Part II:
Agency R&D Budgets

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Department of Defense

Travis R. Doom
Consortium for Science, Policy and Outcomes

Highlights

- Department of Defense (DOD) R&D would continue its recent downward trend since FY 2010, though would remain higher than in any year prior to 2003.
- In aggregate dollars, this decline would be largely driven by cuts to development activities, as in recent years. Weapons development would be reduced by $4.3 billion below FY 2012 levels, including classified programs.
- Basic research would see an increase to $2.2 billion in FY 2014, similar to the increase in FY 2012 and following the gradual long-term increase since FY 1998.
- However, overall science and technology (S&T) in FY 2014 would halt small gains in FY 2012, continuing a recent decline and dropping below FY 2002 levels to $12.7 billion total.

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 FY 2013, the RDT&E budget is estimated to reach $64.7 billion, with additional R&D funding of $3.4 billion for other programs.

DOD R&D funding is distributed to a wide 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 2010. 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). However, the FY 2013 sequester is estimated to cut 9 percent across program elements, eliminate $200 million from university grants, and will delay many contracts awarded to industry.

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 science 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 reflects 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 sequestration in FY 2013, and more 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.

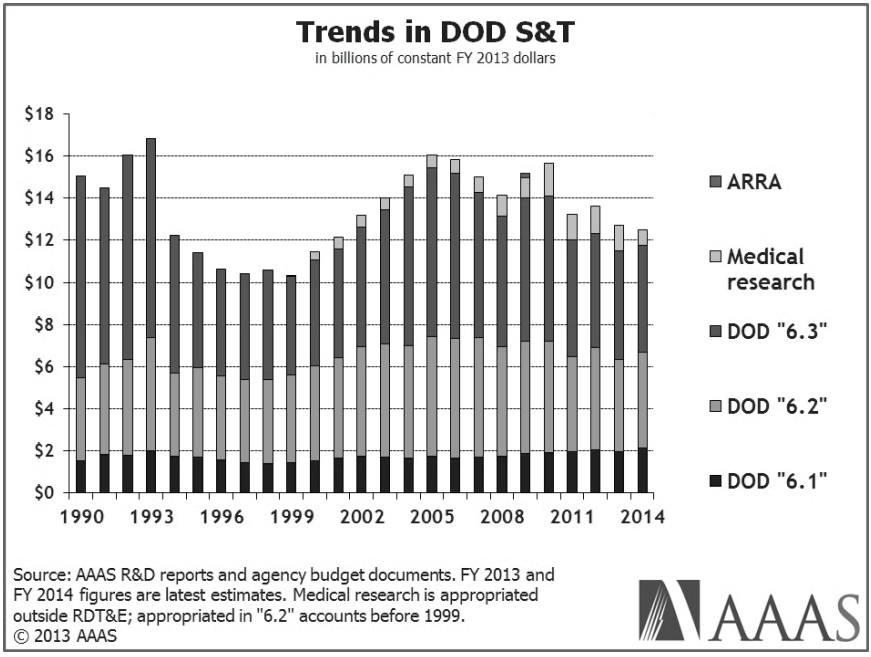
In-depth Review

Basic Research (6.1). In constant 2013 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 in FY 2012, with only small declines in both FY 2004 and FY 2006 (see Figure 1 on the following page). 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 current dollars, FY 2000 basic research funding for Army and Air Force was roughly equivalent at around $275 million each, and roughly equivalent for Navy and Defense agencies at around $480 million each. 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. In FY 2012 actual basic research funding, in nominal dollars, was $409 million for the Army, $591 million for the Navy, $494 million for the Air Force, and $517 million for Defense agencies. Overall, in the last two decades, total basic research funding at DOD has increased from $1.7 billion in FY 1992 to $2.1 billion in FY 2012, with the Air Force outpacing the Army and the steadiest growth in recent years going to the Defense agencies.

FY 2012 basic research received a significant increase. The FY 2014 budget would boost basic research further to $2.2 billion, a gain of 7.7 percent (not accounting for 4 percent inflation between FY 2012 and FY 2014; see Table II-4). Within these funds, the largest gain in dollars by far – $109 million – is for Defense Research Science, distributed for single-investigator basic research in academia, industry and in-house. The multi- and inter-disciplinary University Research Initiatives would see a 2 percent decline overall, with the Navy losing $14 million and the Air Force gaining $6 million. Actual funding in FY 2012 for the Army's University and Industry Research Centers, which includes Collaborative Technology

Alliances, University Centers of Excellence and University Affiliated Research Centers, increased far less than estimated but is expected to increase 11.3 percent in FY 2014. In total, FY 2014 basic research for the Army would gain $28 million, or 6.8 percent, the Navy would gain $25 million, or 4.2 percent, and the Air Force would gain $31 million, or 6.3 percent.

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



The $71 million gain in basic research funding for Defense agencies is more than double the gain seen in each individual military department. $30 million of this jump is infused through Government/Industry University Research, a category that was last funded in FY 2010 at $4 million. The Defense Research Sciences program within DARPA would receive an additional $32 million boost. At the Office of the Secretary of Defense, (OSD) Basic Research Initiatives, a new account in FY 2012, would make the largest percent increase – 55.8 percent – going from $7 to $11 million in FY 2014. The majority of this funding supports the Minerva Research Initiative, aimed at basic social sciences to help better understand cultural and political forces of strategic importance.

Applied Research and Advanced Technology Development (6.2 and 6.3). Since FY 1998 applied research (not counting Defense health research) has remained above $4.0 billion in constant dollars with a plateau of $5.7 billon across FY 2005 to FY 2007. Actual funds in FY 2012 provided a small increase in applied research for all three military departments and the Defense agencies, but the FY 2014 budget would reduce overall applied research funding back to the FY 2011 level, at $4.5 billion total. The largest reduction by far would be $108 million cut from the Air Force.

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. In the FY 2012 appropriations process, lawmakers rolled back these reductions for the Army and Air Force with noticeable increases. However, in FY 2014 the reductions would continue for all three services. The Army and Air Force would remain above their FY 2011 levels, declining to $882 million and $618 million respectively. The Navy, however, has experienced steadier declines in recent years and would drop 13.5 percent to $583 million in FY 2014. On the other hand, Defense agencies, where DARPA and OSD again are the dominant funding sources, would see an increase in FY 2014, up 6.7 percent to $3.1 billion. This increase would reverse comparable declines in both FY 2011 and FY 2012.

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 $1.3 billion in FY 2012, in constant dollars. In recent years, a pattern has emerged in which the Pentagon seeks to reduce program funding, only to see appropriators restore it and more. Such was the case in FY 2012, when appropriators responded to the Administration's $664 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 2014, as the Administration has requested a $543 million reduction, 42.7 percent below FY 2012 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 4.6 percent below FY 2012 levels (see Table II-5). Adjusted for inflation, the S&T budget would reach its lowest level since FY 2001, reversing a small gain in FY 2012 and continuing the long-term decline from the peak in 2005. Only basic research would be sustained with funds further shifting from the military services to the Defense agencies. 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 $14 billion each in FY 2012, still well above FY 2000 levels. FY 2014 would continue declines in advanced component development, down 11.2 percent to $12.1 billion. System development and demonstration shows a small increase of 0.9 percent in FY 2014, though inflation would actually make this a small decline. Management support (6.6) has gently increased to a FY 2010 peak of $6.5 billion in constant 2013 dollars, but FY 2014 would continue a recent decline to $4.3 billion. 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. However, FY 2012 showed the first decline to 6.7 in more than a decade, and the FY 2014 request would continue this decline to $25 billion (see Table II-2).

The decline in total RDT&E in FY 2012 and continued in FY 2014 would bring funds down to $67.3 billion; including medical research and other non-RDT&E funding would bring total DOD R&D down to $69.5 billion. The Army, Navy, Air Force and Defense Agencies would all decline down to $8.0, $16.0, $25.7 and $17.7 billion, respectively (see Table

II-3). DARPA's small increase would not outperform inflation and only Chemical and Biological Defense would be left with no real loss.

Summary and Outlook

Total RDT&E at the Department of Defense has increased substantially since the September 11 attacks, in recent years exceeding $80 billion. This trend embodies 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-22 Joint Strike Fighter were $9.2 billion in FY 2012 alone, $2.6 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 the 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.

The major question now facing defense R&D is not necessarily whether cuts will happen – indeed, they already have begun – but by how much more. As currently formulated, the Administration's request for FY 2014 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. Nonetheless, the bluntness of budget cuts wrought by the FY 2013 sequester is an opportunity to consider how to sharpen major research and acquisition decisions when the normally imperfect budgeting process returns.

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.

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