House and Senate FY 2023 R&D Appropriations

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Table 1: Estimated R&D in FY 2022 Appropriations
(budget authority in billions of dollars)

	FY 2022 Estimated	FY 2023 Request	FY 2023 **House**	FY22 Change Amount	FY22 Change Percent	FY 2022 **Senate**	FY22 Change Amount	FY22 Change Percent
Basic Research	43.5	48.2	46.3	2.9	6.6%	47.0	3.5	8.1%
Applied Research	48.7	50.4	50.3	1.6	3.3%	48.2	-0.5	-1.0%
Development	80.1	89.7	90.9	10.9	13.6%	91.9	11.8	14.7%
R&D Facilities	4.7	5.1	4.9	0.3	5.5%	5.0	0.3	7.2%
Total R&D	**177.0**	**193.5**	**192.5**	**15.6**	**8.8%**	**192.1**	**15.2**	**8.6%**
Defense R&D*	87.0	92.1	94.8	7.8	9.0%	96.7	9.7	11.1%
Nondefense R&D	89.9	101.4	97.7	7.8	8.6%	95.4	5.5	6.1%

*Includes Defense Dept., NNSA, FBI, and DHS CISA
Data from OMB. FY 2020 and FY 2021 data include COVID-19 R&D.
All figures rounded to the nearest million. Changes calculated from unrounded figures.

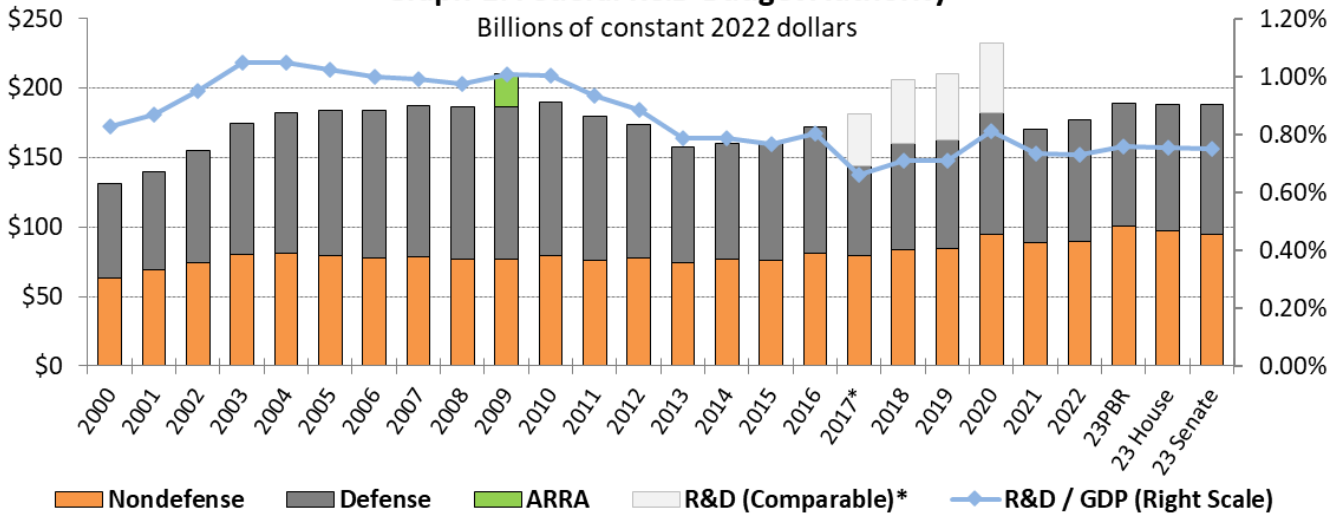
Estimated Totals

Table 1 showcases our current updated estimates[1] for aggregate fiscal year (FY) 2023 R&D in House and Senate appropriations. The House total is $192.5 billion, an increase of $15.6 billion or 8.8% above FY 2022 estimated levels. The Senate closely mirrors the House allocations with $192.1 billion, $15.2 billion over the FY 2022 estimated levels, and $400 million under the House's recommendation.

The House figure is also nearly at parity with the White House's FY 2023 R&D request,[2] with the House allocating just under a billion less, and the Senate a billion and a half. Even with the Senate's more conservative increase, this would mean a $15.2 billion increase to R&D appropriations as compared to 2022.

In spite of this growth, we estimate total federal R&D would continue to plateau as a share of the U.S. economy to 0.75% of GDP (Graph 1). This is potentially due to a predicted 5.5% growth for the U.S. GDP in 2023.[3]

Graph 1: Federal R&D Budget Authority
Billions of constant 2022 dollars



In FY 2017-2020 late-stage development, testing, evaluation, and support, mostly in DOD, is no longer counted as R&D. The "comparable" series adds this funding back in for illustrative purposes. Based on OMB, agency, CBO, and appropriations data. House and Senate figures are estimates. | AAAS December 2022

R&D Breakdowns

The push towards developmental funding that started with the presidential request continues in the Senate. The Senate pushed even further—14.7% of R&D appropriations are slated for development accounts compared to 13.6% in the House. The totals for basic research are also higher in the Senate, 8.1% to the House's 6.6% (decreased from 8.8% by amendments to the 6-bill minibus).

The difference in funding is focused on applied research, with a decrease of 1.0% in the Senate compared to an increase of 3.3% in the House. While the Senate did increase funding for NSF and the newly codified Technology, Innovation and Partnerships (TIP) directorate, this dip may impact some agencies that produce primarily applied research, such as the Departments of Transportation and Energy.

Basic research is also showing up in new places in the Senate's bill—Space Force may be looking at it's very first basic research appropriation with $200 million mentioned in the defense bill. The increase in funding for NSF, perhaps in anticipation of the passing of the CHIPS and Science Act,[4] also increases basic research. A breakdown of R&D appropriations in these and other agencies is available in Table 2.

In the House version, the increases in development funding are primarily housed in DOE, with the bill providing a nearly 70% increase, though increases do exist in nearly every agency. In the Senate's version, DOE still receives an increase in development funding, but is less pronounced. DOD, NIH and Commerce all have their development appropriations increased more greatly in the Senate than in the House.

Also deviating from FY2022, the House proposed higher defense R&D in its initial allocations, with a 9.0% increase compared to 8.6% in nondefense. The Senate expanded on these numbers, with a 11.1% to 6.1% split between defense and nondefense appropriations.

Table 3 displays our estimates of R&D by budget function, the definitions of which generally match those used by the White House Office of Management and Budget and the House and Senate Budget Committees. In raw dollars, health and energy R&D would receive the largest nondefense increases in the House. They remained the highest nondefense functions in the Senate's bill, though lower in comparison to the House, while the defense function saw a nearly $2 billion boost.

The boost to the health budget function is primarily due to increases to NIH, whereas the House appropriated increases higher than the President's request for several

Table 2: Estimated R&D in FY 2022 Appropriations by Agency

(budget authority in billions of dollars)

	FY 2022	FY 2023	FY 2023	FY22 Change		FY 2023	FY22 Change	
	Estimated	Request	**House**	Amount	Percent	**Senate**	Amount	Percent
Defense*	79.1	84.4	86.9	7.8	9.8%	88.8	9.7	12.2%
HHS	44.7	49.8	47.8	3.1	6.9%	46.1	1.4	3.2%
Energy	20.1	23.7	23.7	3.6	17.8%	22.2	2.1	10.4%
NASA**	13.9	13.5	13.1	-0.8	-5.5%	13.3	-0.6	-4.1%
NSF	7.2	8.4	7.7	0.6	8.1%	8.3	1.2	16.4%
USDA	3.2	3.8	3.5	0.3	10.2%	3.5	0.3	10.4%
Commerce	2.3	2.3	2.4	0.1	3.4%	2.6	0.3	10.7%
Interior	1.2	1.4	1.5	0.3	21.7%	1.4	0.2	14.1%
Veterans	1.5	1.7	1.7	0.2	11.7%	1.7	0.2	10.5%
All Others	3.8	4.4	4.4	0.6	16.3%	4.3	0.5	12.0%
Total R&D	**177.0**	**193.5**	**192.7**	**15.7**	**8.9%**	**192.1**	**15.2**	**8.6%**

*Includes Defense Dept., NNSA, FBI, and DHS CISA

**Fluctuations in NASA Exploration R&D spending reflect programs progressing from first-time development to recurring operations, and a change in acquisition strategy for the Human Landing System rather than a decline in overall spending.

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

NIH institutes and centers, and instead ignored the $12.1 billion in Mandatory Pandemic Preparedness (MPP) funds that the Biden Administration proposed. The Senate also ignored the MPP, and additionally reversed a prospective decrease to the Office of the Director, NIDDK and NINDS that the House had prepared. Instead, the Senate slashed the ARPA-H funds even more, returning to the $1 million that was provided in the FY 2022 omnibus, compared to the House's $2.75 million.

Energy saw its numbers initially decreased by the House and then increased later via amendments included in the minibus. Despite these cuts, the increases overall are still significant, and the DOE Office of Science, notably, received $300 million more in the House than the President's request. The Senate continued to cut into Energy Efficiency and Renewable Energy (EERE) programs, specifically administration requests to have large increases for like Solar, Wind and Geothermal Energy. APRA-E, however, increased by $20 million from the House's suggestion to $570 million.

AAAS has also been tracking earmarks, rebranded as community funded projects, since their resurgence last year.[5] These projects are publicly submitted by members of Congress, and if approved are added into the appropriations language to be funded directly. AAAS staff curated the list of submitted earmarks for science, technology, engineering, and math (STEM) related projects. While processing of the Senate's earmarks is underway, we currently estimate $737 million across 311 community project requests with a STEM focus submitted by the House. This is much higher than last year's House total of $260 million. Among individual bills, Labor-HHS (which funds NIH) received the largest earmark tally with $214 million in STEM-focused projects, followed by Military Constriction (MilCon) with $112 million, though $97 million is slated for just one of the four STEM-related projects in that bill. In addition to curating the total list, AAAS sorted the projects into categories, which can be viewed on our earmark tracking dashboard.[6]

International Comparisons

A major motivator underlying the recent push for elevated R&D investment is competition with foreign economies to sustain U.S. preeminence in science and technology. China gets the most attention when it comes to discussions of R&D competitiveness, but it is not alone in seeking increased R&D investment. A prior report on U.S. competitiveness breaks down global science funding efforts.[7]

Graph 2 benchmarks our House and Senate R&D appropriations estimate against the growth in public investments by the nine economies with the largest total (public and private) R&D expenditures (including the United States, which we should note maintains its #1 spot in total R&D dollars). This comparison mostly relies on R&D expenditure data provided by OECD.[8]

The average annual growth in public (i.e., government) R&D expenditure from 2016 to 2020 is displayed for most countries in blue. China's numbers are not based on a

Table 3: R&D by Budget Function

(budget authority in billions of dollars)

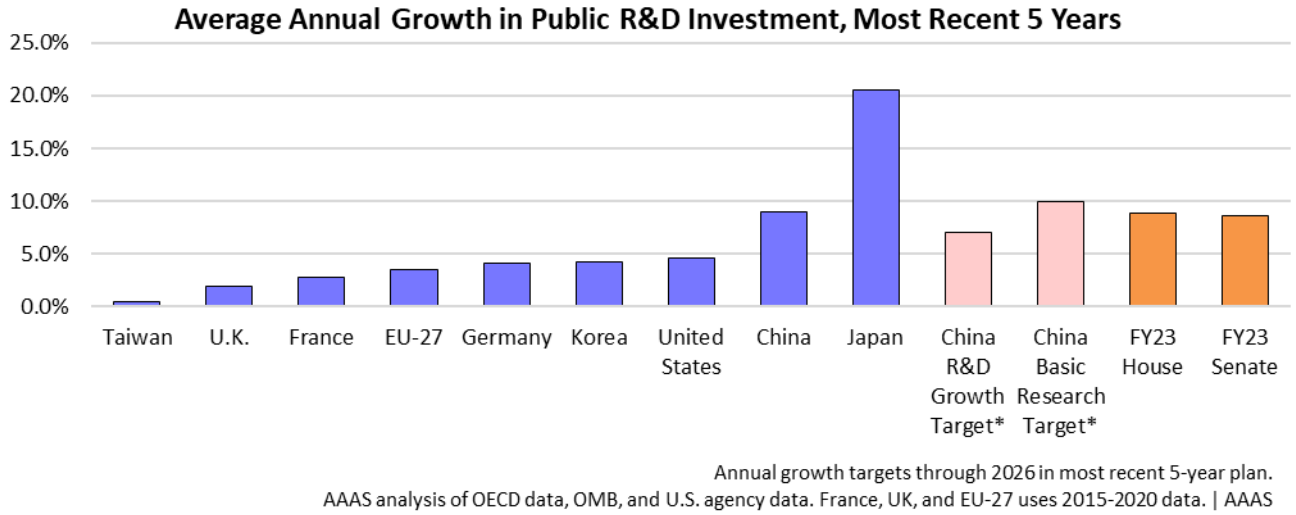
	FY 2022 Estimate	FY 2023 Request	FY 2023 **House**	Change from FY22 Amount	Change from FY22 Percent	FY 2023 **Senate**	Change from FY22 Amount	Change from FY22 Percent
Defense (050)*	95.4	97.7	100.3	4.9	5.2%	102.4	7.0	7.4%
Nondefense	95.6	111.1	107.9	12.4	12.9%	104.6	9.0	9.4%
Space (252)	13.9	13.5	13.1	-0.8	-5.5%	13.3	-0.6	-4.1%
Health (550)	42.4	49.7	47.8	5.4	12.8%	46.2	3.8	8.9%
Energy (270)	4.8	9.7	9.3	4.6	95.2%	8.6	3.8	79.3%
General Science (251)	21.8	23.6	23.3	1.5	7.1%	22.3	0.5	2.2%
Environment (300)	3.6	4.3	4.3	0.7	18.6%	4.1	0.5	12.8%
Agriculture (350)	2.8	3.3	3.0	0.2	7.0%	3.1	0.3	9.6%
All Other	6.3	6.8	7.0	0.7	11.8%	7.0	0.8	12.5%
Total R&D	**190.9**	**208.8**	**208.2**	**17.3**	**9.1%**	**207.0**	**16.0**	**8.4%**

Numbers in parentheses are the federal government budget function codes.
All figures rounded to the nearest million. Changes calculated from unrounded figures.

mandated report to OECD, and thus its data is a little behind other countries shown. For additional context, China has announced five-year annual growth targets for economy-wide R&D and for basic science through 2026, both of which are displayed in pink.[9] Lastly, our House and Senate R&D appropriations estimate is displayed in orange on the right.

As the OECD and AAAS datasets enter the pandemic years, they show annual growth in public R&D investment slowed for most countries. The U.S. maintained a 3.3% increase, comparable to its European counterparts. Korea continued its steady climb, and Japan increased its R&D contributions significantly after a long slump in innovation competitiveness that generated several attempts at motivating national innovation.[10]

Looking at the breakdown of research and development predictions for U.S. R&D as discussed earlier, the House is betting on development – with a 13.6% growth compared to 4.9% in combined basic and applied research. The Senate is looking to invest in even more development, with 14.7% growth over 2022, and a mere 3.3% basic and applied research. In comparison, China's



1) AAAS estimates are based on OMB, agency, and appropriations data and language. For the latest, see: www.aaas.org/rd
2) For additional information about the Biden R&D budget, see: www.aaas.org/news/white-house-requests-varied-increases-new-budget-greaterdetail-come
3) GDP estimates produced by the Congressional Budget Office: www.cbo.gov/data/budgeteconomic-data#4
4) CHIPS and Science bill text: www.commerce.senate.gov/2022/8/view-the-chips-legislation
5) A summary of the FY 22 earmark requests, which includes a detailing of the new selection limits: www.aaas.org/news/look-stem-focusedprojects-house-earmark-requests
6) For an interactive map and list of STEM-focused community project requests, see: www.aaas.org/news/tracking-stem-earmarks2023
7) For additional information, see: www.aaas.org/news/us-rd-and-innovationglobal-context-2022-data-update
8) Main S&T Indicators. (2021, March). OECD. www.oecd.org/sti/msti.htm
9) Normile, D. (2021, March 5). China announces major boost for R&D, but plan lacks ambitious climate. Science | AAAS. www.sciencemag.org/news/2021/03/chinaannounces-major-boost-rd-plan-lacks-ambitiousclimate-targets
10) Normile, D. (2022, May 25) Japan tries—again—to revitalize its research. www.science.org/content/article/japan-triesagain-revitalize-its-research