5

Department of Defense

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HIGHLIGHTS

– Department of Defense (DOD) R&D has declined since FY 2010; FY 2015 would keep funding very near FY 2013 and FY 2014 levels, remaining higher than in any year prior to 2003.

– In total dollars, recent declines to RDT&E have largely been driven by cuts to development activities. However, in FY 2015 total RDT&E would remain nearly unchanged, with slight increases in weapons development offset by declines in science and technology (S&T).

– Basic research would decrease to $2.0 billion in FY 2015, following a slight increase in FY 2014; the gradual long-term increase since FY 1998 has kept basic research around $2.0 billion in recent years.

– S&T in FY 2015 would reverse small gains in FY 2014, continuing a recent decline and dropping below FY 2001 levels to $11.5 billion total.

– The President's Opportunity, Growth, and Security Initiative would provide an additional $2.1 billion for DOD R&D.

INTRODUCTION

The Department of Defense remains by far the largest contributor to federal R&D. Most of this funding is channeled through the Department's Research, Development, Test and Evaluation (RDT&E) budget. RDT&E funding spans seven official classifications from basic research, or "6.1," to operational systems development, or "6.7" (see Table 1 at the end of this chapter). In addition, substantial R&D sums are also allocated to programs outside the RDT&E budget, such as the Defense Health Program and the Chemical Agents and Munitions Destruction Program. In the current fiscal year, FY 2014, the RDT&E

budget is estimated to reach $63 billion, with additional R&D funding of $3 billion for other programs.

DOD R&D funding is distributed to a variety of public and private institutions. While the vast majority of extramural funding goes to industrial contractors for weapons system development, the RDT&E basic and applied research budgets also support a broad engineering and science knowledge base at universities and colleges across the country, and a workforce in more than five dozen armed services laboratory centers, divisions and directorates. For perspective, only the National Institutes of Health and the National Science Foundation surpassed DOD funding for university R&D in FY 2012. That year, DOD remained the single largest federal funder for research in engineering by a wide margin and was a close second behind NSF in funding for computer science. The RDT&E budget also supports a variety of Federally Funded Research and Development Centers (FFRDCs).

The long-term strength of RDT&E goes far beyond the tens-of-billions of dollars invested each year. Technology development has been built into DOD's strategic culture for more than half a century, and is aligned with continuing broad public support for the national security mission. Together, this has allowed the Department of Defense to engage with the frontiers of technology in a uniquely comprehensive way, from basic research to technology end-user. This vast innovation system has yielded an impressive history of monumental outcomes, from technologies including microelectronics and computing to engineering sciences including computational fluid dynamics and fracture mechanics.

Over the years, the Quadrennial Defense Review, the Defense Science Board, senior leadership in the Pentagon, the Congress, and the White House, and a legion of expert observers have all recognized the importance of maintaining strategic technological advantages over potential foreign adversaries. However, the pursuit of ever-greater technical capabilities comes with ever-higher costs. The Department of Defense continues to express interest in finding lower cost solutions to rapidly adapting threats, for example through the Engineered Resilient Systems initiative. And an emphasis on the systems engineering workforce arises from the need to better manage acquisition costs amid contracting budgets. Even the Defense Advanced Research Projects Agency (DARPA) portfolio now includes "innovation to invert the cost equation" as a theme. The national security mission has long insulated the Department of Defense budget, but the Department has been unable

to escape the effects of contracted budgets, and sustained reductions are plausible given the incomparable scale of this institution and the ongoing conflicts over spending priorities over the next decade. The extent to which this will impact RDT&E in the coming decade may reflect the escalation in RDT&E funding over the previous decade.

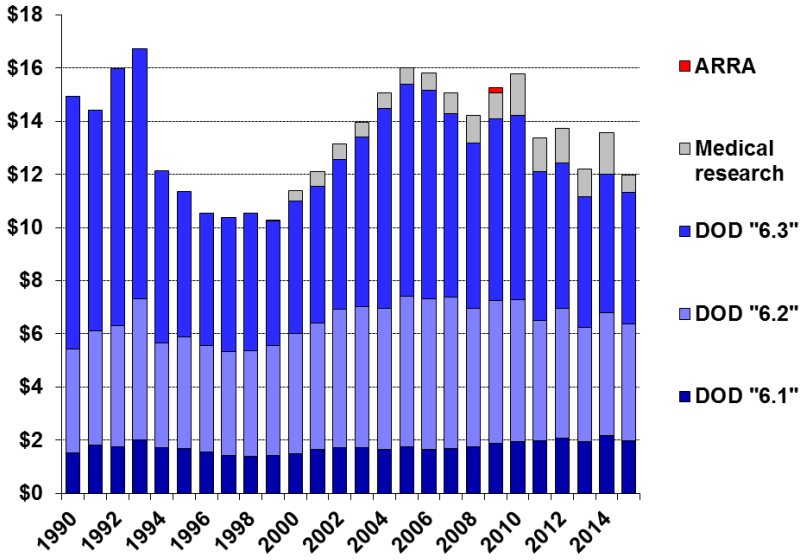
IN-DEPTH REVIEW

Basic Research (6.1). In constant 2014 dollars, basic research funding has been slowly climbing from $1.4 billion in FY 1998 – the low point following post-Cold War reductions – to $2.1 billion estimated in FY 2014 (see Figure 1 on the following page). The FY 2015 budget requests $2.0 billion in current dollars for basic research. The Navy has a leading history in basic research and continues to top defense funding in this category; however, the gap has narrowed slightly. In FY 2004 Defense agency funds for University Research Initiatives (and less significantly for Force Health Protection and Laser funds) were transferred to the military departments. Following this shift in FY 2004, Defense agency basic research funding has steadily rebounded. The FY 2015 budget request for basic research include $424 million for the Army, $576 million for the Navy, $454 million for the Air Force, and $562 million for Defense agencies. Each of these requests is a decline from estimates for FY 2014, but only the Air Force would drop slightly below their FY 2013 level of $461 million in non-inflation adjusted dollars. Overall, total basic research funding at DOD has remained above or very near $2.0 billion since FY 2010, with the Air Force outpacing the Army and the steadiest growth in recent years going to the Defense agencies.

The declines in basic research funding requested in the FY 2015 budget, seen across the military departments and Defense agencies, in part reflect the increases estimated in FY 2014 (see Table II-4). Within these funds, the largest drop in dollars by far – $90 million – is for Defense Research Science, distributed for single-investigator basic research in academia, industry and in-house. Only the Army would see this category increase by $16 million. The Navy, Air Force, and Defense agencies would lose $45 million, $59 million, and $3 million, respectively. However, in total Defense Research Sciences would remain above the FY 2013 level. Similarly, the Army's University and Industry Research Centers, which includes Collaborative Technology Alliances, University Centers of Excellence and University Affiliated Research Centers, would decline to $103 million in FY 2015, but would remain above the actual FY 2013 level of $96 million. The multi- and inter-disciplinary University

Research Initiatives would decline overall. In total, FY 2015 basic research for the Army would decline $12 million, or 2.8 percent, the Navy would lose $43 million, or 6.9 percent, and the Air Force would lose $70 million, or 13.4 percent.

Figure 1. Trends in S&T at the Department of Defense.



Source: AAAS R&D reports, agency budget documents, and appropriations reports. FY 2014 figures are estimates. Medical Research is appropriated outside RDT&E; appropriated as applied research pre-1999. © 2014 AAAS

Within the Defense agencies, Basic Research Initiatives – a new account in FY 2012 under the Office of the Secretary of Defense (OSD) – would absorb $33 million from the National Defense Education Program, reflecting a realignment of the National Security Science and Engineering Faculty Fellowship. Also included within Basic Research Initiatives is the Minerva Research Initiative, aimed at basic social sciences to help better understand cultural and political forces of strategic importance. Part of the increase in recent years to Defense agency basic research has been infused through the Historically Black Colleges and Universities and Minority Institutions, which in FY 2014 was realigned from the applied research budget.

Applied Research and Advanced Technology Development (6.2 and 6.3). In constant 2014 dollars, applied research has risen from $3.9 billion in FY 1997 to a plateau of $5.7 billon across FY 2005 to FY

2007. Since FY 2007, applied research funding has mostly declined. The FY 2015 budget requests $4.5 billion, a drop of nearly 23 percent since FY 2007, adjusting for inflation. In FY 2015, the Army would incur the largest decline of $92 million or 9.6 percent. These cuts are made across several line items including, for example, Materials Technology, Sensors and Electronics Survivability, and Weapons and Munitions Technology. Some line items in the Army applied research budget would see small increases, including Aviation Technology and Combat Vehicle and Automotive Technology. The small increase for Defense agencies, which collectively have the largest applied research budget, would actually be a slight decline when adjusted for inflation. The Tactical Technology line item under DARPA would see the largest increase, moving from roughly $218 million in FY 2014 to $305 million for FY 2015.

Advanced technology development has fluctuated some over the previous decade, but the military departments and Defense agencies have all declined in recent years from peaks earlier this decade. The FY 2015 budget for the Army and Navy would fall below FY 2013 levels to $918 million and $595 million, respectively. The Air Force would also decline, down to $594 million but still above FY 2013 levels. Advanced technology development for Defense agencies would increase by $56 million in FY 2015. Within DARPA, the largest gain would be for Network-Centric Warfare Technology, increasing from roughly $259 million to $387 million. The Defense-wide Manufacturing Science and Technology Program would be boosted from $59 million in FY 2014 to $91 million in FY 2015. These funds would further support the President's National Network for Manufacturing Innovation, which includes regional hubs for 3D printing, digital manufacturing and design, and lightweight metals.

Defense Health Program. While not budgeted as part of the RDT&E account, the Defense Health Program has nevertheless become a prominent source of health funding and a favored program for appropriators. The program is intended to act as an information resource and funder of biomedical research to serve not only the warfighter, but service members' families. Through a peer-reviewed competitive grant process, it has become a major funder of cancer research, especially in breast, ovarian, and prostate cancer. The Defense Health Program's R&D funds are counted here among the 6.2 category.

R&D funding for this program has crept upwards over the past decade, from less than $500 million in FY 2000 to $1.5 billion estimated in FY

2014, in constant dollars. In recent years, a pattern has emerged in which the Pentagon requests far less funding than Congress would prefer, with legislators adding substantial funding for peer-reviewed research during the appropriators proceedings. Such was the case in FY 2014, when appropriators responded to the Administration's $730 million R&D request by funding the program at double this amount.

Even under conditions of constrained spending, a replay of this dynamic is possible in FY 2015, as the Administration has requested an $898 million reduction, 57.8 percent below FY 2014 levels. The bulk of this reduction would come from cuts to medical technology development, though cuts to the program are generally quite broad.

Taken together, the categories described above – basic and applied research, advanced technology development, and medical research – provide the overall DOD science and technology budget. The S&T budget would decline by 10.3 percent below FY 2014 levels (see Table II-5). Adjusted for inflation, the S&T budget would reach its lowest level since FY 2000, reversing gains in FY 2014 and continuing the long-term decline from the peak in 2005. The increases in advanced technology development funding for the Defense agencies and their steady rebound in basic research funding would remain two of the most significant S&T trends over the past decade.

Weapons Development (6.4 to 6.7). The development categories make up the vast majority of the RDT&E budget. In constant 2013 dollars funding for both advanced component development (6.4) and system development and demonstration (6.5) increased steadily during the first half of the last decade, but has since declined to around $12 billion each estimated in FY 2014, still well above FY 2000 levels. FY 2015 would see a $705 million increase in advanced component development and a $431 million decrease in system development and demonstration. Management support (6.6) has gently increased to a FY 2010 peak of $6.5 billion in constant 2014 dollars, but FY 2015 would continue a recent decline to $4.2 billion in current dollars. Operational systems development (6.7) climbed to a peak in FY 2010 of $32 billion, doubling since FY 2000, in constant 2013 dollars and including classified programs. FY 2012 showed the first decline to 6.7 in more than a decade, which continues through the estimate for FY 2014. However, the FY 2015 request would reverse this decline and boost 6.7 by more than $1 billion, or 13.3 percent (see Table II-2).

The decline in total RDT&E would continue in FY 2015 when adjusted for inflation, despite the funding boost the 6.4 and 6.7 categories, totaling $63.7 billion (including a $136 million placeholder for R&D associated with overseas operations). Including medical research and other non-RDT&E funding would bring total DOD R&D to $65.7 billion. The Army and Defense agencies would decline to $6.6 and $16.8 billion respectively. The Air Force would increase to $23.7 billion, though inflation would render this a real decline. Only the Navy would see a slight increase from $14.9 to $16.3 billion (see Table II-3).

SUMMARY AND OUTLOOK

Total RDT&E at the Department of Defense increased substantially after the September 11 attack, exceeding $80 billion. This trend embodied the renewed focus on national security over the past decade, as defense R&D spending was until recently more than twice what it was in the early 1980s, and more than 25 percent higher than at the end of the Cold War. The 6.4 - 6.7 development categories have driven this increase; notable examples include Ballistic Missile Defense and Air Force operational systems development.

Generally, the decades-long acquisition of major platforms and systems continues to drive costs. For instance, acquisition costs for the F-35 Joint Strike Fighter were $7.6 billion in FY 2013 alone, $2.4 billion of which was for RDT&E. In the larger context, the operation and maintenance expenses for integrating new capabilities with existing systems and legacy platforms now overshadow the RDT&E budget. Nevertheless, most RDT&E funds have not escaped wider efforts to reduce expenditures at the Department of Defense. With basic research by far the smallest category, and combined S&T categories only larger than management support, serious efforts to reduce spending in RDT&E will necessarily focus on the downstream development costs. In this sense recent gains in basic research are not made at the expense of development programs. Moreover, the balance of short-term military needs with long-term strategic priorities is not simply a balance of basic research with weapons development.

As currently formulated, the Administration's request for FY 2015 continues the decline of recent years, but it would also still leave DOD R&D at a higher level than at any point prior to 2003. The drawdown in overseas operations continues to remove the impetus for still-massive

defense budgets, but countervailing forces and the political economy that creates them may continue to press against reductions in defense R&D.

Table 1. DOD RDT&E Funding Classification System

Classification	Description
Science and Technology Activities	
Basic research (6.1)	Scientific study for greater understanding of phenomena without specific applications in mind. Farsighted, high payoff research.
Applied research (6.2)	Expansion and application of knowledge to understand the means to meet a specific need. Development of useful materials, devices, systems or methods. Official RDT&E estimates of 6.2 do not include Defense Health Research, though this program is included in overall AAAS estimates of the total DOD science & technology budget.
Advanced Technology Development (6.3)	Development and integration of subsystems and components into model prototypes for field experiments and/or tests in a simulated environment. Proof-of-concept testing.
Weapons Development Activities	
Advanced Component Development and Prototypes (6.4)	Evaluation of integrated technologies or prototypes in realistic operating environments. Technology transitions from laboratory to operational use.
System Development and Demonstration (6.5)	Development of mature systems in preparation for actual production. Prototype performance established at or near planned operational system levels, including live fire testing.
RDT&E Management Support (6.6)	Funds to sustain or modernize installations or operations for the performance of general RDT&E, including test ranges, military construction, and maintenance for laboratories and test vehicles.
Operational System Development (6.7)	Efforts to upgrade systems that have been fielded or have received approval for full production in the near term.
Adapted from DOD Financial Management Regulation 7000.14-R, Volume 2B, available at http://comptroller.defense.gov/fmr/02b/	