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Investing in the Future: Trends in the Defense Department's Science and Technology Funding

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Abstract

Tracking and analyzing defense science and technology (S&T) funding has, historically, been difficult—not just for analysts, but for employees of the Department of Defense (DoD) and Congress itself. The research team collected and analyzed these data to understand how S&T funding has changed over time and to build correlations with various strategic plans and operational needs during the 21st century. The Emerging Technologies Institute (ETI) placed S&T funding levels in the context of five selected eras of strategic planning: Operation Iraqi Freedom, the Budget Control Act of 2011, the Third Offset Strategy, the 2018 National Defense Strategy (NDS), and the 2022 NDS. The research team gathered data from R-1 Budget Justifications from the Office of the Under Secretary of Defense (Comptroller) and congressional appropriations tables.

Through this lens, we identified several important trends. First, S&T budget requests from Fiscal Year (FY) 2003 to FY2015 remained remarkably consistent in inflation-adjusted terms despite significant changes to defense spending driven by the Global War on Terror and the Budget Control Act. Since then, requests have grown remarkably to $17.5 billion in FY2024 (~+21% since FY2016). Second, ETI found that when DoD toplines grow, S&T grows more slowly. However, when DoD toplines shrink, S&T shrinks more slowly. Third, the data show that Congress consistently appropriates more funding for S&T than what is requested in the President's Budget, regardless of party control of Congress or the presidency. Finally, the DoD has not requested that S&T be funded at 3% of the topline in any year in the 21st century, an often-cited goal, and congressional appropriations have not funded S&T at this level since FY2005. These findings, and other trends in the report, provide readers with the context behind past funding decisions that may be applicable to future strategic guidance.

Introduction

Looking at federal spending by examining public government budget data and explanatory materials produced by the executive branch and Congress can often provide more insight into government priorities and activities than strategy documents, lists of strategic goals, and statements made during congressional hearings. If the United States is to continue delivering cutting-edge emerging technologies across a variety of science and technology (S&T) areas in support of national defense missions, stakeholders throughout the policy, scientific, and business communities require a clear view of national priorities that is often best communicated by tracking actual spending by the government. To help achieve this goal, the National Defense Industrial Association (NDIA) Emerging Technologies Institute (ETI) analyzed national defense research and development (R&D) funding data, which typically comprises approximately 50% of all federal R&D funds (Sargent, 2022).

Defense S&T funding is a key component of the federal scientific research and development portfolio. For the purposes of this paper, *S&T* refers to the first three budget activities of the Research, Development, Testing, and Evaluation (RDT&E) budget title, which is typically appropriated in Title IV of annual defense appropriations acts, which the president routinely signs into law to provide the Department of Defense (DoD) with its operating

budget.[1] DoD S&T is typically executed by military services and defense agencies such as Defense Advanced Research Projects Agency (DARPA). S&T activities consist of early-stage R&D work ranging from basic research to early technology prototyping. These activities are performed by universities, small businesses, government labs, and commercial or defense industry. This accounting of defense S&T funding does not include funding under the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program, defense-funded medical research within the Defense Health Agency,[2] chemical agents and munitions destruction, or military construction appropriations for facilities executing S&T activities (e.g., laboratories). It also does not consider additional appropriations that may have come through the CHIPS and Science Act of 2022, or other supplemental appropriations provided to the DoD. These appropriations were omitted from the analysis because, while these research and support activities could each be fairly classified as S&T, they cannot be parsed easily into the categories of basic research, applied research, or advanced technology development without examining individual SBIR/STTR awards, specific medical research efforts, or specific military construction projects.

Figure 1 outlines the eight budget activities that make up the RDT&E portfolio. The first three of these activities totaled approximately $22.3 billion for S&T in Fiscal Year (FY) 2023 final appropriations law. These activities are the focus of this paper's analysis and are intended to develop future military capabilities by funding a broad array of research across scientific fields of study and technology sectors, ranging from speculative general scientific inquiry to technology development to meet specific military needs. The goal of this report is to better understand the impact of various policy environments announced by the DoD or Congress on real S&T spending. To do so, these numbers were put in the context of several selected "strategic environments" in the 21st century.

describe the technological maturity of the work being performed. See the discussion beginning on page 2 of CRS Report No. R44711 (Sargent, 2022) for a full explanation of the "Character of Work Structure" of the eight RDT&E budget activities.

[2] The Defense Health Program (DHP) received significant R&D appropriations, including the congressionally directed medical research programs. DHP was appropriated just over $3 billion in Fiscal Year (FY) 2023 for RDT&E activities, approximately 7.5% of its total funding level. DoD had requested $900 million. This follows a requested $630 million and enacted $2.6 billion in FY2022. These programs contribute to the military research enterprise but are not typically included in the tabulation of S&T funding.

Budget Activity name Commonly referred to as...	Description of funding[3]	Performer of work, by dollars awarded, FY2021[4]	FY2023 Appropriations
Basic Research 6.1,[5] B.A. 1, Budget Activity 1	Funding to uncover "greater knowledge or understanding of the fundamental aspects of phenomena and observable facts"; long-term investment in scientific knowledge. Not intended to support any particular military application, though intended to lead to some scientific breakthroughs that will support future capabilities.	Intramural:[6] 16.76% **All Extramural:**[7] Universities: 59.77%, Industry: 14.09%, Other nonprofits: 3.96%, FFRDCs:[8] 2.85%, Foreign: 2.56%	$2.9B
Applied Research 6.2, B.A. 2, Budget Activity 2	Funding for scientific research for a specific military need, such as identifying the ideal material or modality for a particular capability; medium-term focus. Supports solving a specific technological challenge; not long-term oriented.	Intramural: 31.93% **All Extramural:** Industry: 43.86%, Universities: 14.30%, Other nonprofits: 5.02%, FFRDCs: 4.19%, Foreign: 0.68%	$7.8B
Advanced Technology Development 6.3, B.A. 3, Budget Activity 3	Funding for specific subsystems and components that could become prototypes for experiments and testing. Supports development that models or demonstrates the practical feasibility of a technology. Not guaranteed to lead to further development or procurement.	Intramural: 25.42% **All Extramural:** Industry: 46.61%, Universities: 12.84%, Other nonprofits: 11.09%, FFRDCs: 2.60%, Foreign: 1.43%	$11.6B
Advanced Component Development and Prototypes 6.4, B.A. 4, Budget Activity 4	Funds efforts to develop full prototype components that can operate in real-world conditions. Successful technology demonstration could lead to "Milestone B" approval, the point at which a contract award permits further system development, validation, and demonstration before full procurement.	* Performers of Budget Activities 4-6 are reported together in NSF surveys. Intramural: 35.96% **All Extramural:** Industry: 58.47%, Universities: 2.29%, FFRDCs: 2.50%, Other nonprofits: 0.59%, Foreign: 0.18%	$61.2B
System Development and Demonstration 6.5, B.A. 5, Budget Activity 5	Funds programs that have passed Milestone B approval. Technologies are being prepared to meet program requirements, but are not currently being produced at-scale. Major testing and evaluation efforts begin here to prepare for a "Milestone C" decision, which is the point at which the DoD customer determines whether or not they will support system production & deployment.		$45.2B
RDT&E Management Support 6.6, B.A. 6, Budget Activity 6	Funds all efforts to "sustain and/or modernize the installations or operations" for RDT&E operations. This can include test ranges, laboratory support, military construction, and studies.		$21.2B
Operational System Development 6.7, B.A. 7, Budget Activity 7	Funds efforts to upgrade systems that are already in production or being fielded.	Intramural: 20.14% **All Extramural:** Industry: 78.57%, Universities: 0.28%, Other nonprofits: 0.30%, FFRDCs: 0.68%, Foreign: 0.02%	$41.7B
Software and Digital Technology Pilot Programs 6.8, B.A. 8, Budget Activity 8	Pilot program provides appropriations for more rapid software development and other digital technologies by allowing selected programs to use funding in this appropriation for RDT&E, procurement, and operation and maintenance as-needed. New RDT&E Program Element created beginning in FY2021 based on the recommendations in the DoD Software Acquisition and Practices (SWAP) Report by the Defense Innovation Board.[9]	N/A[10]	$421M

Figure 1. Glossary of DoD Science and Technology Budget Activities (Sargeant, 2018)

Methodology

Each year, the executive branch submits the "President's Budget Request" to Congress. That document and the supplemental materials that lay out justifications and explanations detail what levels of funding the administration sees as appropriate. Each fiscal year, Congress passes "authorization" legislation to authorize the administration's departments and agencies to perform certain activities and provides "appropriations" in the form of appropriations acts to provide money for each department's and agency's activities at levels—higher, lower, or the same as what the executive branch requested.

The documents used for data collection were the annual Defense Appropriations Conference Reports and the DoD Comptroller's RDT&E Programs list (Exhibit R-1) for each fiscal year from FY2001 to FY2023.[3] From these documents, the extracted data were the DoD enacted topline, the requested and enacted budgets for procurement and RDT&E, including RDT&E Budget Activity 1 through Budget Activity 3, as well as Budget Activity 4 as a whole and as allocated for the services and defense-wide spending. These totals are provided in tables in the Joint Explanatory Statements for the annual defense appropriations acts. For years in which the budget activities were not totaled in those tables, the program elements within each budget activity were manually added by comparing program names to the R-1 PDF for the same year.[4] The DoD overall topline was taken to be the sum of Titles I–IX, plus Military Construction, but excluded appropriations in other legislation such as the CHIPS and Science Act of 2022, supplemental appropriations, and other adjustments. Additionally, calculations included Overseas Contingent Operations (OCO) in the years in which it existed to place S&T funding in the context of all Pentagon expenditures (McCabe & McGarry, 2019).

To adjust for inflation, the FY2023 deflator values from the DoD's *FY2023 Green Book* were used (Office of the Under Secretary of Defense [Comptroller], 2022). This includes inflation adjustments for the newly released FY2024 request numbers, which have been adjusted to FY2023 numbers due to the fact that the DoD has not yet released its Pentagon-specific deflators. In this report, "nominal" dollars refer to the funding stated in terms of that prior year's dollars adjusting for inflation. When reporting a year-over-year percentage change, we calculated this using inflation-adjusted funding levels.

To understand how appropriations are affected by strategic environments, the following time periods were selected to help contextualize the analysis of spending trends:

- **The Operation Iraqi Freedom (OIF) Era (2003–2011):** Operation Iraqi Freedom constitutes the primary duration of combat operations in Iraq. Beyond 2011, trends can be much more clearly attributed to the Budget Control Act of 2011 than operations in Iraq.[5]
- **The Budget Control Act (BCA) of 2011:** The BCA was enacted amid political debate about the appropriate level of government spending. The BCA established limits for defense and nondefense discretionary spending that would trigger a budget

[3] The Exhibit R-1 is a document by the DoD comptroller that lists all programs in the RDT&E title's budget request across all services and defense-wide agencies. The document is released annually and, according to the comptroller, defines each development effort with design, cost, schedule, and capability parameters. See DoD (2022).

[4] In contrast to other years, the RDT&E appropriations tables in the FY2011 full-year continuing resolution, the DoD and Full-Year Continuing Resolution Appropriations Act, 2011, did not separate program elements by budget activity and, therefore, did not provide requested or enacted funding totals for individual budget activities.

[5] OIF was selected without Operation Enduring Freedom (OEF) because, due to the length of OEF, it would supersede other 21st century trends.

sequestration if violated. This led to proactive congressional DoD budget cuts to remain under the caps. When an agreement on further cuts failed in 2013, a sequestration occurred that cut defense spending and required DoD and the Office of Management and Budget (OMB) to engage in reprogramming, transfers of funding between accounts, and reductions in procurement (Kogan, 2012; Lynch, 2015). While the legislation was originally scheduled to expire in 2021, the legislation effectively ended in 2019 after the Bipartisan Budget Act increased defense spending caps (Driessen & Lynch, 2019a, 2019b; McGarry, 2015). Additionally, the BCA cannot be fully disentangled from the "earmark[6] moratorium" established by an agreement between President Barack Obama and Former Speaker John Boehner during the FY2011 appropriations deliberations. That moratorium focused on limiting Representatives and Senators from requesting language for specific funds to be allocated to specific projects (Wong, 2011).[7]

- **The DoD's Third Offset Strategy Era (2015–2017):** The Third Offset was an effort to draw on advanced technologies to maintain U.S. military superiority over competitors. One of the goals of this strategy was to find mechanisms for technological innovation within the DoD. Another was to identify high-priority systems and technologies for increased investment and support.
- **The 2018 National Defense Strategy (2018 NDS) Era:** The NDS provides strategic guidance to the DoD. The 2018 NDS covered the years from late 2018 to late 2022 and was characterized by a drive to rapidly develop and advance technologies amid international strategic competition.
- **The 2022 National Defense Strategy (2022 NDS) Era:** The 2022 NDS covers the period from late 2022 to late 2026. The unclassified guidance regularly refers to emerging technologies with an emphasis on near-peer deterrence as a key S&T focus. FY2022's budget request was conceivably generated within the context of the 2018 NDS in addition to the active planning underway to release the 2022 NDS.

Finally, the data were analyzed with respect to the goal that S&T funding should be 3% of the DoD topline.[8] This is a benchmark that is often cited by defense analysts. While imperfect, it is a helpful landmark to measure defense S&T investments that was noted to be a goal by Congress in several National Defense Authorization Acts and by the DoD in its 2001 *Quadrennial Defense Review Report* (Office of the Secretary of Defense, 2001).

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[6] For the purpose of this analysis, *earmarks* are another term for congressional additions to funding levels in excess of what was requested for a particular program or project. Those earmarks can originate from DoD informal requests or unfunded requirements lists, or they can be congressionally driven to achieve a policy goal or support a constituent.

[7] That moratorium ostensibly expired during FY2021, though this type of earmarking re-emerged in practice almost immediately: Congress included generalized earmarks into appropriations language, leaving the DoD to determine the specific congressional intent for the funding increases through informal discussions.

[8] This benchmark evolved from a June 1998 Defense Science Board (DSB) study, which provided several methods for computing an ideal target for S&T funding. Several defense authorization bills have recommended standards based on that report, especially the FY2003 NDAA Conference Report, which commended the DoD's stated goal of 3%. Additionally, Section 214 of Public Law 105- 261, the FY1999 defense authorization bill, expressed the sense of Congress that S&T should grow by 2% above the rate of inflation year-over-year between FY2000 and FY2008. Notably, neither of these congressional recommendations are borne out in the numbers that came to pass during the 2000s. See Sargent (2022), pages 9, 12, 15, and 17 for more information.

Findings

S&T Funding Overview

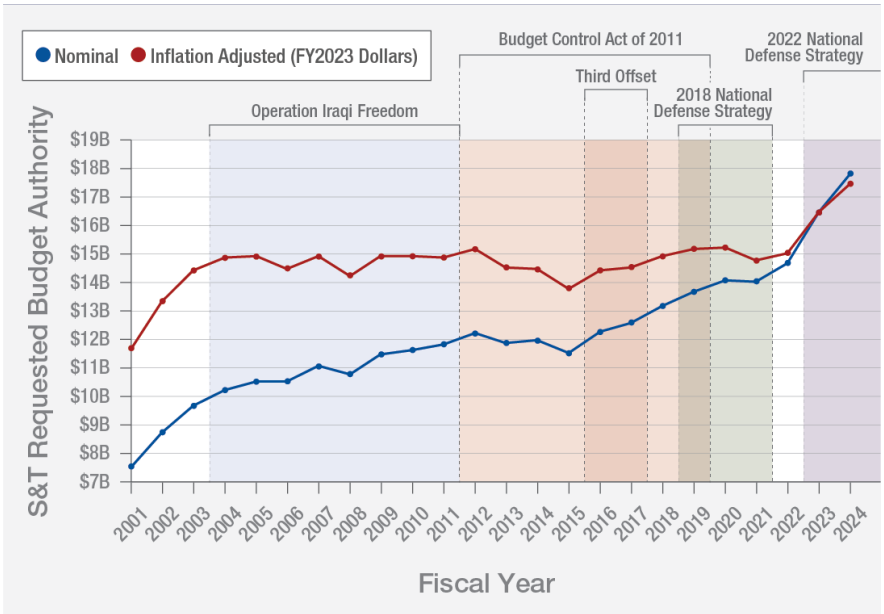

Figure 2. S&T (BA 1-3) Requested Budget Authority by Fiscal Year

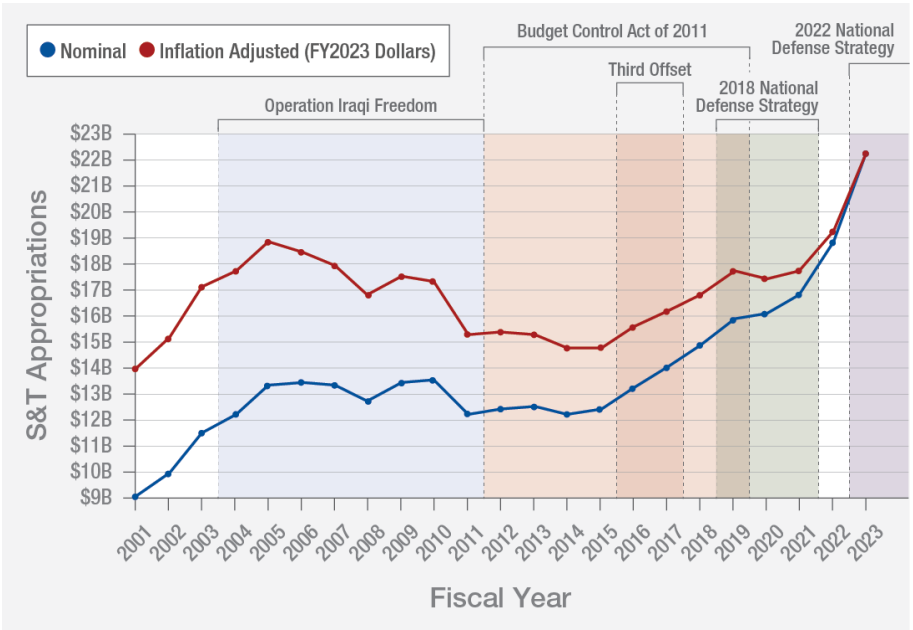

Figure 3. S&T (BA 1-3) Appropriations by Fiscal Year

In the years examined, inflation-adjusted appropriations for S&T activities had peaked at approximately $19 billion and then declined until the most recent appropriations in FY2023, when it rose to $22.3 billion. Since FY2001 ($14 billion), that amounts to an increase of 60% in constant FY2023 dollars, and 146% nominally. Compared to the overall DoD topline—which has increased by over 70% in real terms and nominally by 180%—S&T has become a consistently shrinking component of the DoD budget. Coupled with the acceleration in the pace

of global technology development, this could pose risks for modernization and readiness in an environment where decision-makers must balance today's force readiness with future needs and capabilities. However, it could also be the case that S&T funding at its current level is already sufficient for procuring more of the capabilities that the warfighter will need for future missions and operations; it would make sense for procurement and later-stage modernization efforts like Budget Activity 7 to grow faster if this is the case.

Correlating the data with the selected time periods reveals other insights. While operations in Afghanistan and Iraq coincided with a rapid rise in inflation-adjusted S&T appropriations, likely due to investments driven immediately by 9/11 and the anthrax attacks, the purchasing power of these funds fell by approximately 8% while nominal funding froze at an average of $13.3 billion from FY2005 to FY2010. The Obama Administration's Third Offset initiative appears to coincide with gradual S&T growth in inflation-adjusted terms. However, congressional additions are much more responsible than the President's Budget Request, which would more directly show the Third Offset's influence.

The end of the Budget Control Act in FY2019, influenced by similar strategic guidance on the need to invest in emerging technologies within the 2018 NDS and 2022 NDS, may have been the cause of the current period of growth in both requests and appropriations, which began to accelerate dramatically after FY2021.

S&T in the Context of the DoD Topline and RDT&E

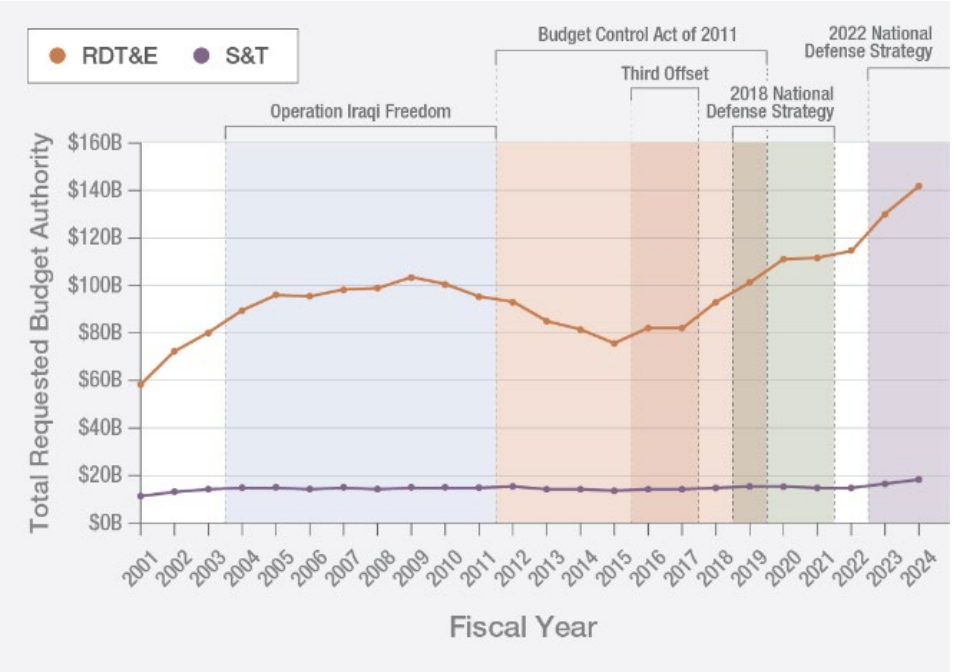

Figure 4. RDT&E and S&T (BA 1-3) Requested Budget Authority by Fiscal Year
Adjusted for Inflation (FY2023 Dollars)

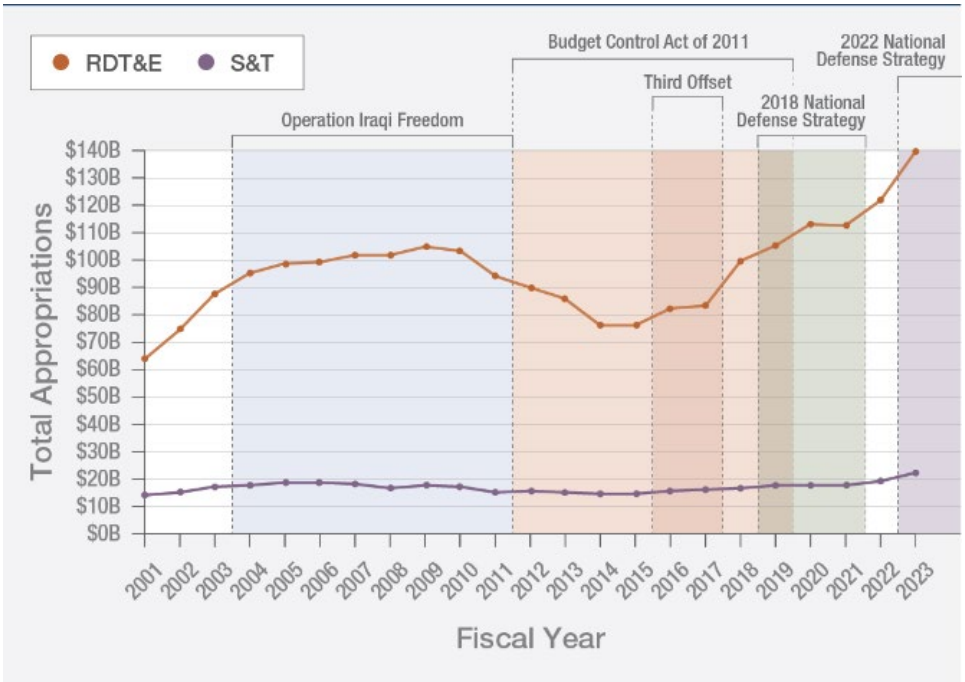

Figure 5. RDT&E and S&T (BA 1-3) Appropriations by Fiscal Year
Adjusted for Inflation (FY2023 Dollars)

When comparing the requested and enacted funding for RDT&E and S&T funding, there are two primary takeaways. First, Congress consistently appropriates more than the administration requests, regardless of the political party in power in either the executive or legislative branch. This has led to a relatively constant amount of funding in real terms for S&T, even during the Budget Control Act years when the DoD requested slightly less.

Congress also consistently appropriates more than what is requested for RDT&E more broadly, though the broader title was strongly affected by funding reductions linked to the Budget Control Act until its final years (FY2016 onward) when Congress began to increase funding again. This may be incidentally related to the larger DoD budget requests stemming from the Third Offset and 2018 NDS eras. Second, this indicates that, in a time of relative fiscal scarcity, both Congress and the DoD consistently chose to maintain S&T funding when resourcing the RDT&E portfolio. This could be due to an institutional desire to see more funding for modernization, or to Congress reacting to feedback from stakeholders in industry and at universities that advocate against cuts for these types of programs as well as for increases for specific S&T projects. A possible alternative explanation could be that decision-makers saw S&T as being particularly sensitive to budget shocks and advocated for less significant declines when compared to other programs.

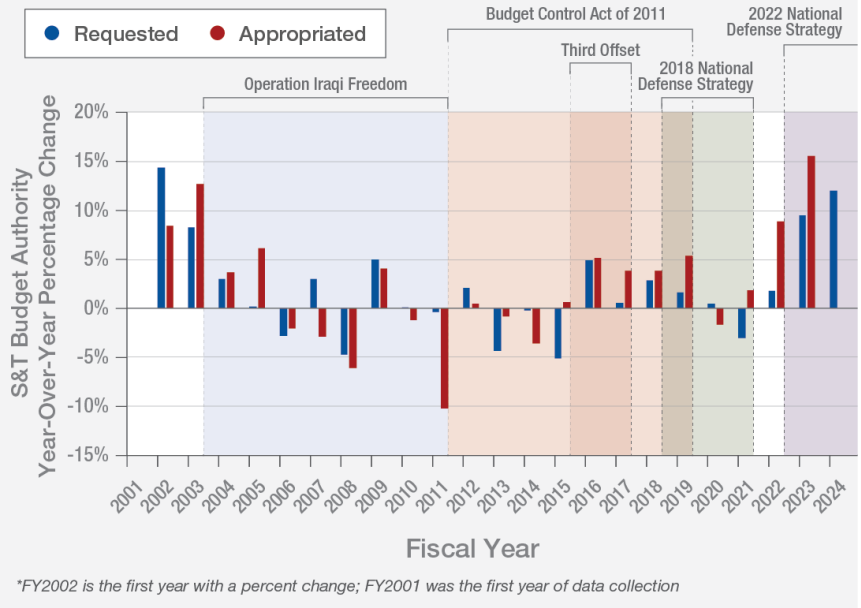

Figure 6. S&T Budget Authority, Percentage Change Year-Over-Year

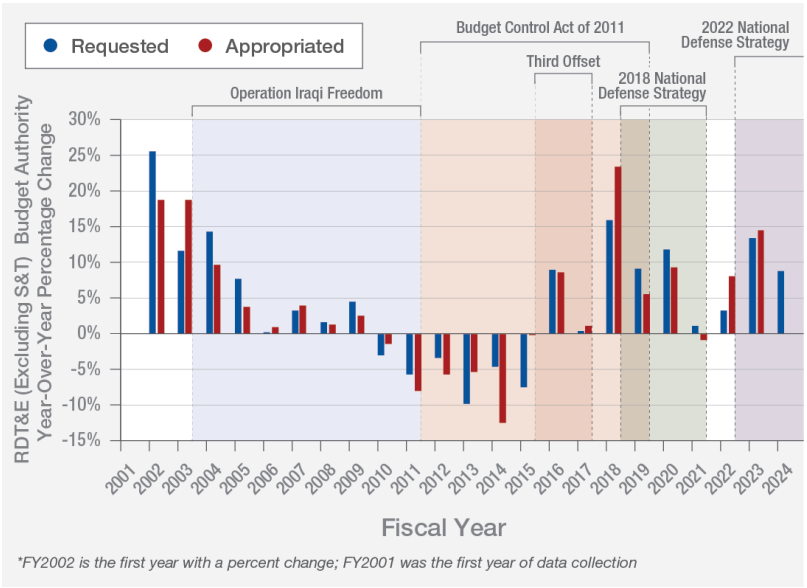

Figure 7. RDT&E (Excluding S&T) Budget Authority, Percentage Change Year-Over-Year

Looking more closely at the rate of change in S&T funding (Figure 6), budget growth and shrinkage year-over-year is both inconsistent and abrupt but relatively small in magnitude compared to swings in RDT&E funding. Compared to the broader RDT&E portfolio, DoD requests and congressional appropriations generally grow S&T funding more slowly than the rest of the RDT&E portfolio when RDT&E is growing. However, S&T funding is often protected when the RDT&E budget is flat or shrinking. This is likely because, when near-term threats seem to be shrinking, near-term prototyping and system development programs are the first to receive cuts. At the same time, S&T funding is likely maintained to hedge against long-term threats.

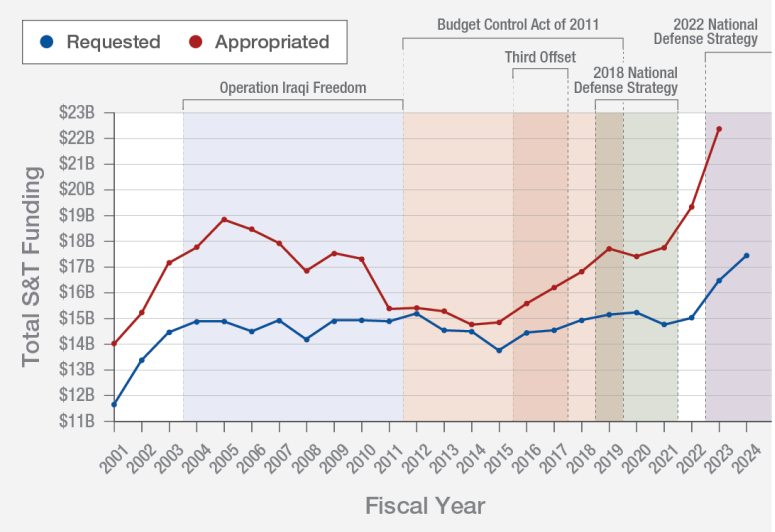

Figure 8. S&T (BA 1-3) Requested and Appropriated Budget Authority by Fiscal Year
Adjusted for Inflation (FY2023 Dollars)

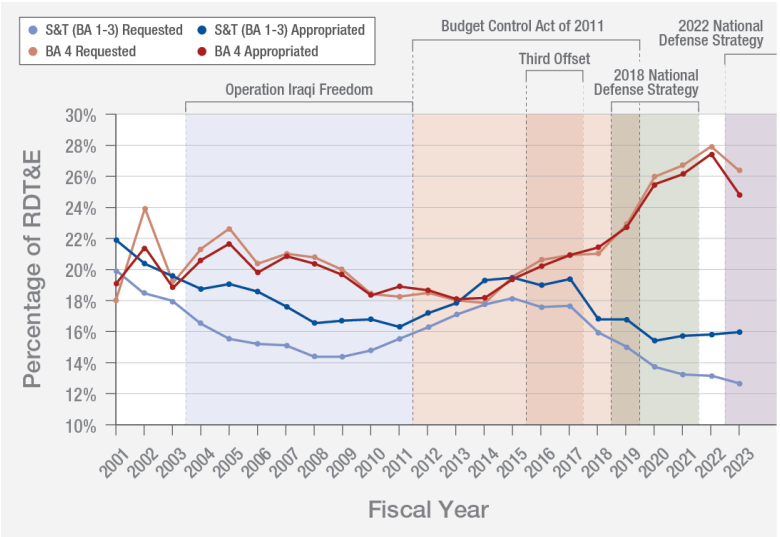

Figure 9. S&T (BA 1-3) and BA 4 Budget Authority, Requested and Appropriated, as a Percentage of Total RDT&E Budget Authority

Returning to Figure 5, these directional swings of low magnitude net out to fairly consistent S&T funding. Because most S&T funds flow out to academic and industry groups to perform the work, rapid increases and decreases cannot be easily absorbed by these institutions when research projects require multiyear investments in workforce and infrastructure, as well as stable and sustained funding to allow research projects to progress. As such, this consistency is welcome. Similarly, if S&T budgets do increase as part of a strategy to help the U.S. for longer-term research competition, policy-makers should do so consistently rather than expecting benefits from any single year increase investments.

Combining requested and enacted S&T funding onto one chart helps illustrate Congress's tendency to appropriate more S&T funding than the DoD requests. For the period examined, the amount of enacted S&T funding always exceeded the President's Budget Request in any given year no matter the strategic era. For example, while the FY2022 Budget

Request did not sufficiently protect the S&T budget topline from unanticipated levels of inflation, the relatively modest decrease in the enacted budget indicates that Congress took actions that resulted in maintaining S&T funding relatively constant in real terms. In FY2023, S&T activities received their largest-ever inflation-adjusted funding request, and Congress earmarked further funding increases for these activities that boosted the enacted funding far beyond inflation.

As mentioned earlier in this section, DoD requests for S&T as a percentage of RDT&E remained notably flat during the Third Offset era. The high increases in S&T funding seen during this era were driven primarily by congressional increases rather than any department-driven planning guidance. Conversely, in the late 2000s, the DoD consistently requested a similar amount of money in real terms, while Congress's willingness to provide such large increases over the request decreased as OIF continued.

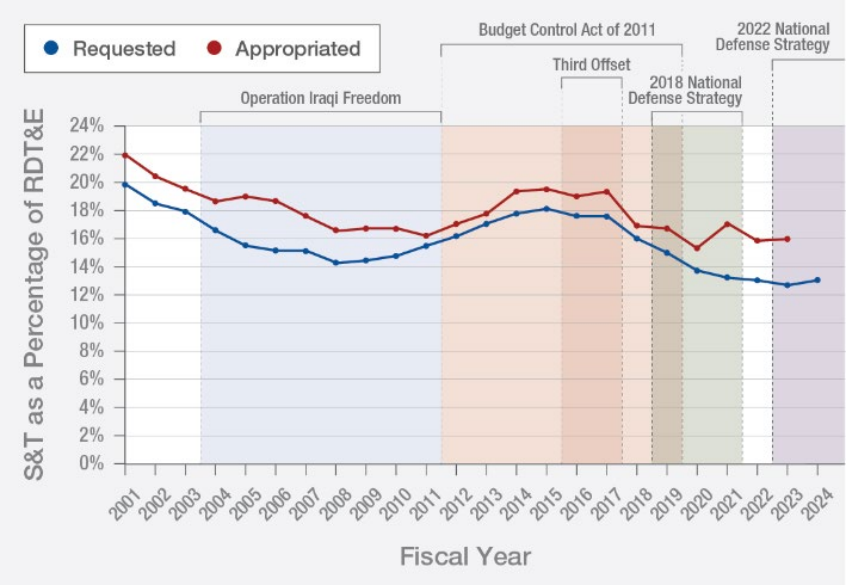

Figure 10. S&T (BA 1-3) Funding as a Percentage of RDT&E Funding

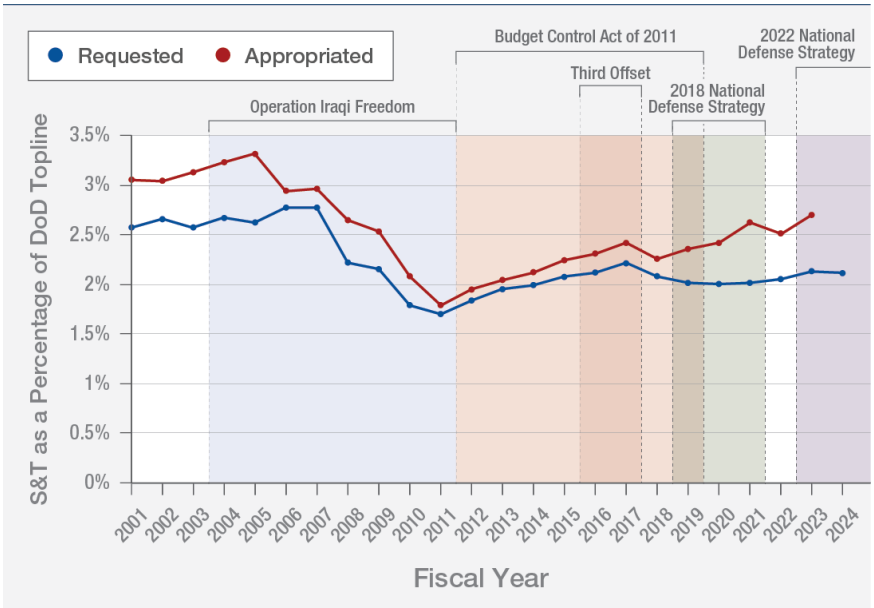

Figure 11. S&T (BA 1-3) Funding as a Percentage of DoD Topline

Even while Congress maintains S&T's funding level, S&T has shrunk by nearly a third as a share of the appropriated RDT&E portfolio over the FY2001 to FY2023 period. The share has fallen from approximately 22% of the inflation-adjusted enacted RDT&E funding in FY2001 to 16% of the funding in FY2023. This is primarily due to significant real growth in the rest of the RDT&E portfolio, which more than doubled in real terms (119%) and increased nominally by 238%. In fact, appropriated RDT&E has nearly doubled nominally since FY2017. This trend is also evident in DoD requests until FY2021, indicating that DoD leaders decided to allocate additional topline resources to near-term R&D and procurement efforts to match the perceived priority of near-term threats. However, S&T requests and appropriations after FY2021 began to grow dramatically, closer to 3% of the topline, consistent with strategic guidance on the technological nature of the great power competition with China and Russia. Because of this growth after FY2021, S&T has nominally grown by 63% over the FY2017 to FY2023 appropriations period. According to this understanding, the simplistic goal of funding S&T at 3% of the DoD topline may not be an important way of defining success. Instead, policy-makers must assess whether or not the inflation-adjusted level of funding for the S&T enterprise is achieving the scientific and technical breakthroughs that warfighters need on relevant timescales.

S&T's shrinking share of RDT&E since 2017 was examined in light of major investments in the modernization of the nuclear triad. While increasing triad modernization investments did contribute to S&T's shrinking share, S&T's share of the RDT&E title fell even when accounting for the triad's share. This is true because growth in RDT&E over the past decade has been sustained across the entire title; investments in the triad alone are not responsible for the massive increase in real funding for development activities across the title.

Another key finding is that the Third Offset era marks a divergence in S&T funding versus RDT&E Budget Activity 4. Beginning in that period, DoD requests for increased funding for bigger projects that benefit from more complete development and prototyping began to accelerate. As a result, Budget Activity 4 grew substantially as a percentage of the RDT&E title.

Separately, because the Budget Control Act appears to have increased S&T's share of RDT&E as other items in the budget shrunk, it appears that the only selected era that truly affected S&T's prioritization was the one controlled with the force of a law driving automatic cuts at the agency level, rather than any intentional actions by decision- makers. Without those types of statutory fiscal constraints, S&T budget activities only grow when the RDT&E title grows even faster, as it did in FY2023. The earmark moratorium discussed earlier also reduced congressionally directed spending on S&T during these years.

For its part, Budget Activity 4 has seen its share of the RDT&E funding grow substantially over the same period, reflecting an increased interest in prototyping activities and investments in major acquisition programs.

The DoD also seeks to influence the appropriation of additional funds through its annual unfunded requirements lists, often used by Congress to provide funding for activities that the DoD was unable to budget for. These lists rarely include S&T activities but often do include projects for Budget Activities 4 to 7. For example, of the approximately $21.4 billion in unfunded priority requests across the DoD in FY2023, only about 0.58% was for unclassified S&T programs. Across every service and combatant command, it appears that only $162.6 million was listed for S&T programs—nearly entirely from the Navy. Virtually all of this money was for projects within the Applied Research portion of the Innovative Naval Prototypes (INP) program element, and Congress ultimately appropriated a $25 million increase for this purpose. That means that, out of approximately $8 billion in congressional earmarks for S&T in the FY2023 Consolidated Appropriations Act, less than half of a percentage came from the

Unfunded Priorities List process.

The fact that unfunded requirement lists are rarely used for the S&T enterprise does not mean that the DoD does not pay attention to basic and applied research. However, the simple fact that these types of research activities provide less political value for congressional earmarking (because they do not directly support priority constituencies) may explain why the later budget activities in RDT&E have grown faster than S&T.

All told, S&T funding began to shrink from its peak percentage of the DoD topline in the mid-2000s before beginning to rebound in 2011 in Congress. S&T was funded at approximately 2% of topline, a remarkably consistent number, even in the face of significant advocacy in strategic plans such as the Third Offset and the 2018 NDS. It may be the case that, even though the language in the Secretary of Defense's Defense Planning Guidance (DPG) often instructs the services to maintain a minimum of 0% real growth in S&T with the intent to set a minimum for funding levels, in practice it becomes both the ceiling and the floor of what services will program for S&T for the next year.

It is also notable that, even though maintaining S&T funding at 3% of the DoD topline has been described as a DoD goal, the Pentagon has not requested this level of funding in any year between FY2001 and the present. This is true regardless of whether or not OCO funds are included as part of the topline. Appropriations last pushed funding to this benchmark in FY2005 and inched quite close—just over 2.7%—in FY2023. This decline below 3% occurred before the Budget Control Act and has not returned to that 3% target in the years since the BCA ended. Because, as noted above, the Budget Control Act appears to coincide with a period of S&T budget growth as a share of the topline again as other components of the DoD topline ceded resources, it appears that outright fiscal restraint may not be the reason for S&T budget activities' shrinking share.

Conclusion

This white paper is intended to be the first in a series of papers by ETI on defense S&T programs, budget requests, and appropriations. This paper seeks to describe the types of events that drive S&T funding levels. To better understand these trends, a capability to track more details of budget and appropriations data to better monitor these critical investments and the opportunities they represent to develop new defense technologies would be useful. This includes a strategy to better track congressional marks (adds and reductions), more detailed information from service and defense-wide Exhibit R-2 Budget Justification materials, other reports such as the DD Form 1414, and more detailed tracking that follows specific emerging technologies from the research phase to contracting.[9, 10]

For the most part, the time periods analyzed do not appear to coincide with significant variation in S&T spending as a priority, even while several of these eras reflect several administrations' rhetoric and goals for defense modernization. The major exception to this rule is the Budget Control Act of 2011, which meaningfully coincides with S&T growing as a share of the RDT&E and DoD toplines due to cuts in other areas. It is notable that despite pronouncements from the DoD throughout Third Offset and 2018 NDS periods on the

[9] The Exhibit R-2 is produced for each program within a service or defense-wide agency. It includes specific budget justification materials for each program, including a summary of resources, mission description, and justification narratives for a given program and each of its projects. See DoD (2022), Chapter 5.

[10] The DD Form 1414 is a form submitted by the DoD to Congress within 60 days after enactment of a new defense appropriations act. The form establishes the DoD's baseline funding levels for each account—including adjustments, rescissions, and supplemental appropriations—which the DoD can transfer or reprogram against. Read more in McGarry (2021).

importance of S&T funding, it appears to have been congressional actions during periods of significant earmarking that push S&T dollars to dramatically higher levels relative to the topline. Both the DoD and Congress have fallen short of the stated goal to fund the S&T portfolio at a level of 3% of the DoD topline in the 21st century.

At the same time, analysis of the S&T funding portfolio alone has shown that absolute spending in S&T has been remarkably consistent in real terms—approximately $14.5 billion per year over the course of the 21st century. However, the portfolio began to grow in inflation-adjusted terms during the Third Offset and has only increased since then in requests during the 2018 and 2022 NDS periods. It appears that something closer to $16 to $17 billion may be the new equilibrium for S&T funding requests. This increase across the past three administrations may be due to a strategic shift towards great power competition.

The implications of this report indicate that the high funding added by Congress for S&T is unlikely to last once the appropriated DoD topline begins to flatten. This is likely to be true even as the 2022 NDS and senior defense officials emphasize in testimony that modernization and investments in critical technology areas are crucial for maintaining a capability edge over potential adversaries.

The research and engineering community, both inside and outside of the federal government, benefit greatly from clear and consistent levels of funding. Research institutions cannot easily absorb large injections of funding that may not be sustained due to the need to hire more researchers, patiently pursue technical achievements, and build more laboratory and test infrastructure. They also cannot adapt to rapidly falling funding, which leads to project cancellations and an environment where research teams cannot take risks. For this reason, there would be some benefit in the DoD and Congress re-evaluating, and maintaining, a standard benchmark of S&T funding. That benchmark may be the "3% of topline" metric, but it could also be the case that this metric is too rigid and ignores the fact that non-S&T costs may rightfully grow faster to respond to near-term threats. Other goals, such as a commitment to protect S&T funding from inflation or to boost S&T funding at a specified rate, may also be helpful. This process will require active planning and programming efforts by the DoD as well as active legislative support by Congress, with benefits that flow across the DoD to its many modernization efforts planned for the decade ahead.

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