals and Enviro Health	95	94	**92**	-3	-3.0%
Natural Hazards	113	118	**98**	-20	-16.8%
Water Resources	121	123	**95**	-28	-23.0%
Core Science Systems	86	88	**72**	-17	-19.0%
Science Support 1/	0	0	**0**	0	-15.4%
U.S. Geological Survey (USGS)	677	688	**561**	-127	-18.4%
Bureau of Ocean Energy Management	73	65	**58**	-7	-10.9%
Bureau of Safety and Env Enforce	27	25	**25**	0	1.8%
National Park Service	27	28	**26**	-2	-6.7%
Bureau of Reclamation	96	131	**81**	-50	-38.0%
Bureau of Land Management	22	22	**24**	2	7.1%
U.S. Fish and Wildlife Service	32	32	**15**	-17	-53.4%
Wildland Fire Management	10	6	**3**	-3	-50.0%
Bureau of Indian Affairs	5	5	**5**	0	2.4%
Office of Surface Mining	4	5	**0**	-5	-100.0%
Total Interior R&D	973	1,006	**798**	-208	-20.7%
Conduct of R&D	971	1,004	**796**	-208	-20.7%
R&D Facilities	2	2	**2**	0	0.0%

(continued)

Table I-16. Department of the Interior R&D (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Select Department of the Interior Discretionary Budgets (including non-R&D components)					
Bureau of Land Management	1,246	1,218	**1,087**	-131	-10.8%
Bureau of Ocean Energy Management	101	74	**114**	40	53.8%
Bureau of Safety and Environmental Enforce	109	83	**112**	29	34.7%
Office of Surface Mining	241	253	**129**	-124	-48.9%
Bureau of Reclamation	1,265	1,307	**1,097**	-209	-16.0%
U.S. Geological Survey	1,062	1,085	**922**	-163	-15.0%
Ecosystems	160	160	**132**	-28	-17.3%
Land Resources**	140	149	**113**	-36	-24.4%
Energy, Minerals and Environmental Health	95	94	**92**	-3	-3.0%
Natural Hazards	139	145	**118**	-27	-18.6%
Water Resources	211	215	**173**	-42	-19.4%
Core Science Systems	112	116	**93**	-23	-19.9%
Science Support	106	106	**89**	-16	-15.4%
Facilities	100	100	**112**	12	11.7%
U.S. Fish and Wildlife Service	1,508	1,520	**1,303**	-217	-14.3%
National Park Service	2,582	2,932	**2,553**	-379	-12.9%
Bureau of Indian Affairs	2,796	2,860	**2,488**	-372	-13.0%

*USGS R&D figures are enacted amounts reported by the agency; total Interior R&D represents unofficial AAAS estimates based on FY 2017 omnibus legislation. Discretionary totals for FY 2017 reflect omnibus enacted levels.

**Renamed from current Climate and Land Use Change Program.

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

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

1/ R&D is less than $500,000.

Table I-17. Environmental Protection Agency R&D
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Environmental Protection Agency R&D 1/					
Science and Technology	494	480	**264**	-216	-45.1%
Homeland Security	37	33	**23**	-10	-30.3%
Human Health Risk Assessment	36	38	**23**	-15	-40.0%
Air and Energy**	104	92	**31**	-61	-66.7%
Safe and Sustainable Water	115	106	**69**	-38	-35.5%
Sustainable Communities	154	134	**54**	-80	-59.6%
Chemical Safety	93	89	**62**	-28	-31.0%
National Priorities	0	4	**0**	-4	-100.0%
Superfund	19	16	**12**	-3	-20.0%
Homeland Security	37	33	**17**	-16	-47.9%
Chemical Safety	3	3	**5**	2	87.9%
Sustainable Communities	14	11	**6**	-6	-50.7%
Oil Spill Response	1	1	**0**	0	-35.7%
Sustainable Communities	1	1	**1**	0	-24.2%
Leaking Underground Storage Tanks 2/	0	0	**0**	0	0.0%
Total EPA R&D	513	496	**277**	-219	-44.2%
EPA Discretionary Budget (including non-R&D components)					
Science and Technology 3/	764	714	**397**	-317	-44.4%
Environmental Programs and Management	2,651	2,620	**1,717**	-902	-34.4%
Superfund	1,159	1,089	**762**	-327	-30.0%
State and Tribal Assistance Grants	3,485	3,527	**2,933**	-594	-16.8%
Clean Water State Fund	1,351	1,394	**1,394**	0	0.0%
Drinking Water State Fund	854	863	**863**	0	0.0%
Buildings and Facilities	45	34	**40**	5	14.8%
Leaking Underground Storage Tanks	94	92	**47**	-45	-48.4%
Oil Spill Response	19	18	**16**	-2	-13.7%
Inspector General	40	41	**37**	-4	-9.7%
E-Waste Manifest	3	3	**0**	-3	-100.0%
Total EPA Discretionary Budget	8,258	8,058	**5,655**	-2,403	-29.8%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation. All other FY 2017 figures reflect omnibus enacted levels.
**Renamed from current Air, Climate and Energy (ACE) Program.
Source: OMB R&D data, agency budget justification and agency budget documents.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
1/ Research programs may include non-R&D.
2/ R&D is less than $500,000.
3/ Includes rescission of $54 million in prior-year funding.

APPENDIX 1
OVERVIEW TABLES

Table A-1. R&D in the FY 2017 Budget by Agency and Character of Work
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Total R&D (Conduct of R&D and R&D Facilities)**					
Defense 1/	72,801	76,653	**85,171**	8,518	11.1%
S&T ("6.1"-"6.3")	*12,779*	*13,979*	***13,224***	*-755*	*-5.4%*
All Other DOD	*60,022*	*62,674*	***71,947***	*9,273*	*14.8%*
Health and Human Services	32,243	34,122	**26,144**	-7,978	-23.4%
National Institutes of Health	*30,843*	*32,802*	***25,093***	*-7,709*	*-23.5%*
All Other HHS	*1,400*	*1,320*	***1,051***	*-269*	*-20.4%*
Energy	15,007	15,958	**13,436**	-2,522	-15.8%
Atomic Energy Defense	*6,307*	*7,099*	***7,306***	*207*	*2.9%*
Office of Science	*5,305*	*5,344*	***4,433***	*-911*	*-17.1%*
Energy Programs	*3,394*	*3,515*	***1,697***	*-1,817*	*-51.7%*
NASA	13,273	13,586	**10,332**	-3,254	-24.0%
National Science Foundation	6,022	6,051	**5,370**	-681	-11.3%
Agriculture	2,657	2,590	**2,102**	-488	-18.8%
Commerce	1,675	1,813	**1,563**	-249	-13.7%
NOAA	*675*	*804*	***671***	*-133*	*-16.5%*
NIST	*762*	*775*	***652***	*-123*	*-15.8%*
Transportation	948	974	**945**	-29	-2.9%
Homeland Security	582	623	**564**	-59	-9.5%
Veterans Affairs	1,222	1,346	**1,357**	11	0.8%
Interior	973	1,006	**798**	-208	-20.7%
U.S. Geological Survey	*677*	*688*	***561***	*-127*	*-18.4%*
Environmental Protection Agency	513	496	**277**	-220	-44.2%
Education	254	257	**246**	-11	-4.3%
Smithsonian	251	265	**304**	39	14.7%
International Assistance Programs	248	266	**73**	-193	-72.5%
Patient-Centered Outcomes Res	469	463	**533**	70	15.1%
Justice	51	47	**68**	21	43.2%
Nuclear Reg Comm	86	75	**67**	-8	-10.7%
State	40	40	**37**	-3	-7.5%
Housing and Urban Development	63	47	**58**	11	23.0%
Social Security	101	101	**101**	0	0.0%
Tennessee Valley Authority	10	13	**16**	3	23.1%
Postal Service	19	31	**32**	1	3.2%
Corps of Engineers	9	9	**11**	2	16.7%
Consumer Product Safety Comm	2	2	**1**	-1	-50.0%
Total R&D	149,520	156,834	**149,606**	-7,229	-4.6%
Defense R&D 1/	79,109	83,752	**92,477**	8,725	10.4%
Nondefense R&D	70,411	73,082	**57,129**	-15,954	-21.8%

1/ Total includes DOD RDT&E prior-year budget authority adjustments.

(continued)

Table A-1. R&D in the FY 2018 Budget by Agency and Character of Work (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Basic Research					
Defense	2,230	2,282	**2,235**	-48	-2.1%
Health and Human Services	15,630	17,302	**12,816**	*-4,486*	*-25.9%*
National Institutes of Health	*15,558*	*17,227*	***12,728***	*-4,499*	*-26.1%*
All Other HHS	*72*	*74*	***88***	*14*	*18.3%*
Energy	4,605	4,675	**3,981**	-694	-14.8%
Atomic Energy Defense	*105*	*71*	***113***	*42*	*59.9%*
Office of Science	*4,452*	*4,575*	***3,830***	*-745*	*-16.3%*
Energy Programs	*48*	*29*	***38***	*8*	*28.2%*
NASA	3,578	3,623	**3,717**	94	2.6%
National Science Foundation	4,829	4,843	**4,280**	-563	-11.6%
Agriculture	1,031	1,027	**952**	-75	-7.3%
Commerce	235	226	**200**	-26	-11.4%
NIST	*235*	*226*	***200***	*-25*	*-11.2%*
Homeland Security	41	40	**42**	2	5.7%
Veterans Affairs	386	390	**394**	4	1.0%
Interior	54	54	**44**	-11	-19.6%
U.S. Geological Survey	*54*	*54*	***44***	*-11*	*-19.6%*
Education	24	33	**31**	-2	-6.1%
Smithsonian	220	233	**226**	-7	-2.9%
Justice	17	10	**17**	7	73.0%
Corps of Engineers	1	1	**1**	0	-29.8%
International Assistance Programs	1	4	**0**	-4	-100.0%
Total Basic Research	32,883	34,743	**28,934**	-5,808	-16.7%
Defense	2,335	2,353	**2,348**	-5	-0.2%
Nondefense	30,548	32,390	**26,587**	-5,803	-17.9%

(continued)

Table A-1. R&D in the FY 2018 Budget by Agency and Character of Work (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Applied Research					
Defense	7,732	7,853	**6,721**	-1,132	-14.4%
Health and Human Services	16,422	16,586	**13,158**	-3,428	-20.7%
National Institutes of Health	*15,140*	*15,407*	***12,256***	*-3,151*	*-20.5%*
All Other HHS	*1,282*	*1,179*	***902***	*-277*	*-23.5%*
Energy	6,381	6,657	**6,800**	144	2.2%
Atomic Energy Defense	*4,554*	*4,745*	***5,376***	*632*	*13.3%*
Energy Programs	*1,827*	*1,912*	***1,424***	*-488*	*-25.5%*
NASA	2,439	2,555	**2,563**	8	0.3%
National Science Foundation	760	745	**671**	-74	-10.0%
Agriculture	1,119	1,151	**973**	-179	-15.5%
Commerce	895	994	**765**	-229	-23.1%
NOAA	*430*	*504*	***366***	*-138*	*-27.4%*
NIST	*367*	*383*	***311***	*-72*	*-18.8%*
Transportation	542	550	**538**	-13	-2.3%
Homeland Security	179	178	**152**	-26	-14.6%
Veterans Affairs	804	924	**936**	12	1.3%
Interior	780	796	**632**	-164	-20.6%
U.S. Geological Survey	*512*	*514*	***422***	*-92*	*-17.9%*
Environmental Protection Agency	432	418	**234**	-185	-44.2%
Education	132	132	**130**	-2	-1.5%
International Assistance Programs	201	195	**55**	-140	-71.8%
Patient-Centered Outcomes Research	469	463	**533**	70	15.1%
Justice	15	10	**16**	6	53.3%
Nuclear Reg Comm	86	75	**67**	-8	-10.7%
State	27	27	**24**	-3	-11.1%
Housing and Urban Development	40	30	**40**	10	32.0%
Social Security	101	101	**101**	0	0.0%
Tennessee Valley Authority	5	6	**5**	-1	-16.7%
Corps of Engineers	5	5	**5**	0	0.0%
Consumer Product Safety Comm	2	2	**1**	-1	-50.0%
Total Applied Research	39,569	40,455	**35,119**	-5,336	-13.2%
Defense	12,285	12,598	**12,098**	-500	-4.0%
Nondefense	27,283	27,858	**23,022**	-4,836	-17.4%

(continued)

Table A-1. R&D in the FY 2018 Budget by Agency and Character of Work (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Total Research (basic and applied)					
Defense	9,962	10,135	**8,956**	-1,180	-11.6%
Health and Human Services	32,052	33,888	**25,974**	-7,914	-23.4%
National Institutes of Health	*30,698*	*32,634*	***24,984***	*-7,650*	*-23.4%*
All Other HHS	*1,354*	*1,254*	***990***	*-264*	*-21.0%*
Energy	10,986	11,331	**10,781**	-550	-4.9%
Atomic Energy Defense	*4,658*	*4,816*	***5,490***	*674*	*14.0%*
Office of Science	*4,452*	*4,575*	***3,830***	*-745*	*-16.3%*
Energy Programs	*1,875*	*1,941*	***1,462***	*-480*	*-24.7%*
NASA	6,018	6,178	**6,280**	102	1.6%
National Science Foundation	5,589	5,588	**4,950**	-638	-11.4%
Agriculture	2,150	2,179	**1,925**	-254	-11.7%
Commerce	1,130	1,219	**965**	-255	-20.9%
NOAA	*430*	*504*	***366***	*-138*	*-27.4%*
NIST	*601*	*609*	***512***	*-97*	*-16.0%*
Transportation	542	550	**538**	-13	-2.3%
Homeland Security	220	218	**194**	-24	-10.9%
Veterans Affairs	1,190	1,314	**1,330**	16	1.2%
Interior	834	851	**676**	-175	-20.5%
U.S. Geological Survey	*512*	*514*	***422***	*-92*	*-17.9%*
Environmental Protection Agency	432	418	**234**	-185	-44.2%
Education	156	165	**161**	-4	-2.4%
Smithsonian	220	233	**226**	-7	-2.9%
International Assistance Programs	201	195	**55**	-140	-71.8%
Patient-Centered Outcomes Research	469	463	**533**	70	15.1%
Justice	32	20	**33**	13	62.9%
Nuclear Reg Comm	86	75	**67**	-8	-10.7%
State	28	31	**24**	-7	-22.0%
Housing and Urban Development	40	30	**40**	10	32.0%
Social Security	101	101	**101**	0	0.0%
Tennessee Valley Authority	5	6	**5**	-1	-16.7%
Corps of Engineers	6	6	**6**	0	-6.6%
Consumer Product Safety Comm	2	2	**1**	-1	-50.0%
Total Research	72,452	75,198	**64,054**	-11,144	-14.8%
Defense	14,620	14,951	**14,445**	-506	-3.4%
Nondefense	57,832	60,247	**49,609**	-10,639	-17.7%

(continued)

Table A-1. R&D in the FY 2018 Budget by Agency and Character of Work (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Development**					
Defense	63,842	66,516	**76,498**	9,982	15.0%
S&T (6.3)	*5,633*	*6,456*	***6,022***	*-434*	*-6.7%*
All Other DOD	*58,209*	*60,059*	***70,476***	*10,416*	*17.3%*
Health and Human Services	30	31	**26**	-5	-15.9%
All Other HHS	*30*	*31*	***26***	*-5*	*-15.9%*
Energy	2,864	3,519	**1,678**	-1,840	-52.3%
Atomic Energy Defense	*1,365*	*1,993*	***1,466***	*-527*	*-26.5%*
Energy Programs	*1,499*	*1,526*	***212***	*-1,313*	*-86.1%*
NASA	7,234	7,372	**3,925**	-3,447	-46.8%
Agriculture	177	180	**160**	-20	-11.3%
Commerce	236	243	**226**	-17	-6.8%
NOAA	*82*	*87*	***64***	*-23*	*-26.1%*
NIST	*14*	*29*	***9***	*-19*	*-68.3%*
Transportation	373	390	**375**	-16	-4.0%
Homeland Security	354	406	**370**	-36	-8.8%
Veterans Affairs	32	32	**27**	-5	-15.6%
Interior	137	153	**120**	-34	-21.9%
U.S. Geological Survey	*111*	*119*	***95***	*-24*	*-20.2%*
Environmental Protection Agency	78	75	**43**	-33	-43.5%
Education	98	92	**85**	-7	-7.6%
International Assistance Programs	46	67	**18**	-49	-73.0%
Justice	19	27	**30**	3	10.2%
State	13	13	**13**	0	0.0%
Housing and Urban Development	23	17	**18**	1	6.9%
Postal Service	19	31	**32**	1	3.2%
Tennessee Valley Authority	5	7	**11**	4	57.1%
Corps of Engineers	5	5	**5**	0	0.0%
Total Development	75,584	79,175	**83,659**	4,484	5.7%
Defense	65,207	68,509	**77,964**	9,455	13.8%
Nondefense	10,377	10,667	**5,695**	-4,971	-46.6%

(continued)

Table A-1. R&D in the FY 2018 Budget by Agency and Character of Work (continued)

(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Conduct of R&D (basic and applied research, development)**					
Defense	73,804	76,601	**85,454**	8,853	11.6%
S&T (6.1-6.3 and medical)	*12,779*	*13,979*	***13,224***	*-755*	*-5.4%*
All Other DOD	*61,025*	*62,622*	***72,229***	*9,607*	*15.3%*
Health and Human Services	32,082	33,919	**26,000**	-7,919	-23.3%
National Institutes of Health	*30,698*	*32,634*	***24,984***	*-7,650*	*-23.4%*
All Other HHS	*1,384*	*1,285*	***1,016***	*-269*	*-20.9%*
Energy	13,850	14,850	**12,459**	-2,391	-16.1%
Atomic Energy Defense	*6,023*	*6,809*	***6,955***	*147*	*2.2%*
Office of Science	*4,452*	*4,575*	***3,830***	*-745*	*-16.3%*
Energy Programs	*3,374*	*3,467*	***1,674***	*-1,793*	*-51.7%*
NASA	13,251	13,550	**10,205**	-3,345	-24.7%
National Science Foundation	5,589	5,588	**4,950**	-638	-11.4%
Agriculture	2,327	2,359	**2,085**	-274	-11.6%
Commerce	1,365	1,462	**1,191**	-271	-18.6%
NOAA	*511*	*591*	***430***	*-161*	*-27.2%*
NIST	*616*	*638*	***521***	*-117*	*-18.3%*
Transportation	915	941	**913**	-28	-3.0%
Homeland Security	574	623	**564**	-59	-9.5%
Veterans Affairs	1,222	1,346	**1,357**	11	0.8%
Interior	971	1,004	**796**	-208	-20.7%
U.S. Geological Survey	*677*	*688*	***561***	*-127*	*-18.4%*
Environmental Protection Agency	510	494	**276**	-218	-44.1%
Education	254	257	**246**	-11	-4.3%
Smithsonian	220	233	**226**	-7	-2.9%
International Assistance Programs	248	266	**73**	-193	-72.5%
Patient-Centered Outcomes Research	469	463	**533**	70	15.1%
Justice	51	47	**63**	16	32.6%
Nuclear Reg Comm	86	75	**67**	-8	-10.7%
State	40	40	**37**	-3	-7.5%
Housing and Urban Development	63	47	**58**	11	23.0%
Social Security	101	101	**101**	0	0.0%
Tennessee Valley Authority	10	13	**16**	3	23.1%
Postal Service	19	31	**32**	1	3.2%
Corps of Engineers	9	9	**11**	2	16.7%
Consumer Product Safety Comm	2	2	**1**	-1	-50.0%
Total Conduct of R&D	148,036	154,324	**147,713**	-6,611	-4.3%
Defense	79,828	83,410	**92,409**	8,999	10.8%
Nondefense	68,207	70,912	**55,304**	-15,608	-22.0%

(continued)

Table A-1. R&D in the FY 2018 Budget by Agency and Character of Work (continued)
(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
R&D Facilities and Capital Equipment					
Defense	90	52	**0**	-52	-100.0%
Health and Human Services	161	203	**144**	-59	-29.1%
National Institutes of Health	*145*	*168*	***109***	*-59*	*-35.1%*
All Other HHS	*16*	*35*	***35***	*0*	*-1.0%*
Energy	1,157	1,108	**977**	-131	-11.8%
Atomic Energy Defense	*284*	*290*	***351***	*60*	*20.8%*
Office of Science	*853*	*770*	***603***	*-167*	*-21.7%*
Energy Programs	*20*	*48*	***23***	*-25*	*-51.3%*
NASA	22	36	**128**	91	250.3%
National Science Foundation	433	463	**420**	-43	-9.3%
Agriculture	330	231	**17**	-213	-92.5%
Commerce	310	350	**373**	22	6.3%
NOAA	*164*	*214*	***242***	*28*	*13.2%*
NIST	*146*	*137*	***131***	*-6*	*-4.2%*
Transportation	33	33	**32**	-1	-1.7%
Homeland Security	8	0	**0**	0	- -
Interior	2	2	**2**	0	0.0%
Environmental Protection Agency	3	2	***1***	-2	-79.4%
Smithsonian	31	32	**78**	46	140.7%
Total R&D Facilities	2,579	2,513	**2,175**	-337	-13.4%
Defense	374	342	**351**	9	2.5%
Nondefense	2,205	2,171	**1,825**	-346	-15.9%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.
**The official definition of development has changed, excluding some previously counted funding in NASA and the 6.7 account in DOD. These figures keep DOD 6.7 included for comparability.
Source: OMB R&D data, agency budget justifications and other agency budget documents and data.
Note: The projected GDP inflation rate between FY 2017 and FY 2018 is 2 percent.
All figures are rounded to the nearest million. Changes calculated from unrounded figures.

Table A-2. Distribution of the FY 2018 Budget
(outlays in billions of dollars)

	FY 2016 Actual	FY 2017 Estimate	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Discretionary					
Defense	585	594	**643**	49	8.3%
Nondefense	600	619	**601**	-18	-2.9%
Total Discretionary	1,185	1,213	**1,244**	31	2.6%
Entitlements and Mandatory					
Social Security /1	910	946	**1,005**	59	6.2%
Medicare /1	588	593	**582**	-11	-1.8%
Medicaid	368	378	**404**	25	6.7%
Other Mandatory	656	749	**649**	-100	-13.4%
Total Mandatory	2,523	2,667	**2,640**	-27	-1.0%
Net Interest	240	276	**315**	39	14.0%
Undistributed Offsetting Receipts	-95	-93	**-104**	-11	11.8%
Total Budget (Outlays)	3,852	4,062	**4,094**	32	0.8%
Total Receipts	3,268	3,460	**3,654**	195	5.6%
Unified Surplus or Deficit	-584	-603	**-440**	162	-27.0%
On-Budget Deficit	*-620*	*-644*	***-466***	*179*	*-27.8%*
Off-Budget Surplus/Deficit	*36*	*42*	***25***	*-16*	*-39.2%*
Gross Domestic Product (GDP)	18,407	19,162	**20,014**	852	4.4%
Federal Budget as Percentage of GDP	20.9%	21.2%	**20.5%**		

Source: Budget of the U.S. Government FY 2018.
All figures rounded to the nearest billion. Changes calculated from unrounded figures.
Note: The projected GDP inflation rate between FY 2017 and FY 2018 is 2 percent.
/1 Excludes administrative costs for these programs, which are classified as discretionary.

Table A-3. Historical Trends in R&D and Federal Outlays
(outlays in billions of dollars)

	FY 1970 Actual	FY 1980 Actual	FY 1990 Actual	FY 2000 Actual	FY 2010 Actual	**FY 2018 Budget**
Composition of Federal Outlays						
Mandatory Programs /1	61	262	568	951	1,913	**2,536**
Net Interest	14	53	184	223	196	**315**
Defense Discretionary	82	135	300	295	689	**643**
Nondefense Discretionary	38	142	200	320	658	**601**
Total Federal Outlays	196	591	1,253	1,789	3,456	**4,095**
Federal R&D Outlays						
Defense	8	15	41	41	81	**57**
Nondefense	7	16	23	33	60	**61**
Total Federal R&D Outlays	15	31	64	74	141	**118**
Composition of Federal Outlays						
Mandatory Programs /1	31.2%	44.4%	45.3%	53.2%	55.3%	**61.9%**
Net Interest	7.4%	8.9%	14.7%	12.5%	5.7%	**7.7%**
Defense Discretionary	41.9%	22.8%	24.0%	16.5%	19.9%	**15.7%**
Nondefense Discretionary	19.6%	24.0%	16.0%	17.9%	19.0%	**14.7%**
Total Federal Outlays	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**
Federal R&D Outlays as Percentage of Discretionary Outlays /2						
Defense	9.8%	10.9%	13.7%	13.9%	11.8%	**8.8%**
Nondefense	19.1%	11.2%	11.5%	10.4%	9.1%	**10.1%**
Total R&D as Percent of Discretionary	12.7%	11.0%	12.8%	12.1%	10.5%	**9.4%**
Federal R&D Outlays as Percentage of GDP						
Defense R&D	0.8%	0.5%	0.7%	0.4%	0.5%	**0.28%**
Nondefense R&D	0.7%	0.6%	0.4%	0.3%	0.4%	**0.30%**
Total R&D as Percent of GDP	1.5%	1.1%	1.1%	0.7%	1.0%	**0.59%**

Source: Budget of the U.S. Government FY 2018.
All figures rounded to the nearest billion. Changes calculated from unrounded figures.
/1 Net of offsetting receipts.
/2 R&D as a percentage of its respective category (e.g., defense R&D as a percentage of defense discretionary).

Table A-4. Major Functional Categories of R&D

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

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18		Percentage of Total ('18)
				Amount	Percent	
Defense (050) 1/**	79,109	83,752	**92,477**	8,725	10.4%	61.8%
Nondefense**	70,411	73,082	**57,129**	-15,954	-21.8%	38.2%
Space (252)	*12,811*	*13,041*	***9,830***	*-3,211*	*-24.6%*	*6.6%*
Health (550)	*33,909*	*35,894*	***27,999***	*-7,895*	*-22.0%*	*18.7%*
Energy (270)	*3,490*	*3,603*	***1,780***	*-1,822*	*-50.6%*	*1.2%*
General Science (251)	*11,328*	*11,395*	***9,803***	*-1,592*	*-14.0%*	*6.6%*
Environment (300)	*2,476*	*2,607*	***2,012***	*-595*	*-22.8%*	*1.3%*
Agriculture (350)	*2,353*	*2,301*	***1,849***	*-452*	*-19.6%*	*1.2%*
Transportation (400)	*1,428*	*1,560*	***1,485***	*-74*	*-4.8%*	*1.0%*
Commerce (370)	*1,019*	*1,040*	***924***	*-116*	*-11.1%*	*0.6%*
International (150)	*288*	*306*	***110***	*-196*	*-64.0%*	*0.1%*
Justice (750)	*613*	*628*	***592***	*-36*	*-5.8%*	*0.4%*
All Other	*696*	*709*	***745***	*36*	*5.0%*	*0.5%*
Total R&D	149,520	156,834	**149,606**	-7,229	-4.6%	100.0%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.

**The official definition of development has changed, excluding some previously counted funding in NASA and the 6.7 account in DOD. These figures keep DOD 6.7 included for comparability.

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

Classifications generally follow the government's budget function categories except Health (which here includes health R&D in VA) and other certain minor accounts.

Numbers in parentheses are the federal government budget function codes.

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

1/ Includes Department of Defense and defense programs in DOE.

Table A-5. Defense and Nondefense R&D by Character of Work

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

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	% Change FY 17-18	% Dist of FY '18
Basic Research					
Defense	2,335	2,353	**2,348**	-0.2%	1.6%
Nondefense	30,548	32,390	**26,587**	-17.9%	17.8%
Total Basic	32,883	34,743	**28,934**	-16.7%	19.3%
Applied Research					
Defense	12,285	12,598	**12,098**	-4.0%	8.1%
Nondefense	27,283	27,858	**23,022**	-17.4%	15.4%
Total Applied	39,569	40,455	**35,119**	-13.2%	23.5%
Development					
Defense	65,207	68,509	**77,964**	13.8%	52.1%
Nondefense	10,377	10,667	**5,695**	-46.6%	3.8%
Total Development**	75,584	79,175	**83,659**	5.7%	55.9%
Total Conduct of R&D (basic and applied research and development)					
Defense	79,828	83,410	**92,409**	10.8%	61.8%
Nondefense	68,209	70,914	**55,304**	-22.0%	37.0%
Total Conduct	148,036	154,324	**147,713**	-4.3%	98.7%
R&D Facilities and Capital Equipment					
Defense	374	342	**351**	2.5%	0.2%
Nondefense	2,205	2,171	**1,825**	-15.9%	1.2%
Total R&D Facilities	2,579	2,513	**2,175**	-13.4%	1.5%
Total R&D					
Defense	79,109	83,752	**92,477**	10.4%	61.8%
Nondefense	70,411	73,082	**57,129**	-21.8%	38.2%
Total R&D	149,520	156,834	**149,606**	-4.6%	100.0%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.

**The official definition of development has changed, excluding some previously counted funding in NASA and the 6.7 account in DOD. These figures keep DOD 6.7 included for comparability.

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

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

Defense includes Department of Defense and defense programs in DOE.

Table A-6. R&D Funding by Congressional Appropriations Subcommittee

(budget authority in millions of dollars)

	FY 2016 Actual	FY 2017 Estimate*	**FY 2018 Budget**	Change FY 17-18	
				Amount	Percent
Defense**	72,711	76,601	**85,171**	8,570	11.2%
Labor, HHS, Education	32,488	34,451	**26,554**	-7,897	-22.9%
Commerce, Justice, Science	21,021	21,497	**17,333**	-4,164	-19.4%
Energy and Water	15,208	16,186	**13,611**	-2,575	-15.9%
Agriculture	2,859	2,719	**2,263**	-456	-16.8%
Interior and Environment	2,019	1,999	**1,606**	-393	-19.6%
Military Construction, VA	1,312	1,398	**1,357**	-41	-2.9%
Transportation, HUD	*1,030*	*1,052*	***1,035***	*-17*	*-1.6%*
Homeland Security	582	623	**564**	-59	-9.5%
State and Foreign Operations	288	306	**110**	-196	-64.0%
Financial Services	2	2	**1**	-1	-50.0%
Total R&D	149,520	156,834	**149,606**	-7,229	-4.6%

*R&D figures are AAAS estimates based on FY 2017 omnibus legislation.

**The official definition of development has changed, excluding some previously counted funding in NASA and the 6.7 account in DOD. These figures keep DOD 6.7 included for comparability.

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

Totals include mandatory spending, outside normal appropriations process.

APPENDIX 2 THE FEDERAL BUDGET PROCESS

The annual federal budgeting cycle is a long, complicated process that can seem opaque to outsiders. This appendix is intended to help shed some light on that process.

It's useful to think of the federal budget cycle in four phases. The first phase is agency planning; the second phase covers budget review by the Office of Management and Budget. These two phases together amount to the president's budget formulation. A third phase is the congressional appropriations cycle; and the fourth and final phase is the execution of the budget by the agencies starting Oct. 1, the beginning of the fiscal year. Altogether, it takes the machinery of government well over two years to formulate, appropriate and execute a single fiscal year's budget. That means three budgets are in play at any given time.

THE PRESIDENT'S BUDGET FORMULATION

The most public portion of the cycle is the congressional process, typically beginning in the spring before the fiscal year starts. However, the process actually begins a year before then – and a full 18 months or more before the start of the fiscal year in question – when federal agencies begin their internal budget planning. This means that, for instance, in spring 2010, agencies were already beginning to plan for the FY 2012 budget, which didn't take effect until Oct. 1, 2011.

The agency budget process is an information-intensive mix of bottom-up formulation and top-down guidance. Beginning in the spring, individual offices or units take the lead, with departmental oversight, in developing their strategic plans, identifying their key priorities and goals, and producing estimates of the staff and resources necessary for achieving those goals. Offices receive guidance and directives on policy and funding priorities from agency leadership, which may be communicated through spring budget retreats or other channels. As a part of the process, agency personnel draw on information or recommendations provided throughout the year by advisory boards, National Academies, panels or other external stakeholders. Ultimately, expert technical judgment by agency heads and staff is central in budget formulation and assessment. Agencies may also have to respond to congressional guidance, legislative changes, and mandates in previous appropriations bills and reports.

The Executive Office of the President also performs an important oversight role. Agencies and offices receive their primary guidance from the OMB, which orchestrates the budget formulation process, serves as an information resource, and carries out the president's policy preferences. This guidance is delivered via meetings, memoranda or more informal interpersonal contacts, and can include directives on general priorities, principles, strategies or targets for increases and cuts. Science programs also receive budget guidance from the Office of Science and Technology Policy (OSTP), formally through a joint OMB/OSTP guidance memo typically released in the summer. This memo identifies key areas for investment, such as climate research, biotechnology or advanced manufacturing, for instance.

Eventually, agency requests are completed and submitted to OMB for a stringent, thorough review in early fall. OMB reviews the requests, decides what the administration will and will not support, and notifies agencies of these decisions through what are called "passbacks," usually issued around Thanksgiving. The agencies can then either accept OMB's decisions or, more often, appeal. OMB and the agencies must hash out their differences by January, in time for the president's budget submission to Congress.

The Budget and Accounting Act of 1921 sets the requirement for a presidential budget. Current law requires submission by the first Monday in February, though the budget can be delayed. For instance, the Obama administration delayed the FY 2012 and FY 2013 requests by one week each; the FY 2014 and FY 2015 requests were issued much later. The budget is also typically delayed during presidential transition years by two months or more.

THE CONGRESSIONAL PROCESS

The president's job is to issue the budget request, but only Congress can actually grant funding, known as appropriations. Fiscally speaking, the president starts the conversation, but Congress finishes it; or, in the old line, "The president proposes, the Congress disposes." Congress does this by passing the 12 appropriations bills necessary to fund the government each year. This process gets underway when the president delivers his or her budget in February. In addition, Congress receives reports on the long-term fiscal and economic outlook from the Congressional Budget Office. These documents identify long-term trends in economic growth, spending and deficits.

With these materials in hand, the congressional budget process commences. The first item of business for Congress is passage of the annual budget resolution. The budget resolution, which is developed by the House and Senate Budget Committees, sets an overall framework for funding decisions. It is not signed by the president, and thus is not law, but still serves to bind congressional appropriations decisions later.

The two Budget Committees, working separately, establish top-line numbers for revenues, mandatory or direct spending, and discretionary spending, with input from other legislators, committee chairs and party leadership. The discretionary spending target is particularly important for federal R&D, as the federal R&D budget doesn't tend to fluctuate much as a share of the federal discretionary budget.

The resolution must pass both the House and Senate floor by a simple majority, and any differences between the two versions are worked out by conference committee, a joint committee composed of members of both chambers. This work is to be completed by April 15, but the resolution is often delayed. Indeed, in many years the House and Senate cannot agree on overall figures, and fail to pass a concurrent budget resolution. When this occurs, each chamber can adopt its own framework in the form of a "deeming resolution," meaning that each chamber can operate under its own spending target, which can create major problems when it's time to resolve the differences.

Once these targets are established, the scene shifts to the Appropriations Committees. The Appropriations Committee in each chamber takes the discretionary spending target and divides it among the appropriations subcommittees, through what are called 302(b) allocations after the relevant section of the Congressional Budget Act. Each subcommittee is responsible for producing one spending bill; there are 12 appropriations subcommittees, one for each bill, and each committee gets its own allocation. This allocation limits the size of the spending bill produced by each subcommittee, and they can be very different: the Defense Appropriations Subcommittees might have $500 billion to work with, while the Interior and Environment Subcommittees have less than a tenth of that.

Science agencies are scattered throughout these 12 bills, and often must compete with nonscience agencies for funding. For instance, the NIH budget is part of the appropriations bill that funds Labor, Health and Human Services as well as Education.

Appropriations subcommittees begin to hold hearings on the president's budget request as early as February, mere weeks after the request has been issued. Usually in April, the subcommittees – traditionally starting with the House first – begin marking up and amending their respective bills. Each of the 12 bills must be passed by its subcommittee before being considered by the full Appropriations Committee. It is during the subcommittee and committee phase that earmarks were usually attached, though congressional leaders declared a moratorium on them beginning in FY 2011. While earmarks are in reality a very small portion of overall spending, their number grew in the decades leading up to the moratorium, and their relative merits continue to be debated in some quarters.

Once each spending bill has passed the chamber's Appropriations Committee, it is subject to action by the full chamber. The bills can again be amended on the chamber floor, though the 302(b) spending limits mentioned above remain in force. Thus, most amendments looking to increase spending for a given program must shift spending around rather than add to the sum total. Spending bills can pass the House by a simple majority, but are subject to filibuster in the Senate. Spending bills are also subject to presidential veto, and the administration may threaten a veto or otherwise issue a position on a bill through policy statements. Once a spending bill has passed both chambers of Congress, a conference committee is formed to work out the differences between the two versions, and eventually the completed bill is sent to the White House for the president's signature.

The federal fiscal year ends September 30, so all 12 spending bills must be completed and signed by then. If Congress cannot finish its appropriations work on time and wants to avoid a shutdown, it has the option of passing a continuing resolution. Continuing resolutions typically just extend the level of funding from the prior year, though they can also contain funding changes targeted at specific programs. These changes are known as "anomalies." For instance, when Congress has passed continuing resolutions covering the Department of Energy, they've sometimes added extra funding for nonproliferation R&D.

In some years, multiple continuing resolutions are required to avoid a shutdown, one after the other, until final appropriations are passed. Congress can also bundle multiple appropriations bills together into an omnibus spending package. These steps have been common in recent years due to continuing conflict over spending and deficits. Lastly, the president can issue, and Congress can pass, supplemental or emergency spending bills. These may be necessary to provide sufficient funds for wars, hurricane relief or other needs.

APPENDIX 3 METHODOLOGY AND DATA SOURCES

The data presented by the AAAS R&D Budget and Policy Program cover only research and development (R&D), not the entire federal budget, except as noted. Within the federal budget, most appropriations are not specifically labeled as R&D except for certain program areas, such as defense. Consequently, most funds for R&D are not line items in an agency's budget or a spending bill, but are included within general program funding. The Office of Management and Budget requires agencies to submit data on R&D programs as part of their annual budget submissions. Specifically, the agencies provide data on funding levels for basic research, applied research, development, R&D facilities construction and major capital equipment for R&D (see definitions below).

R&D figures rarely correspond to budget line items as found in appropriations bills or the president's budget. Agencies make determinations as to what proportion of line items are classified as R&D, and many budget line items have both R&D and non-R&D components. Agencies also differ in their tabulation and reporting practices. For instance, some agencies classify program direction or management support as R&D, and others do not.

The R&D data presented in the tables represent the agencies' best estimates of actual and proposed federal funding for R&D collected by OMB and AAAS. These figures incorporate information provided to OMB by two dozen agencies accounting for more than 99 percent of all federal R&D and information collected by AAAS from individual agencies after the release of the full budget. Some adjustments to the original OMB-provided data are made to reflect agency revisions, coding errors, AAAS conversations with agency budget officials, adjustments to conform to historical trends, agency budget documents, supplemental appropriations, emergency spending and rescissions.

When year-to-year changes are expressed in constant dollars, the deflators used are the Gross Domestic Product (GDP) deflators from the Budget of the United States Government FY 2017, Historical Table 10.1.

Budget statistics can be presented on three bases: **(1) budget authority**, corresponding to the funds appropriated each year; **(2) obligations**, indicating the amounts of contracts and grants entered into; and **(3) outlays**, representing the amounts actually expended. Because budget decisions in the executive branch and in Congress are almost always made using budget authority, this metric most accurately reflects current changes in budget policies. AAAS thus uses budget authority as the most meaningful real-time measure of budget decisions.

Although this report relies mostly on OMB and agency data for R&D, it also relies on data from other sources to provide a context for the federal R&D enterprise. When these other sources are used, they are noted in tables and charts. The reader should be aware that although these sources use the same definitions of R&D as AAAS, there may be discrepancies between different data sources resulting from several factors: 1) the use of performer rather than agency surveys; 2) the use of obligations or expenditures rather than budget authority; 3) the use of a calendar year rather than the federal fiscal year; and 4) the use of conduct of R&D, rather than total R&D (including R&D facilities and capital equipment).

Notes on Budget Functions: All activities in the federal budget are classified into 20 broad functional categories. (AAAS separates the General Science, Space and Technology function into its subfunctions of General Science and Space; AAAS also classifies VA under Health rather than Veterans Benefits and Services.) Each function often includes programs from multiple agencies. Each R&D program is assigned to only one function, even though the R&D activity may address several functional concerns.

DEFINITIONS

In this report, R&D refers to actual research and development activities as well as R&D facilities. These definitions are used by the Office of Management and Budget, the National Science Foundation and AAAS.

Research is systematic study directed toward more complete scientific knowledge or understanding of the subject studied. The federal government classifies research as either basic or applied according to the objective of the sponsoring agency.

– In **basic research**, the objective is to gain knowledge or understanding of phenomena without specific applications in mind.

– In **applied research**, the objective is to gain knowledge or understanding necessary for meeting a specific need.

Development is the systematic use of the knowledge or understanding gained from research directed toward the production of materials, devices, systems or methods, including design, development and improvement of prototypes and new processes. It excludes quality control, routine product testing and production.

R&D funding normally includes those personnel, program supervision and administrative support costs directly associated with R&D activities. Laboratory equipment is also included. Defense R&D also includes testing, evaluation, prototype development and other activities that precede actual production.

Funding for **R&D facilities** (also known as R&D plant) includes construction, repair or alteration of physical plant (e.g., reactors, wind tunnels, particle accelerators or laboratories) used in the conduct of R&D (R&D facilities construction). It also includes major capital equipment used for R&D.

The allocation of agency budgets among basic research, applied research and development is not an exact procedure, and some allocations are inevitably arbitrary. The severe time pressures under which these figures are compiled for OMB can also pose a challenge. Nevertheless, there is likely sufficient consistency within each agency's estimates so that the trends are meaningful.

As mentioned above, the federal R&D funding data in this report are presented in terms of **budget authority**. Budget authority is the initial budget parameter for congressional action on the president's proposed budget. Other R&D data sources may express R&D funding in terms of obligations or outlays. There are also R&D data sources that obtain funding data from funding recipients (companies, universities) rather than from funding **sources** (agencies).

Budget authority is the legal authorization to expend funds.

Obligations represent orders placed, contracts awarded, services received and similar transactions during a given period, regardless of when the funds were appropriated and when the future payment of money is required.

Outlays represent checks issued and cash payments made during a given period, regardless of when the funds were appropriated or obligated. Some surveys refer to outlays as expenditures.

As an example, Congress may appropriate $100 million to NASA in FY 2006 for an R&D laboratory. NASA may then issue contracts to build the lab and sign $50 million of the contracts in FY 2006 and $50 million in FY 2007. Upon completion of the lab in FY 2007, NASA may then write checks to the contractors for a total of $100 million. Budget authority would be $100 million in FY 2006; obligations would be split $50 million each in FY 2006 and FY 2007; outlays would be $100 million in FY 2007. In the federal budget process, there is normally a lag between budget authority and outlays for large capital projects and research contracts; budget authority and outlays usually occur in the same year for recurring expenses such as staff salaries.

(Definitions adapted from National Science Foundation, *Federal R&D Funding by Budget Function: Fiscal Years 2007-2009*, Arlington, Va., 2008.)

APPENDIX 4 AAAS COMMITTEE ON SCIENCE, ENGINEERING AND PUBLIC POLICY

William Bonvillian (2020)
Massachusetts Institute of Technology

Julie Goonewardene (2020)
University of Texas System

Miriam (Mim) John (2020)
Consultant

Mary Maxon (2018)
Lawrence Berkeley National Laboratory

Michael R. Nelson (2018)
CloudFlare

William Provine (2018)
Dupont

Anthony (Bud) Rock (2019)
Association of Science-Technology Centers

* Terms expire on the last day of Annual Meeting in year shown.

AAAS

The American Association for the Advancement of Science (AAAS) is the world's largest general scientific society and publisher of the journal *Science* (www.sciencemag.org), as well as *Science Translational Medicine*; *Science Signaling*; a digital, open-access journal, *Science Advances*; and beginning in 2016, two new journals — *Science Robotics* and *Science Immunology*. AAAS was founded in 1848 and includes some 250 affiliated societies and academies of science, serving 10 million individuals. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world. The nonprofit AAAS (www.aaas.org) is open to all and fulfills its mission to "advance science and serve society" through initiatives in science policy, international programs, science education, public engagement and more. For the latest research news, log on to EurekAlert! (www.eurekalert.org), the premier science-news website, a service of AAAS.

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American Association for
the Advancement of Science

1200 New York Avenue, NW
Washington, DC 20005