

# The FY 2020 Federal R&D Budget

Matt Hourihan

April 9, 2019

For the 2019 Engineering Public Policy Symposium

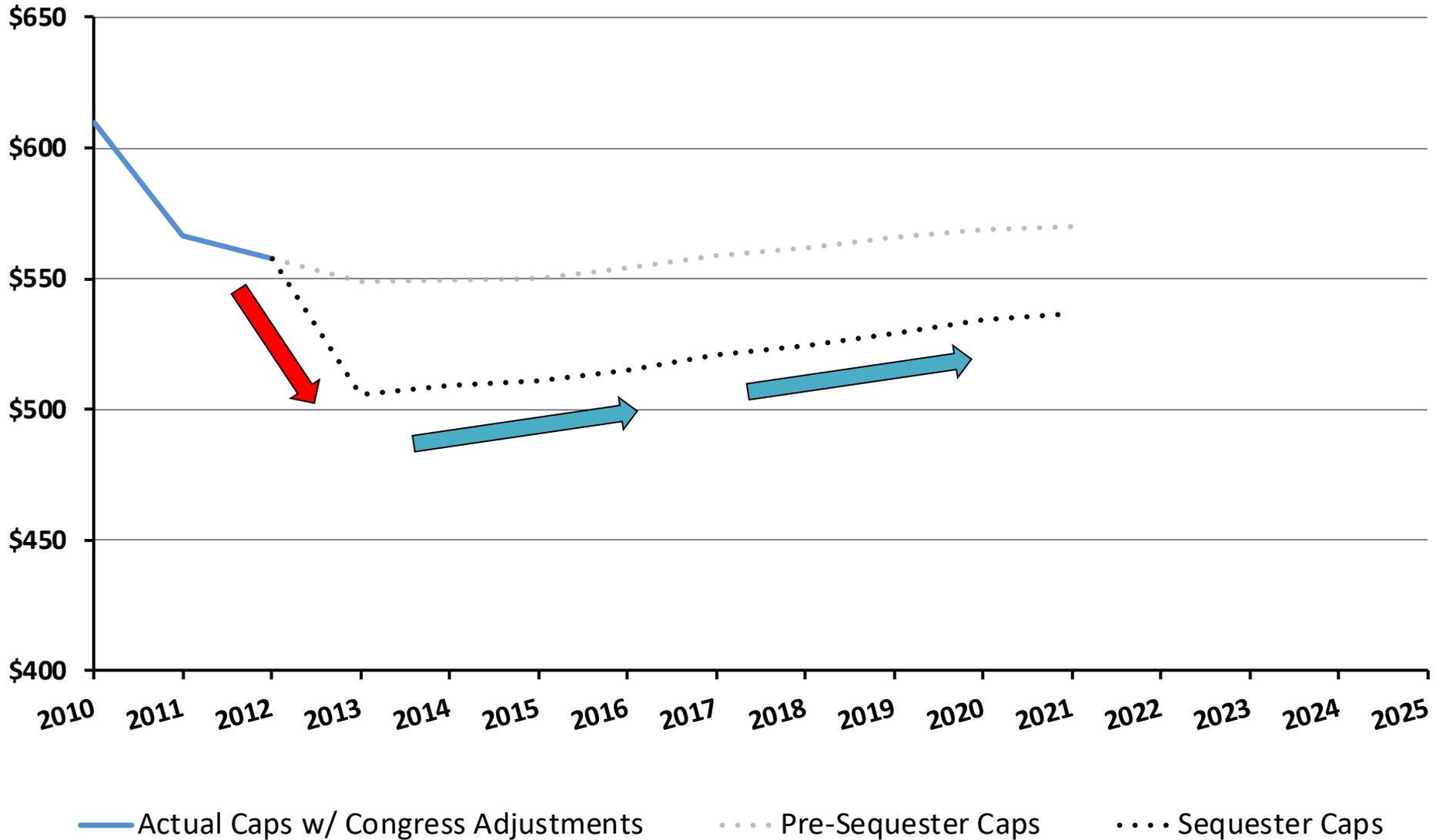
AAAS R&D Budget and Policy Program

<http://www.aaas.org/rd>



# Limits on Nondefense Spending

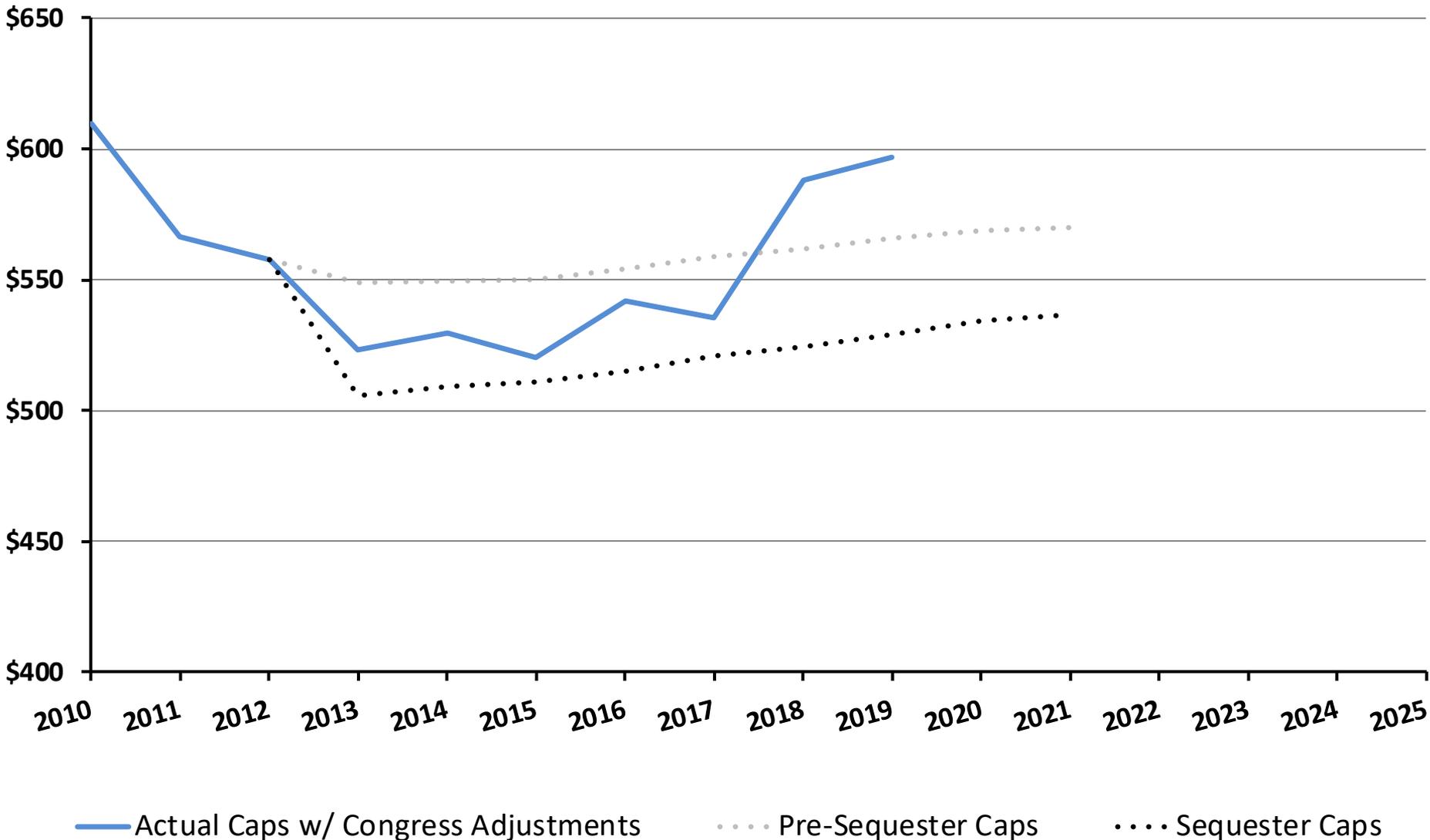
Billions of constant 2019 dollars



\*Current caps last through 2021. Based on past and current budget resolutions, the Budget Control Act and subsequent legislation, and the FY20 request.

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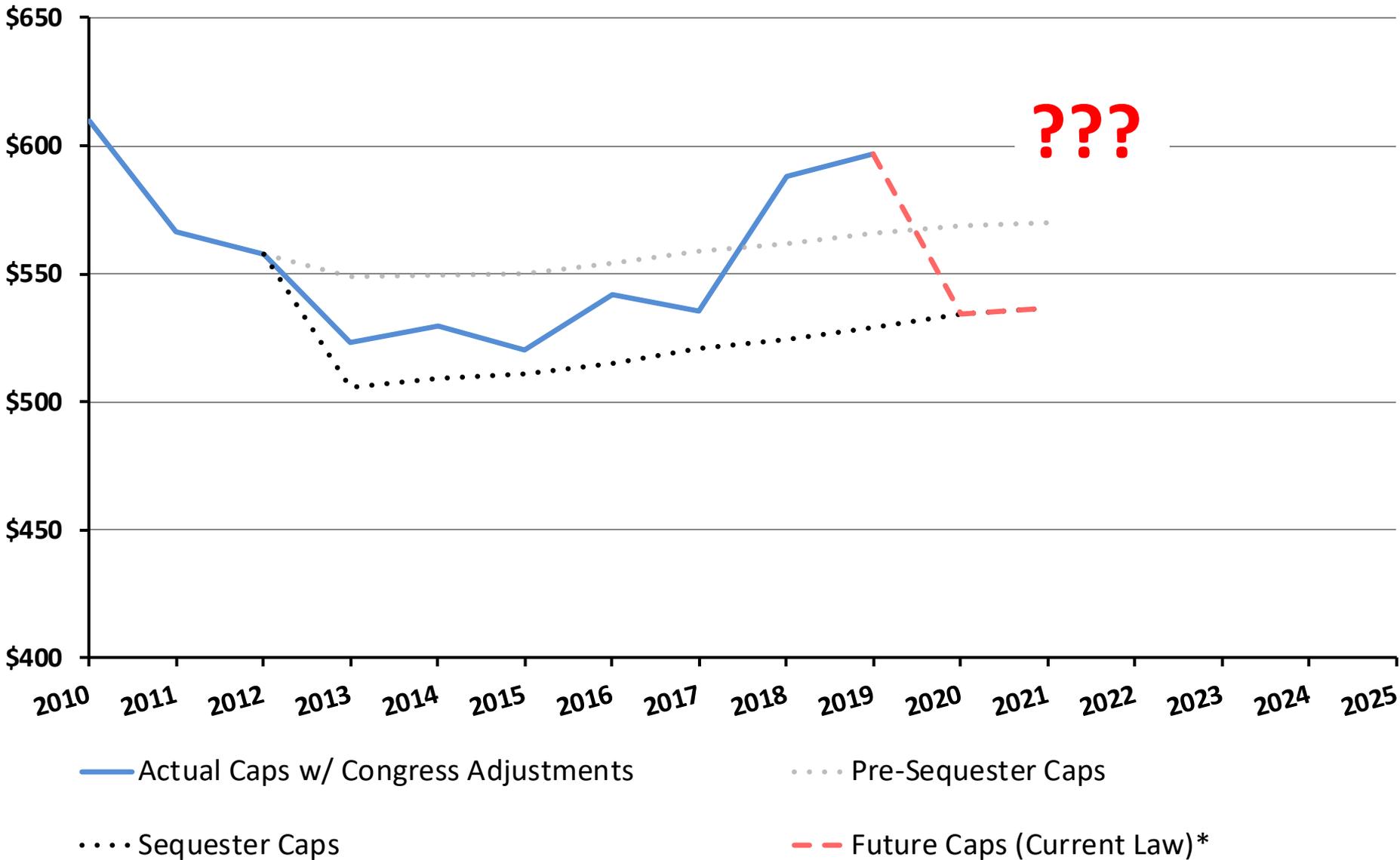
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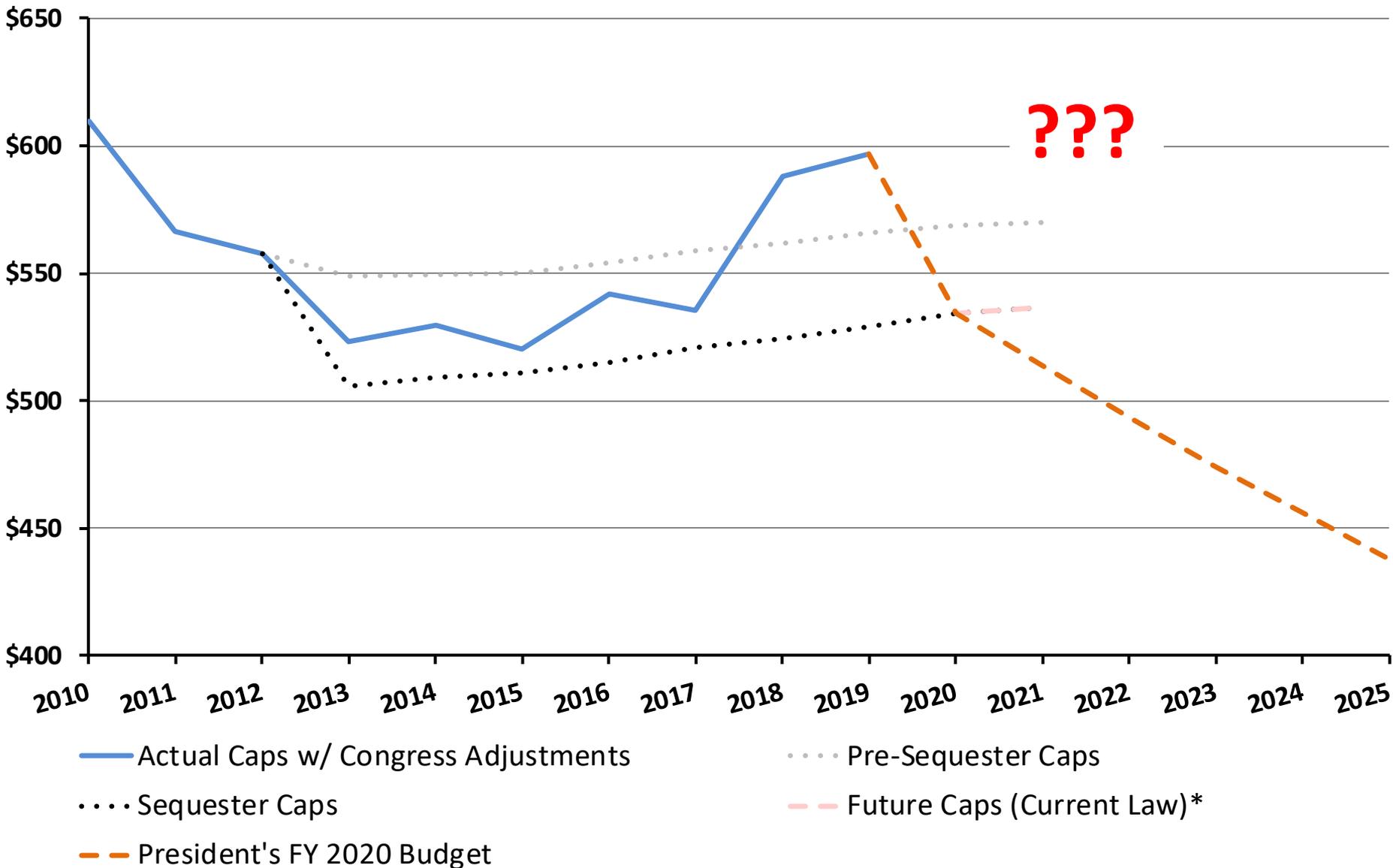
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## Estimated R&D in the FY 2020 White House Budget

(budget authority in millions of dollars)

	FY 2018 Actual	FY 2019 Estimate*	FY 2020 Budget	FY19 Change	
				Amount	Percent
Total R&D	145,130	150,346	142,158	-8,188	-5.4%
Defense R&D	68,897	70,803	75,369	+4,566	+6.4%
Nondefense R&D	76,233	79,544	66,789	-12,755	-16.0%

### By Character

Basic Research	36,587	39,482	35,073	-4,409	-11.2%
Applied Research	43,517	45,806	37,969	-7,837	-17.1%
Development	61,158	60,880	65,733	+4,853	+8.0%
Facilities & Equipment	3,868	4,178	3,383	-795	-19.0%

*\*Based on mix of OMB and agency R&D data and AAAS estimates of FY 2019 appropriations for some agencies.*

*Note: The projected GDP inflation rate between FY 2019 and FY 2020 is 2.0 percent.*

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

3/27/19 | AAAS

### Select priorities:

- Artificial Intelligence: \$1.7 billion+
- Quantum Science: \$430 million
- Lunar Exploration: \$1.2 billion
- Exascale Computing: \$809 million (DOE)
- Cybersecurity: \$17.4 billion (incl. non-R&D)

# Science & Tech Agencies in the Trump Administration's Budgets

Proposed year-over-year changes, nominal dollars



FY18 Request

FY19 Request

FY20 Request

\* Includes renewables, efficiency, nuclear, fossil, grid research, cybersecurity, ARPA-E. | AAAS

# Research Funding: The Basics



- **DOD Science & Tech:** -9.7%, -\$1.5 billion
  - Basic research: -8.2%, \$208 million
  - DARPA: +3.7%, +129 million, to \$3.6 billion
- **DOE Office of Science:** -16%, -\$1.0 billion – across most programs, user facilities
- **DOE Technology Programs:** particular emphasis on cutting efficiency, renewables, manufacturing, but others too
- **NSF:** Overall budget: -12.5% / -\$1.0 billion – all directorates down at least 8%
  - 1,000 fewer competitive awards, 21% success rate
- **NIH:** Overall budget: -\$4.9 billion / +12.6% - Most institutes reduced by ~14%
  - ~4,000 fewer competitive awards, sub-14% (!!) success rate
- **NASA:** -2.2% to \$21 billion total; Science Directorate: -8.7%; Lunar exploration
- **NIST:** Lab programs -15%; manufacturing extension zeroed out (again)
- **NOAA, EPA, USGS:** Research -41%, several programs reduced / terminated

# Some Priorities and New Projects



- **DOD:**
  - National Security Innovation Network
  - Defense Innovation Unit
  - DARPA's AI Thrust
- **DOE:**
  - Harsh Materials
  - Advanced Energy Storage
  - Coal Generation Efficiency
  - Energy Frontier Research Centers
- **NSF:**
  - Convergence Accelerators
  - Midscale Infrastructure
  - LHC Upgrades
- **NIH:** Pediatric cancer
- **USDA:** Competitive grants



# “Un-Priorities”

- **Energy Technology:** ARPA-E zeroed, most other programs cut
- **Manufacturing**
  - Innovation institute support reduced / eliminated (DOD, DOE)
  - DOE AMO Hubs funding terminated
  - MEP terminated
- **Several university programs**
  - NIST, DHS Centers of Excellence
  - DOD: Navy university initiatives, Army centers
  - Sea Grant, Space Grant
- **Human Capital**
  - Reduced support for National Defense Education Program
  - Cuts / eliminates education & training programs in NSF, NASA, NIH, DOE
- **Earth / Climate research:** NOAA climate grants, DOE earth system modeling, select NASA missions, USGS and EPA programs, all cut / zeroed



## So What's Next?

- Is Congress likely to allow this drop in discretionary spending to happen?
  - Remember, 9% for nondefense and 11% for defense (\$125 billion total)
- Pentagon + Defense hawks: sequestration is bad for national security
- House / Senate Dems: we must take care of nondefense spending too
- Debt ceiling action necessary in early fall
- **However...**deficits are exploding
  - And the border wall situation is...a situation

Congress

### Expect a 'prolonged fight' over spending caps

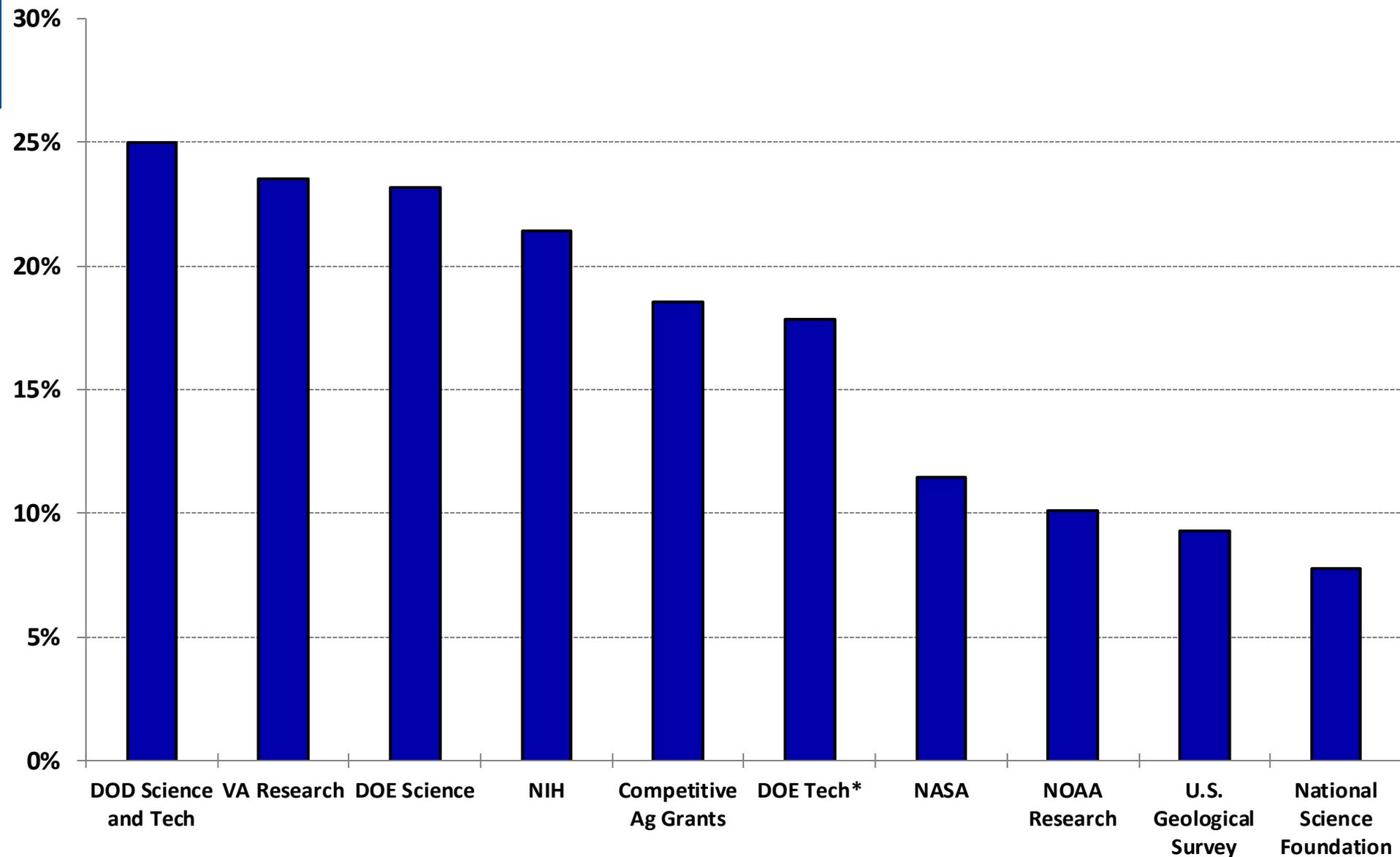
Deal might not be reached until it's too late to get next year's spending bills done in time



Rep. John Yarmuth, D-Kentucky, leaves a House Democrats' caucus meeting in the Capitol in January. (Bill Clark/CQ Roll Call file photo)

# Science Agency Budget Increases Since January 2017

*Percent change from FY 2016 - FY 2019, nominal dollars*



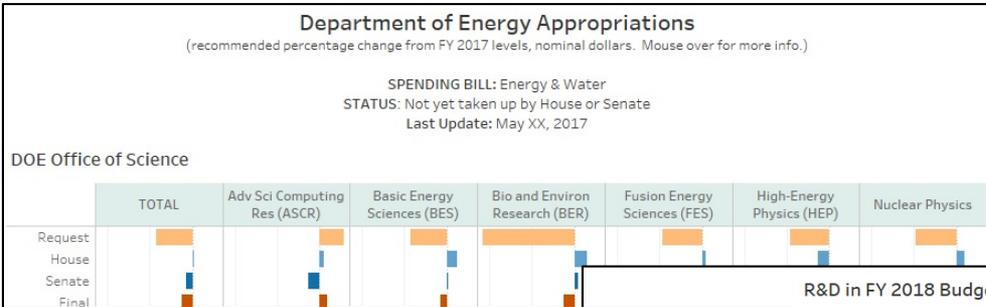
\*Nuclear, fossil, renewables, efficiency, grid, ARPA-E.

Source: agency budget documents and appropriations. Note: inflation is 3.3% over this time. | AAAS 2018

# Some Research-Relevant Appropriators...



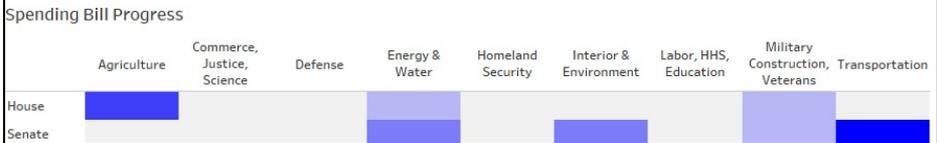
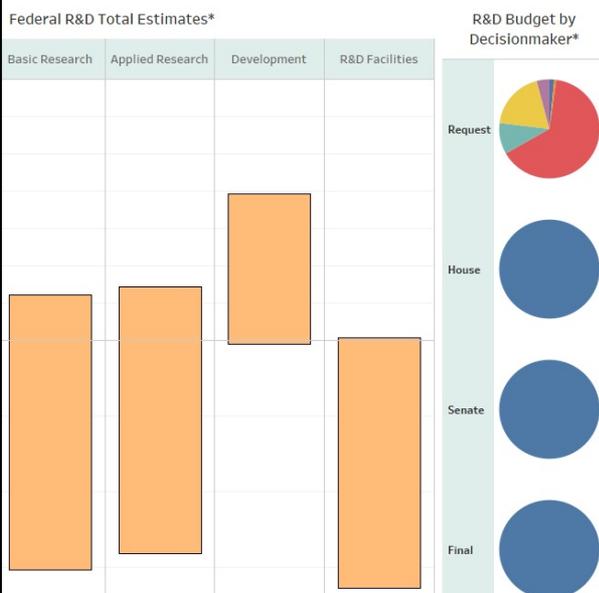
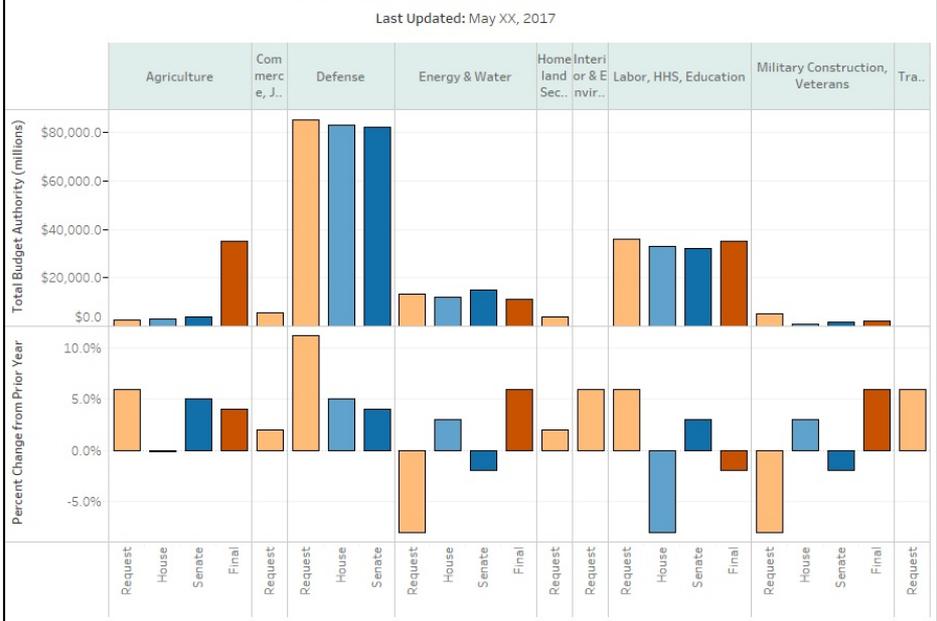
Subcommittee	House		Senate	
	Chair	Ranking	Chair	Ranking
<b>Labor-H</b> (funds NIH, CDC, other HHS)	DeLauro (CT)	Cole (OK)	Blunt (MO)	Murray (WA)
<b>CJS</b> (funds NSF, NASA, NIST, NOAA)	Serrano (NY)	Aderholt (AL)	Moran (KS)	Shaheen (NH)
<b>Energy &amp; Water</b> (funds Dept. of Energy)	Kaptur (OH)	Simpson (ID)	Alexander (TN)	Feinstein (CA)
<b>Defense</b>	Visclosky (IN)	Calvert (CA)	Shelby (AL)	Durbin (IL)
<b>Agriculture</b>	Bishop (GA)	Fortenberry (NE)	Hoeven (ND)	Merkley (OR)
<b>Interior</b>	McCollum (MN)	Joyce (OH)	Murkowski (AK)	Udall (NM)



### R&D in FY 2018 Budget and Appropriations

Federal R&D funding in Congress is allocated via several spending bills, authored by the appropriations subcommittees. Current AAAS estimates of R&D by select spending bill and subcommittee are shown below.

The President's budget request are displayed below; House and Senate estimates will be added once all are released. Mouse over for more info, or use the tabs above to view appropriations by agency or by Congressional subcommittee and spending bill.



For more info...



[mhouriha@aaas.org](mailto:mhouriha@aaas.org)

202-326-6607

<http://www.aaas.org/rd>

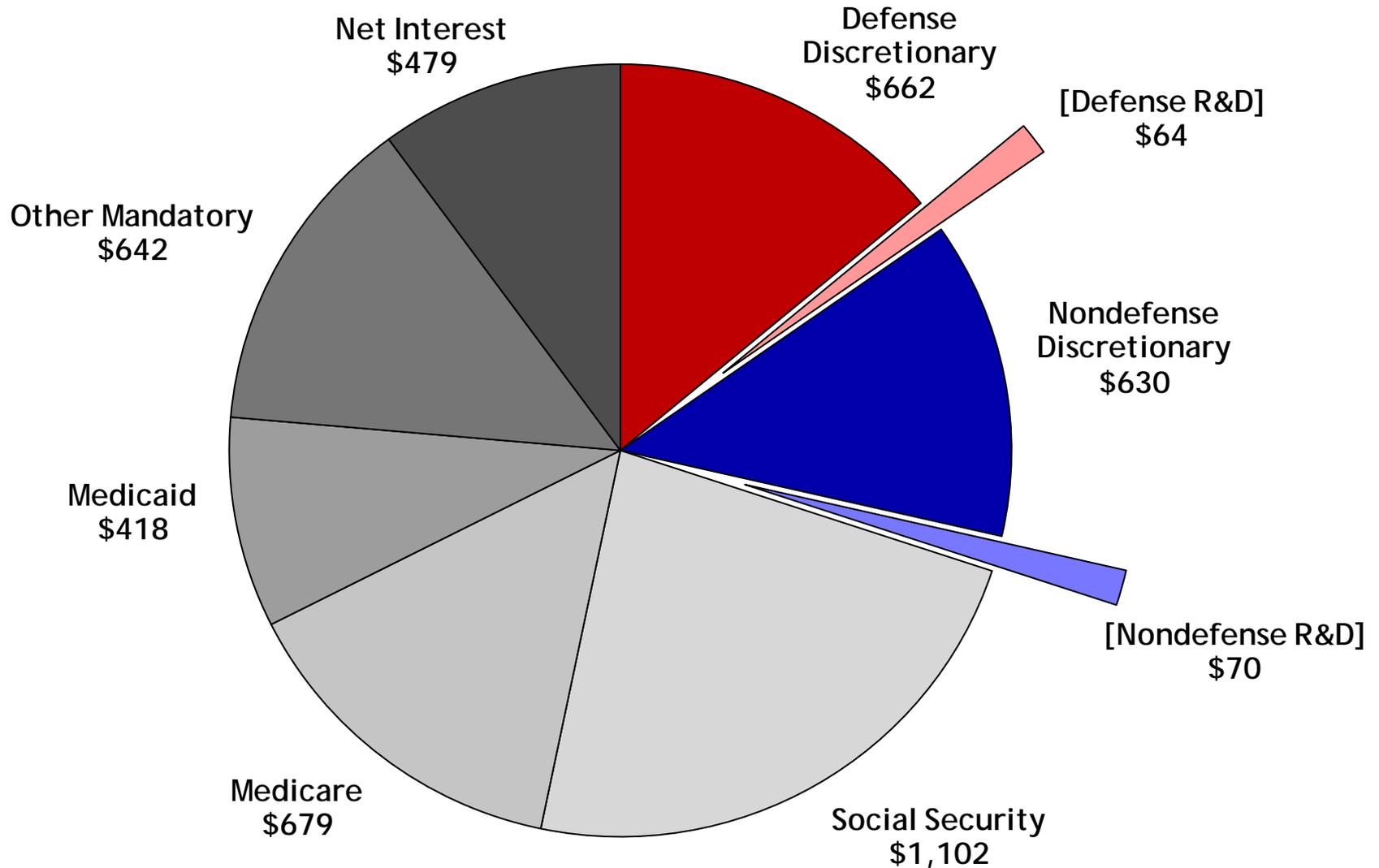
(extras to follow)



# Composition of the Proposed FY 2020 Budget

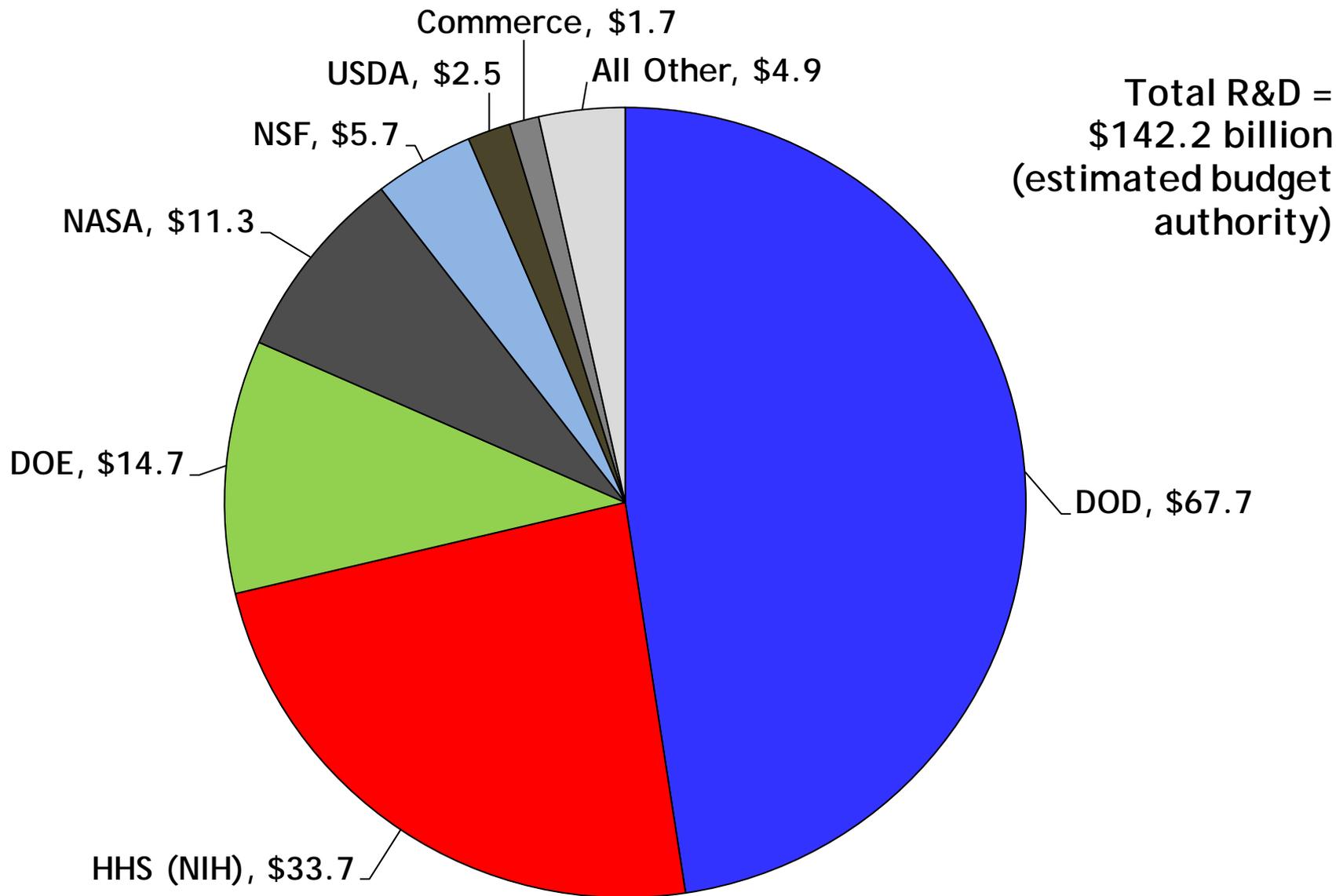
## Total Outlays = \$4.7 trillion

outlays in billions of dollars



# Total Requested R&D by Agency, FY 2020

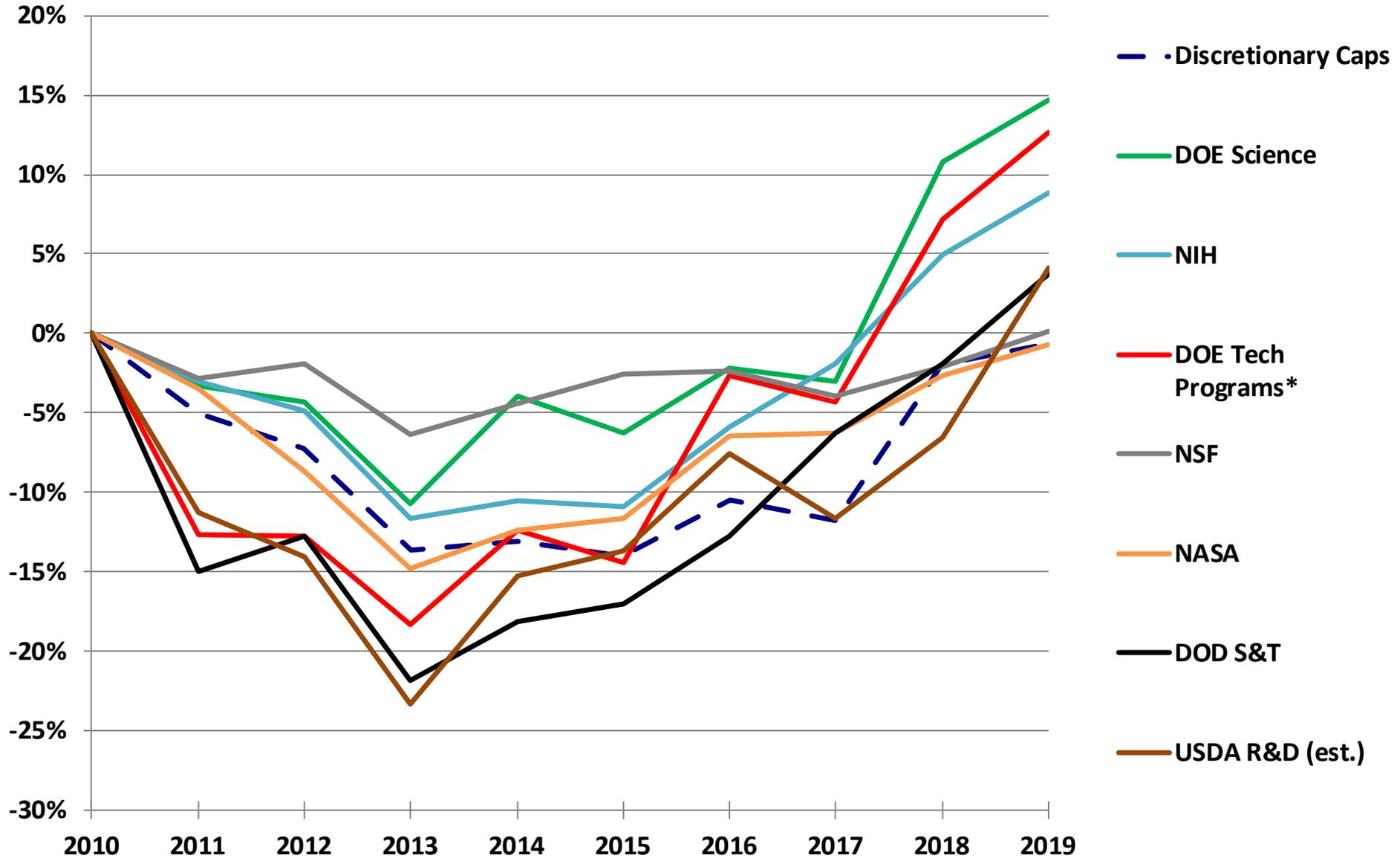
budget authority in billions of dollars



Total R&D =  
\$142.2 billion  
(estimated budget  
authority)

# Federal S&T Spending Since FY 2010

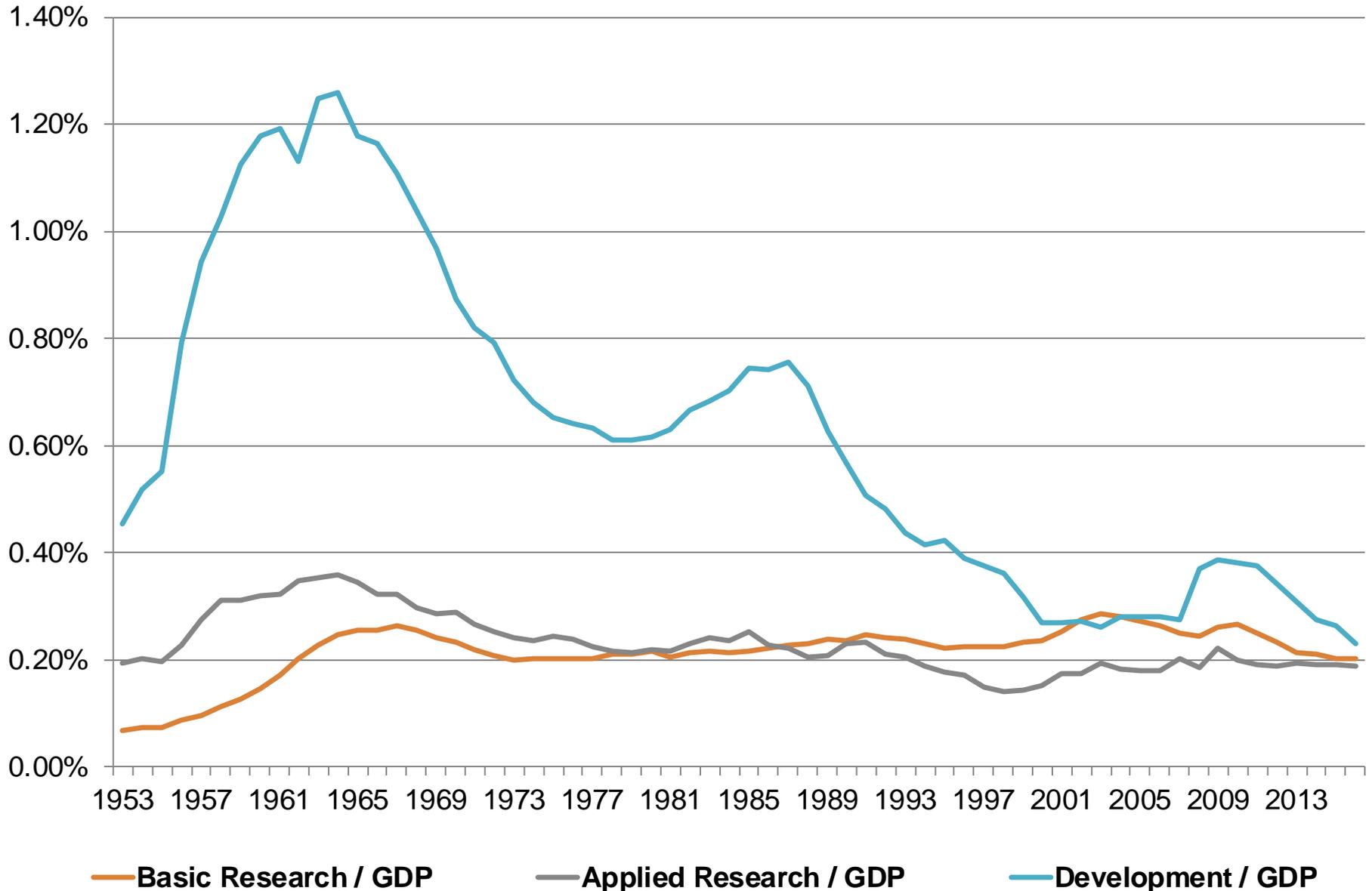
Percent change from FY10 levels, constant dollars



\*Includes OE, EERE, Fossil, Nuclear, Cybersecurity, ARPA-E.

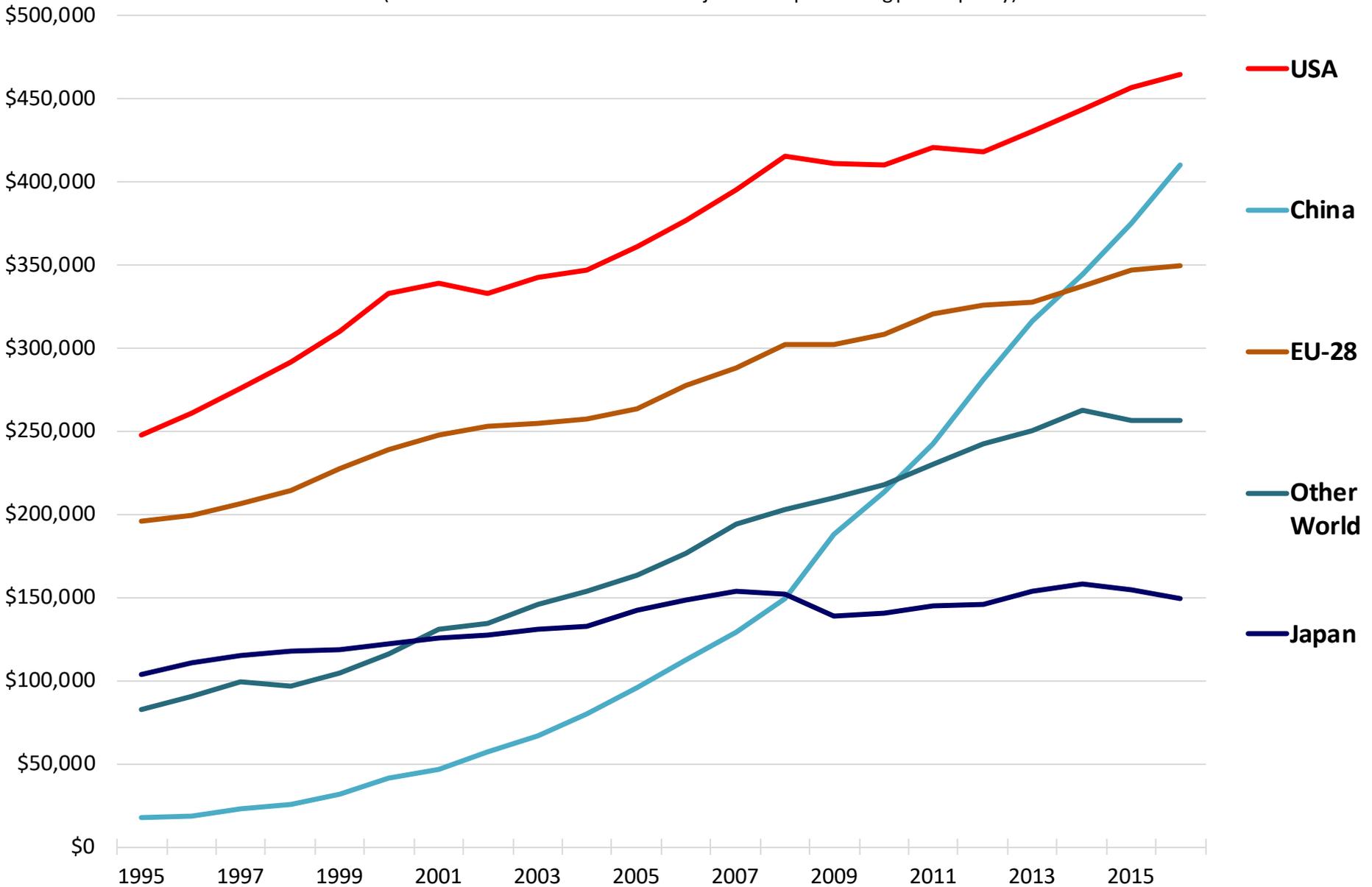
Based on AAAS analyses of historical OMB, agency, and appropriations data. © 2019 AAAS

# Government R&D as a Share of GDP by Character



# World R&D by Country / Region

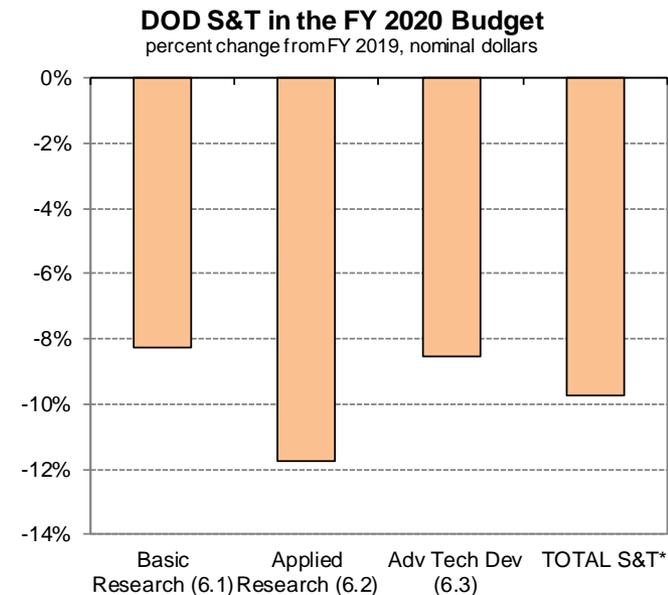
(millions of constant 2010 dollars adjusted for purchasing power parity)



# DOD Science & Technology



- **Total funding:** -9.7%, -\$1.5 billion
- **Basic research:** -8.2%, \$208 million
  - Cuts across all military branches
  - National Defense Education Program: -32.1%
  - University Initiatives: -12.8%
- **DARPA:** +3.7%, +129 million, to \$3.6 billion
  - Plus-ups for AI research, human-machine interaction, materials science, photonics, pharmacology, etc
- **Priority DOD investments include:**
  - Hypersonic weapons (\$2.6 billion)
  - AI and machine learning (\$927 million)
  - Cyber ops (\$9.6 billion)
  - Autonomous systems (\$3.7 billion)
  - Space (\$14.1 billion)
    - \$149.8 million for new Space Development Agency
- Applied research programs also cut by \$708 million / 12%
- Plus-up for Defense Innovation Unit
- Scaled back support for manufacturing innovation institutes



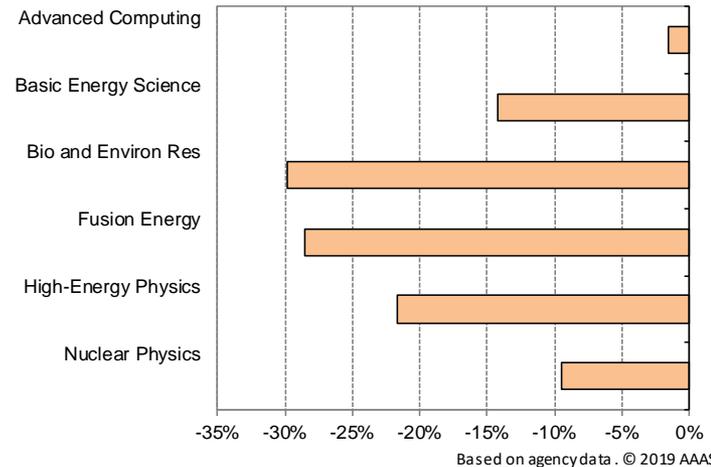
\*Total S&T combines 6.1, 6.2, and 6.3. © 2019 AAAS

# Department of Energy



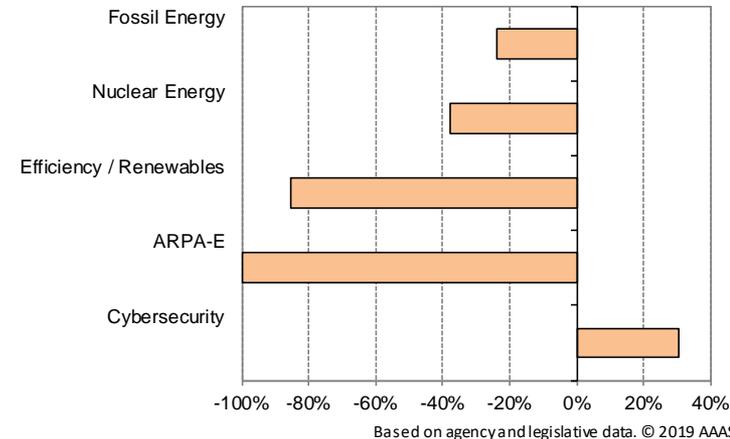
- **Office of Science: -16%, -\$1.0 billion**
  - Quantum info science would receive a 61% increase
  - 4% increase for ASCR program research
  - BES: cuts for research, user facility operations; but EFRCs up for a re-compete with an 18% increase above FY19
  - BER: broad reductions but particularly tough for environmental side of the shop (~50% reduction)
  - Fusion: 31.8% reduction to domestic research; ITER cut by 18.9%
  - HEP: 18.9% cut to research incl. LHC activities
  - Nuclear Physics: 9.4% reduction

**FY 2020 Office of Science Budgets in the Request**  
percent change from FY 2019, nominal dollars



- **Technology programs:**
  - ARPA-E eliminated again
  - Steep cuts for EERE, Nuclear, Fossil programs
  - \$156 million for new Cybersecurity Office, a 30% boost
  - New Initiatives:
    - \$158 million for new Advanced Energy Storage Initiative
    - \$59 million for new Harsh Environment Materials Initiative
  - \$100 million for Versatile Fast Test Reactor, a 54% increase

**FY 2020 Energy Program Budgets**  
percent change from FY 19, nominal dollars

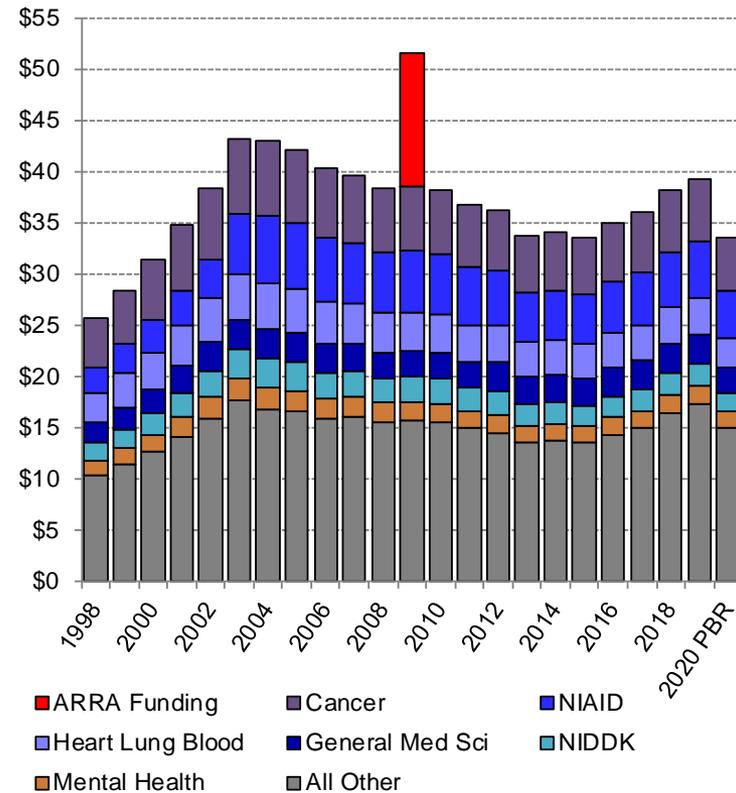


# Department of Health and Human Services



- **NIH: -\$4.9 billion / +12.6%**
  - Most institutes reduced by ~14%
  - \$50 million boost for pediatric cancer
    - Though total NCI budget cut by \$897 million
  - \$6 million for Centers for AIDS Research
  - 1.3 billion for opioids-related research (same as FY19)
  - 32% reduction in competing RPGs! (to about 7,900 total in FY20)
  - Sub-14% success rate!
  - Other Initiatives:
    - Cancer Moonshot down to \$195 million (from \$400 million)
    - Precision Medicine down to \$149 million (from \$379 million)
    - BRAIN Initiative down to \$140 million (from \$429 million)
  - AHRQ consolidation (again)
  
- **CDC: ~10% cut to nonmandatory programs, across most program areas**

**NIH Budget, FY 1998 - 2020**  
budget authority in billions of constant FY 2019 dollars

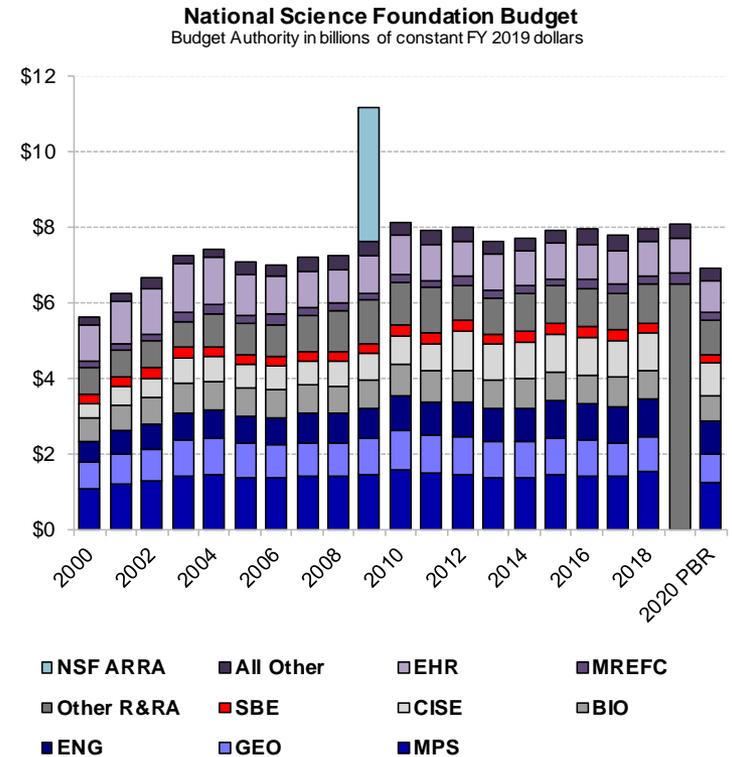


Source: Agency budget documents and appropriations. Adjusted for biomedical R&D inflation rate (BRDPI). © 2019 AAAS

# National Science Foundation



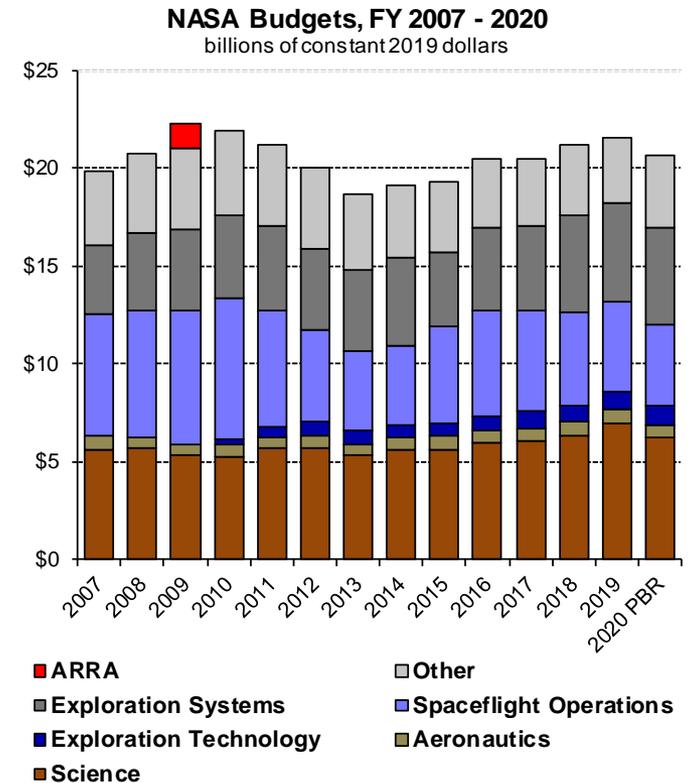
- **Overall budget: -12.5% / -\$1.0 billion**
  - New research grants to drop by 1,000
  - Funding rate down to 21%
  - Every directorate down by at least 8%
  
- **Select Initiatives**
  - 10 Big Ideas - \$297 million total (research ideas = \$30 million each)
  - Convergence Accelerators – standalone, time-limited, multidisciplinary initiatives (2 x \$30 million each)
  - I-Corps basically flat; cybersecurity, neuro research down
  
- **STEM Education**
  - Total funding down 15.3% / \$1.1 billion (across K-12, undergrad, graduate)
  - 400 fewer graduate fellows vs FY18
  - Programs to broaden participation: -17%
  
- **Major Construction:**
  - Antarctic Infrastructure Modernization continues
  - New funding for five-year LHC upgrade project
  - \$75 million for Mid-Scale Infrastructure (“Big Idea”)



# NASA



- -2.2% to \$21 billion total
  - STEM Engagement Office eliminated (again)
  - Aeronautics -8%
  
- Science Directorate: -8.7%
  - Planetary Science: -4.9%
    - Jupiter Europa mission receives ~\$600 million, versus \$740 million provided in FY19 omnibus
  - Earth Science: -7.8%
    - PACE and CLARREO Pathfinder eliminated, again
  - Astrophysics: WFIRST eliminated, again
  
- Exploration
  - Large increase for Gateway
  - Plus \$323 million for lunar surface exploration and capabilities
  - Moon in five years? Without SLS? New directorate for moon / Mars activities?



Based on historical and current NASA data. Note program and account names have changed over time. © 2019 AAAS

## Other Agencies



- USDA
  - NIFA: \$500 million / +20.5% increase for AFRI and new \$50 million competitive program for modernization of land-grant research facilities
    - But capacity programs cut back to varying degrees
  - ARS: 7.7% cut to non-facilities funding
  - Continues effort to relocate ERS and NIFA
- NIST: MEP eliminated, again, plus 15% reduction for lab activities
  - Capital Fund proposed for CO facility repairs
- NOAA, USGS, EPA: big-to-very-big cuts to R&D activities (again)
  - Sea Grant eliminated
- DHS: S&T Directorate cut by 29%; new WMD Office