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# RESEARCH BRIEF

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## Long-Term US Defense Budget Trends and Implications for Defense Technological Innovation

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Department of Defense concerns over an eroding technological and capability advantage have spurred the development of the Third Offset Strategy to focus investments on areas of greatest US competitive advantage, including undersea warfare, precision strike, and human-machine teaming. However, flat defense budgets and rising operations and maintenance costs (O&M) will continue to constrain procurement and research, development, test, and evaluation (RDT&E) spending within the US defense budget over the near and medium term. Later-stage RDT&E for the technological maturation of weapons systems and platforms in development will be more impacted. The concentration of large, costly, and technologically advanced programs within the RDT&E budget exacerbates the budgetary and strategic risks of any cost overruns, while making them more likely. This brief outlines US defense budgetary trends for the overall defense budget and for RDT&E spending, highlights areas of particular risk, and describes the potential impacts on US defense technological innovation.

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## DEFENSE RDT&E BUDGET CHALLENGES

The US Department of Defense (DoD) is chafing at the budget restrictions imposed by the Budget Control Act of 2011 (BCA) in response to fears of a rapidly-growing deficit. Although the uncapped war funding budget (the Overseas Contingency Operations accounts) has been used to supplement the capped base budgets, defense spending has declined sharply in real terms from the record highs of the conflicts in Iraq and Afghanistan. Now, facing the potential emergence of an era of great power competition, the department is re-orienting research and procurement efforts to counter potential peer or near-peer adversaries. The DoD's concerns over an eroding technological and capability advantage has spurred the development of the Third Offset Strategy, to focus investments on areas of greatest US competitive advantage, including undersea warfare, precision strike, and human-machine teaming.

However, the DoD must innovate and, critically, incorporate these innovations into the force on a relative shoestring. RDT&E spending is projected to decline, reaching about \$61.1 billion in fiscal year (FY) 2030, \$10 billion less than in FY 2017 and \$32.3 billion less than the recent peak of \$93.4 billion in FY 2007.

In the near term, the DoD's budget will continue to be capped by the BCA through FY 2021. It is likely that the department will receive approximately \$15–18 billion in sequester relief each year through the remainder of the BCA caps. After the BCA caps expire, the DoD projects that defense spending will remain flat in real terms through FY 2026, at about \$540 billion annually. The long-term budget environment suggests that national spending on defense will remain largely flat over the next 20–30 years,

absent a clear exogenous threat. Rising deficits, driven by the divergence between demographically-driven rising outlays in entitlement programs and flat revenues, are projected to reach 155 percent of US gross domestic product by 2046. Without major shifts in government social services or taxation policy, these long-term budget challenges will depress the resources available for discretionary spending for defense and other programs.

The DoD's plans are likely to cost more to execute than projected—or than a flat overall defense budget will be able to support in the long term (see Figure 1). This gap will be greatest for O&M and procurement. Between FY 2017 and FY 2030, the DoD plans for procurement budgets to rise slightly above inflation. However, the department will likely need more funding than its budget projections account for—about \$15 billion more than planned in FY 2025. The DoD's RDT&E spending is projected to decline slowly between FY 2017 and 2030, reaching about \$61.1 billion in FY 2030, \$10 billion less than in FY 2017. However, within a flat overall defense budget, rising costs of O&M and personnel will crowd out spending on procurement, and to a lesser extent, RDT&E. The combination of intractable cost growth with more-costly procurement plans will lead to difficult tradeoffs between procurement and force structure over the next 20–30 years, similar to the choices that were made in response to the BCA caps.

The DoD plans to spend significantly less on RDT&E in FY 2017–2021 than it has in recent years. RDT&E spending would rise slightly from \$71.8 billion in FY 2017 to \$73.8 billion in FY 2018 before declining steadily to \$66.5 billion in FY 2021. Over this period, RDT&E funding would face a compound annual

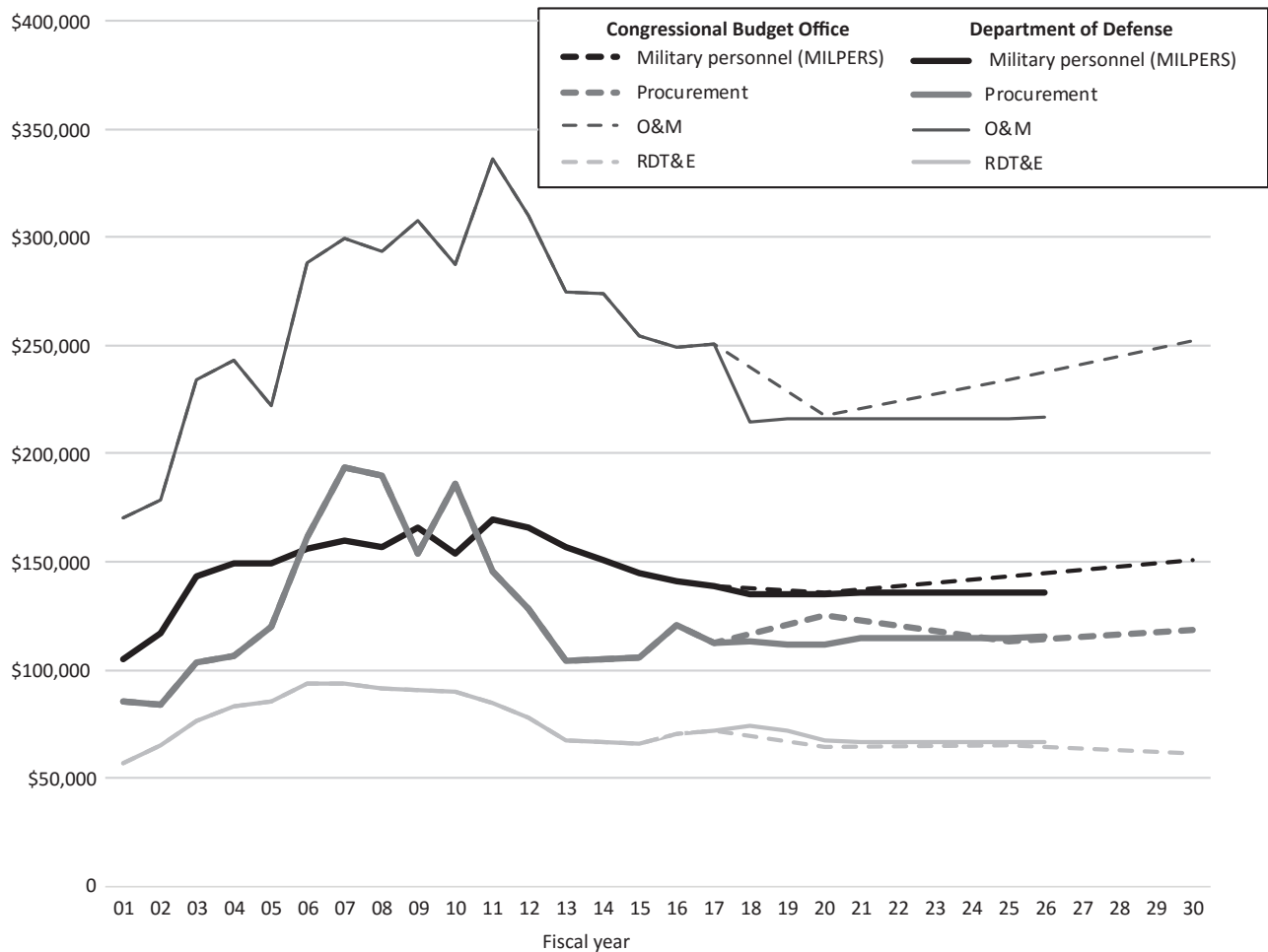
decline of 1.5 percent, after a growth rate of 1.53 percent annually from FY 2001 to 2017. While DOD only projects the topline of the defense budget between FY 2021 and 2026, if the relative proportion of funding allocated to RDT&E holds constant after FY 2021, DOD would spend approximately \$66.5 billion on RDT&E annually over that timeframe.

## THE THIRD OFFSET STRATEGY

According to Assistant Secretary of Defense for Defense Research and Engineering Stephen Welby, the Third Offset Strategy is intended to maintain and enhance core US advantages, build new asymmetric capabilities, and counter adversary anti-access and area-denial capabilities.<sup>1</sup> The Third Offset Strategy can be considered an aspect of broader US strategic competition with China, intended to cost-effectively update US conventional deterrence for the new competitive era, by making it more difficult for potential adversaries to achieve their aims and ensuring the ability to impose high costs in the attempt. Critically, these investments must not only begin tilting the cost-imposition balance back in favor of the United States, but also be affordable within the current constrained defense budget. The DoD will also have to be cost conscious in order to be able to include these newly-developed capabilities into the force in sufficient scale.

Within the umbrella of the Third Offset Strategy, over the next five years the DoD plans to invest \$3 billion in weapons and concepts for surface strike and air-to-air combat to combat the anti-access challenge; \$500 million in improved ability to defend key capabilities or locations and camouflage and dispersal abilities for the guided munitions salvo competition; and \$3 billion in new submarine and undersea capabili-

1 Assistant Secretary of Defense for Research and Engineering Stephen Welby, "Third Offset Technology Strategy," statement before the of the Senate Armed Services Committee, Emerging Threats and Capabilities Subcommittee, April 12, 2016, [http://www.defenseinnovationmarketplace.mil/resources/Welby\\_041216\\_SASC\\_ETC.pdf](http://www.defenseinnovationmarketplace.mil/resources/Welby_041216_SASC_ETC.pdf).



**FIGURE 1.** DoD’s Future Years Defense Program (FYDP) plans and projected spending by appropriations title in thousands, FY2017–2030

ties, including new payloads, sensors, mines, and torpedoes. Other investments are more futuristic, including \$3 billion to advance human-machine teaming, including improving collaborative decision-making and enabling swarming of systems; \$1.7 billion for cyber and electronic warfare, including systems that can sense, learn, and react autonomously; and more than \$500 million to expand wargaming, test new operational concepts, tactics, techniques and procedures, and demonstrate advanced capabilities, with a particular focus on ground combat.<sup>2</sup>

Whatever the precise boundaries of the Third Offset Strategy investments, they represent a small propor-

tion of the \$365.2 billion in current year dollars (\$351.4 billion in constant FY 2017 dollars) that the DoD is planning to spend on RDT&E in the FY 2017 FYDP (2017–2021). More generally, key DoD RDT&E investments are in space and space-based systems, missile defense programs, cyber-space operations, munitions, and basic science and technology research. Examining planned RDT&E investments in the 2017 FYDP illuminates the DoD’s priority areas of effort in the near term, as well as a preview of what systems, technologies, and capabilities will move out of RDT&E and into procurement over the longer term (15–30 years).

### FORTHCOMING TECHNOLOGICAL INNOVATIONS

For the next five years, planned funding for operational systems development to upgrade existing systems makes up the largest category of RDT&E, at \$107.5 billion in current dollars, or 37 percent of total RDT&E funding. Excluding classified systems, the weight of near-term effort for development for existing systems is for the F-22, the F-35, wringing greater capability out of existing aircraft via engine improvements, and space-related systems.

The 2017 FYDP planned RDT&E funding for system development and

<sup>2</sup> Ibid.

demonstration (SDD) illustrates what programs and systems are moving down the acquisition pipeline within the engineering and manufacturing development phase, and will likely reach full-rate procurement within the next 5–7 years. Again, space systems and the F-35 account for the largest share of funding. Other major programs include the Next Generation Jammer and the Carrier-Based Aerial Refueling System—a re-working of the Unmanned Carrier-Launched Airborne Surveillance and Strike effort into a less-stealthy unmanned refueling and intelligence, reconnaissance, and surveillance platform, rather than a stealthier unmanned surveillance and strike platform.

Further back in the acquisition pipeline, in advanced component development and prototypes (ACD&P), where the rubber meets the road in terms of technological innovations being applied to weapons systems and platforms, major areas of effort in the FY 2017 FYDP remain ballistic missile defense, the new long-range strike bomber, the Aegis ship and Ashore ballistic missile defense, the ground-based strategic deterrent replacement for the Minuteman III intercontinental ballistic missiles, and the replacement of the Ohio-class ballistic missile submarine. Collectively, these planned RDT&E investments suggest a strong emphasis on the priorities outlined by the Third Offset Strategy: space capabilities, cyber, advanced air combat capabilities, and precision strike and missile defense.

## GROWING RDT&E BUDGET RISK

Defense budget pressures over the middle term will challenge the DoD's ability to continue these investments and move weapons systems and plat-

forms through the RDT&E and acquisition pipeline from advanced component development and prototypes to the costlier SDD stage and into initial low-rate production. Funding for SDD for weapons systems and platforms that are in engineering management and development will be 15.5 percent lower in real terms in FY 2021 than in FY 2017. The DoD has expressed concern about the declining level of funding for this RDT&E budget activity as a risk factor for “losing technological superiority in multiple operational domains.”<sup>3</sup>

This planned FY 2017–2021 funding level for SDD (see Figure 2), and the projected funding levels of about \$11 billion annually thereafter through FY 2030, will probably be insufficient to cover the DoD's current plans. According to DoD data, RDT&E costs for major acquisition programs in SDD have been steadily increasing since FY 2001. The problem is more acute for larger programs. After weighting for size, the median cost growth of programs extant in 2014 was 46 percent. While the band of cost growth was narrower, 50 percent of programs still experienced RDT&E cost growth in the SDD stage of between 13 and 59 percent above original estimates.<sup>4</sup> While more recent programs have experienced lower RDT&E cost growth, they have also been smaller and less complex.

The type of program also matters. Development in space, unmanned aerial vehicles, and command, control, communications, and intelligence (C3I) experienced high cost growth in engineering management and development: 86 percent, 109 percent, and 67 percent for median programs, respectively, after weighting for program size. By contrast, the median cost growth for development for aircraft and ships was 36 percent

and 44 percent, respectively.<sup>5</sup> This acquisition performance data suggests that several of DoD's newly-started acquisition efforts are likely to experience significant RDT&E cost growth within the FY 2017–2021 timeframe and beyond, despite recent improvements in containing acquisition costs.

## AIR FORCE MORE EXPOSED TO TECH RISK

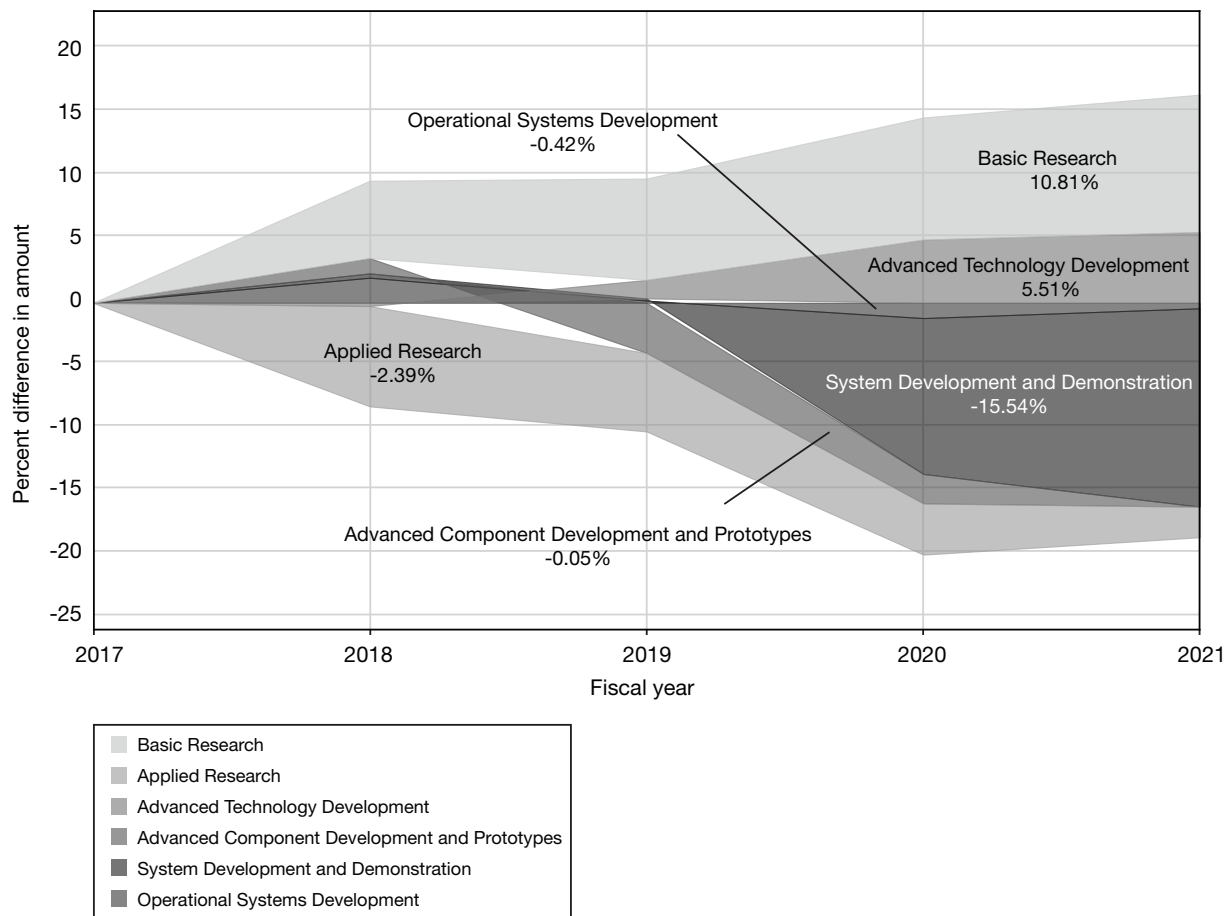
The DoD's planned emphasis on space, cyberspace, and C3I capabilities are precisely the types of acquisition programs likely to face higher RDT&E cost growth and schedule delays. The Air Force's planned long-range strike bomber, the B-21, is the single largest RDT&E development program between FY 2017 and 2021, with a projected \$12.1 billion in RDT&E funding. Although the Air Force is very focused on controlling costs and appears to be managing the program well in its initial days, the sheer scale and complexity of this program heighten the risk.

Within the middle and late stages of the RDT&E portions of the acquisition pipeline, the Air Force's funding levels nearly double from FY 2017 through FY 2021, while the Navy's will decline by 80 percent. The Air Force's increases are driven by a handful of major acquisition programs. New programs, the long-range strike bomber, and the ground-based strategic deterrent system (the follow-on to the Minuteman III ICBM), drive the Air Force's spending in the ACD&P stage, while continuing spending on the space-based infrared system and the advanced extremely high frequency satellite are the largest wedges in SDD. Together, these four programs make up 64 percent of the Air Force's planned spending on RDT&E in these areas, up from 28

3 Undersecretary of Defense for Acquisition, Technology, and Logistics, “Performance of the Defense Acquisition System, 2015 Annual Report,” September 2015, 3.

4 Ibid., 37–38.

5 Ibid., 51–52.



**FIGURE 2.** Relative change in projected RDT&E funding by budget activity, 2017 FYDP

percent in 2017. The F-35 and the KC-46 tanker had made up a large proportion of the Air Force’s SDD spending, but by FY 2017 those costs have largely wound down as those systems move into production.

By contrast, the Navy’s two largest programs in development, the Ohio-class replacement ballistic missile submarine and CBARS, will make up just 13 percent of total planned funding for ACD&P and SDD in FY 2021. As with the Air Force, the RDT&E funding for the F-35 has largely finished by FY 2017, and does not account for the decline in Navy funding for RDT&E ACD&P and SDD between FY 2017 and 2021.

## CONCLUSION

It is unlikely that the DoD will be able to execute its currently planned pipe-

line of RDT&E and procurement programs within the flat defense budgets likely over the mid to long term. Procurement and late-stage RDT&E funding are the most likely areas to face reductions when budgets are tight or declining—a trend evident in DoD’s response to the constraints imposed by the BCA caps and previous budget downturns. Additionally, the types of defense technological investments in the pipeline, and emphasized within the Third Offset Strategy, are predominantly either large programs, or programs in the space, unmanned vehicle, and C3I arenas. These types of programs are both more likely to experience cost growth in development, and more likely to experience high cost growth.

These trends suggest that a “bet-the-farm” approach of a large, costly, leap-ahead suite of capabilities is far

likelier to go over budget than a more limited scope of innovation. To realize the technological innovations DoD envisions as part of the Third Offset Strategy and be able to incorporate them into the force structure, the Pentagon will have to focus on containing costs and smaller-scale programs and efforts to innovate existing platforms rather than large, complex, transformative programs.

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