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The Missile Defense Agency and the Color of Money

Fewer Resources, More Responsibility, and a Growing Budget Squeeze

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ISBN: 978-1-4422-5965-2 (pb); 978-1-4422-5966-9 (eBook)

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Washington, DC 20036
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4501 Forbes Boulevard
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List of Acronyms

ABIR	Airborne Infrared
ABL	Airborne Laser
ABM	Anti-Ballistic Missile
AMDR	Air and Missile Defense Radar
BA	Budgetary Authority
BMD	Ballistic Missile Defense
BMDO	Ballistic Missile Defense Organization
BMDS	Ballistic Missile Defense System
BRAC	Base Realignment and Closure
C4I	Command, Control, Communications, Computers and Intelligence
CSA	Combat Support Agency
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
FMF	Foreign Military Financing
FY	Fiscal Year
FYDP	Future Years Defense Program
GBI	Ground-based Interceptor
GMD	Ground-based Midcourse Defense
HEL-MD	High Energy Laser—Mobile Demonstrator
IDA	Institute for Defense Analyses
IMU	Inertial Measurement Unit
JLENS	Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System
KEI	Kinetic Energy Interceptor
LaWS	Laser Weapons System
LRDR	Long Range Discrimination Radar
MDA	Missile Defense Agency
MDAP	Major Defense Acquisition Program

MEADS	Medium Extended Air Defense System
MILCON	Military Construction
NDAA	National Defense Authorization Act
O&M	Operations and Maintenance
PATRIOT	Phased Array Tracking Radar to Intercept on Target
R&D	Research and Development
RDT&E	Research, Development, Testing and Evaluation
SAM-D	Surface-to-Air Missile, Development
SBX	Sea-based X-band Radar
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization
SM	Standard Missile
SOCOM	Special Operations Command
STSS	Space Tracking and Surveillance System
TBMD	Theater Ballistic Missile Defense
THAAD	Terminal High Altitude Area Defense
TOA	Total Obligational Authority
XBR	X-band Radar

Acknowledgments

The authors would like to recognize and thank all of those who reviewed drafts of the report or provided background thoughts for the research, including Mark Cancian, Michael Dyer, Dick Formica, Brian Green, Michael O'Hanlon, Todd Harrison, Kath Hicks, Andrew Hunter, Arch Macy, Jim Miller, Trey Obering, Jamie Price, Kenn Todorov, and others.

The report was made possible by general support to CSIS.

Introduction

Over the past 15 years, missile defense has gone from an idea largely restricted by treaty, to a kind of infancy with initial defensive capabilities, to what now might be termed a kind of adolescence. Along the way, a confluence of several trends has put the Missile Defense Agency (MDA) budget under increasing but underappreciated strain. Evaluating the overall missile threat environment, the desired capabilities and quantity of missile defenses, and MDA's particular role in combating these threats will be important for the next administration.

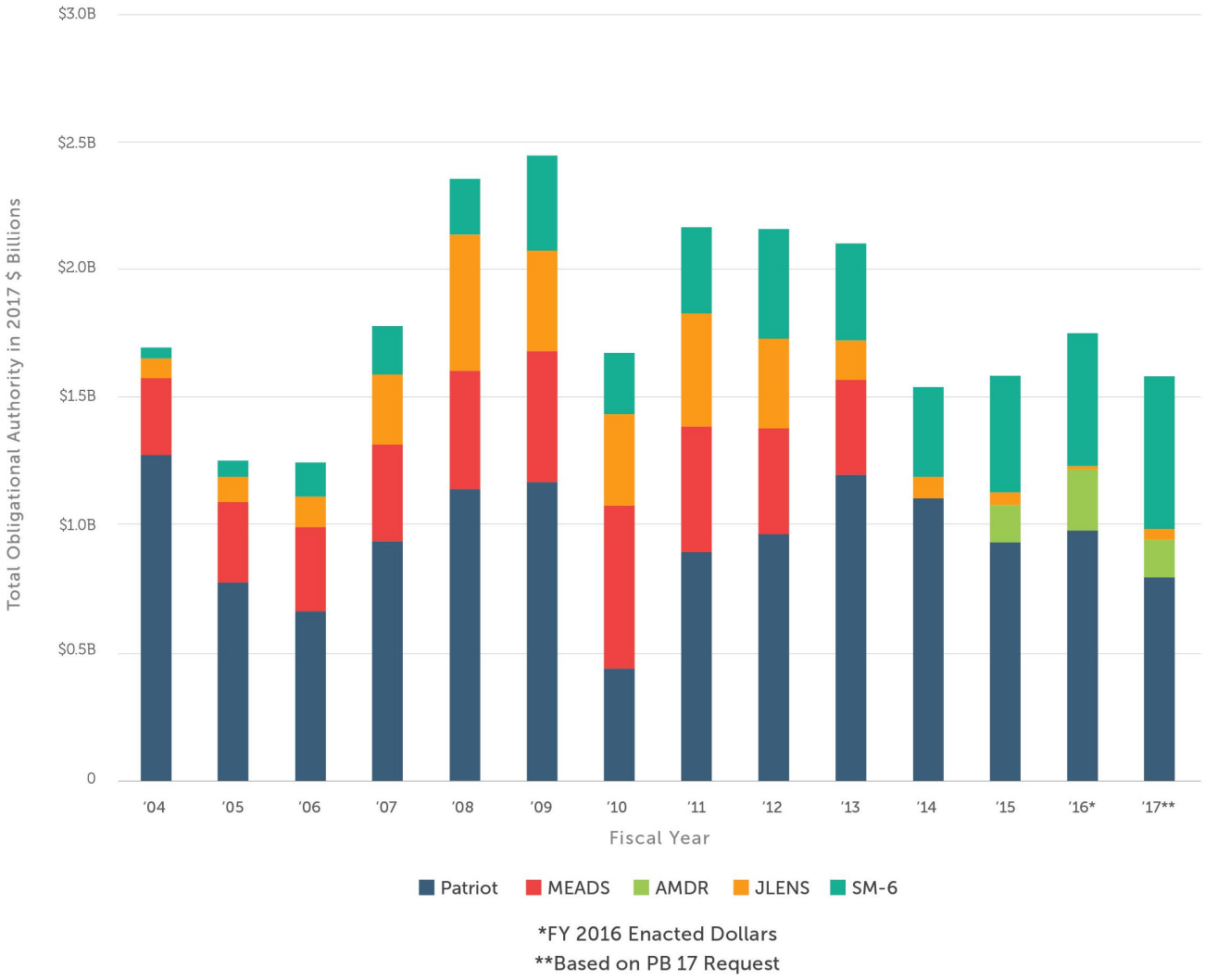
Created in 2002, MDA is the successor to the Strategic Defense Initiative Organization (SDIO, 1984–1993) and the Ballistic Missile Defense Organization (BMDO, 1994–2001).[1] Both SDIO and BMDO existed under the Anti-Ballistic Missile (ABM) Treaty of 1972, so while work was done on theater systems such as PATRIOT, they never moved much beyond research and development (R&D) for national or homeland missile defense.[2] Indeed, when President Ronald Reagan launched the Strategic Defense Initiative (SDI) in 1983, its first task was "to define a long-term research and development program."[3] MDA, by contrast, was created with the intention of real-world

1. To be sure, many U.S. missile defense activities preceded SDI. The 1984 Homing Overlay Experiment (HOE), for instance, the first successful exoatmospheric hit-to-kill intercept test, was conducted by the U.S. Army. The creation of the SDIO resulted, however, in the consolidation and central management of missile defense efforts spread across Service budgets. General Accounting Office (GAO), *Strategic Defense Initiative Program: Controls Needed Over Construction and Operational Support Funds* (Washington, DC: GAO, 1986), http://www.gao.gov/assets/210/208598.pdf.

2. The end of the Cold War heralded a change of course in the program, including renaming SDIO as the BMDO and a reorientation toward theater as opposed to strategic or homeland defenses. The former would include real-world deployments; the latter would remain a research and development effort. The 1994 BMDO charter reflects this priority, identifying the responsibilities to "*Enable deployment* of an effective and rapidly relocatable advanced theater missile defense capability," and "*Develop options* for, and deploy when directed, an antiballistic missile (ABM) system that is capable of providing effective defense of the U.S. homeland." Emphasis added. DoD *Ballistic Missile Defense Organization Charter*, DoD Directive 5134.9 (August 18, 1994), http://fas.org/spp/starwars/offdocs/940824.htm.

3. Ronald Reagan, "Address to the Nation on National Security by President Ronald Reagan" (speech, March 23, 1983). National Security Decision Directive-119 clarified that SDI would be a "committed technology development and

Figure I.1. Selected Missile Defense Funding outside MDA, 2004–2017



deployments in the absence of the ABM Treaty. So, while R&D would remain key to outpacing ever-evolving missile threats, there now existed an agency charged with actually fielding these capabilities, at least in their initial configurations.

As both regional and homeland missile defense programs have matured from R&D concepts to deployed and operational systems, MDA has acquired missions and roles well exceeding those of BMDO and SDIO. In a sense, MDA has acquired new "colors of money,"[4] or rather new tasks, over and above its traditional R&D focus. Over the past decade, MDA's budget has come to include increased percentages of procurement, operations and maintenance (O&M), and foreign assistance to Israel, at levels well beyond what was intended at the agency's creation. To be sure, much

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demonstration effort." Ronald Reagan, *Memo on the Strategic Defense Initiative*, National Security Decision Directive-119 (January 6, 1984), http://www.thereaganfiles.com/8416-nsdd-119.pdf.

4. The phrase "color of money" refers to an appropriation category for a DoD financial account. The types of accounts include Procurement; RDT&E, O&M; Military Construction, and others. See "PPBE Process: Color of Money," *AcqNotes*, http://www.acqnotes.com/acqnote/acquisitions/color-of-money.

important air and missile defense work occurs outside of MDA (see Figure I.1). The considerable majority, however, is centralized in MDA, and that is the focus of this study.[5]

All this has happened amid a declining topline budget and still steeper imposed cuts from budget caps. As with many other parts of the Department of Defense (DoD), MDA is expected to do more with less. This combination has had a variety of adverse effects, but in particular puts a special squeeze on MDA's research, development, testing, and evaluation (RDT&E) budget. These investments in technology will be important to outpace future missile threats. New technologies and challenges include greater mobility and survivability, more sophisticated countermeasures, longer ranges, the proliferation of cruise missiles, hybrid boost-glide vehicles, other forms of hypersonic threats, and greater means of deception. Had not significant, long-term R&D efforts been maintained in the decades prior to the 2002 withdrawal from the ABM Treaty, it would simply not have been possible to deploy a limited homeland defense capability in 2004, or to field regional systems like Aegis and Terminal High Altitude Area Defense (THAAD), which are now in high demand by combatant commanders and other allies and partners around the world.

Today, nearly 30 countries maintain ballistic missile capabilities, with approximately 50 ballistic missile variants.[6] The missile defense mission has also grown more challenging as antagonists now possess capabilities that are more robust, accurate, and diverse, threatening U.S. and allied forces both at sea and on land. In a November 2014 memorandum to the secretary of defense, Admiral Jonathan Greenert, chief of naval operations, and General Raymond Odierno, chief of staff of the Army, jointly wrote of "growing challenges associated with ballistic missile threats that are increasingly capable, continue to outpace our active defense systems, and exceed our Services' capacity to meet Combatant Commanders' demand."[7] Looking ahead, the United States and its allies and partners may expect to encounter more multifaceted threats that could overcome current defense systems, including advanced cyber intrusions, electronic warfare, directed energy, and hypersonics.[8] Future decisionmakers will have to consider whether MDA should retain its near-exclusive focus on the *ballistic* missile defense mission or expand to address the broader suite of cruise missile, air defense, and hypersonic threats.

R&D has always been at the institutional and conceptual center of ballistic missile defense development. In particular, the steady advancement of missile technology creates an imperative for missile defense technology to "outpace the threat." Straining MDA's R&D is one of several concerning manifestations of what Secretary of Defense Ashton Carter and others have called the

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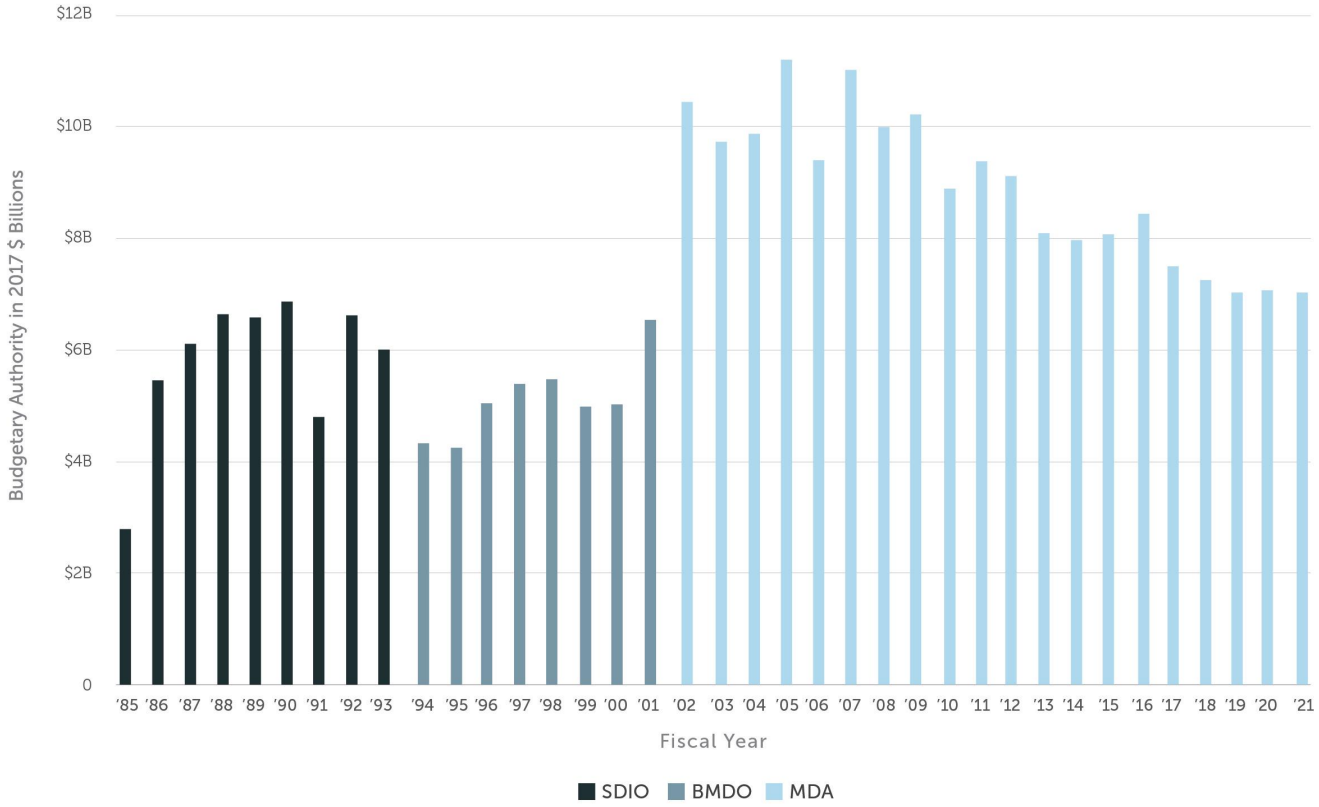
5. These include current and former Army and Navy programs, such as PATRIOT/PAC-3/MSE (in BMDO until transferred), MEADS, HEL-MD, SM-6 and SM-2 Block IV, LaWS, Phalanx, and other integrated air and missile defense work.

6. *Ballistic Missile Defense Programs in Review of the Defense Authorization Request for Fiscal Year 2017 and the Future Years Defense Program: Hearing before the Committee on Armed Services, Subcommittee on Strategic Forces*, U.S. Senate, 114th Cong. (April 13, 2016) (statement of Lieutenant General David L. Mann), http://www.armed-services.senate.gov/imo/media/doc/Mann_04-13-16.pdf.

7. Jonathan W. Greenert and Raymond T. Odierno, "Memorandum for Secretary of Defense—Subject: Adjusting the Ballistic Missile Defense Strategy" (November 5, 2014), http://news.usni.org/2015/03/19/document-army-navy-memo-on-need-for-ballistic-missile-defense-strategy.

8. Ibid.

Figure I.2. SDIO/BMDO/MDA Top-Level Funding, FY1985–FY2021



temptation to "eat our seed corn."[9] Under Secretary of Defense for Acquisition, Technology and Logistics Frank Kendall has likewise stressed the importance of R&D: "Just patching the things we've got is probably not going to be adequate. . . . We're going to have to go beyond that."[10] MDA and congressional leadership have echoed these warnings.

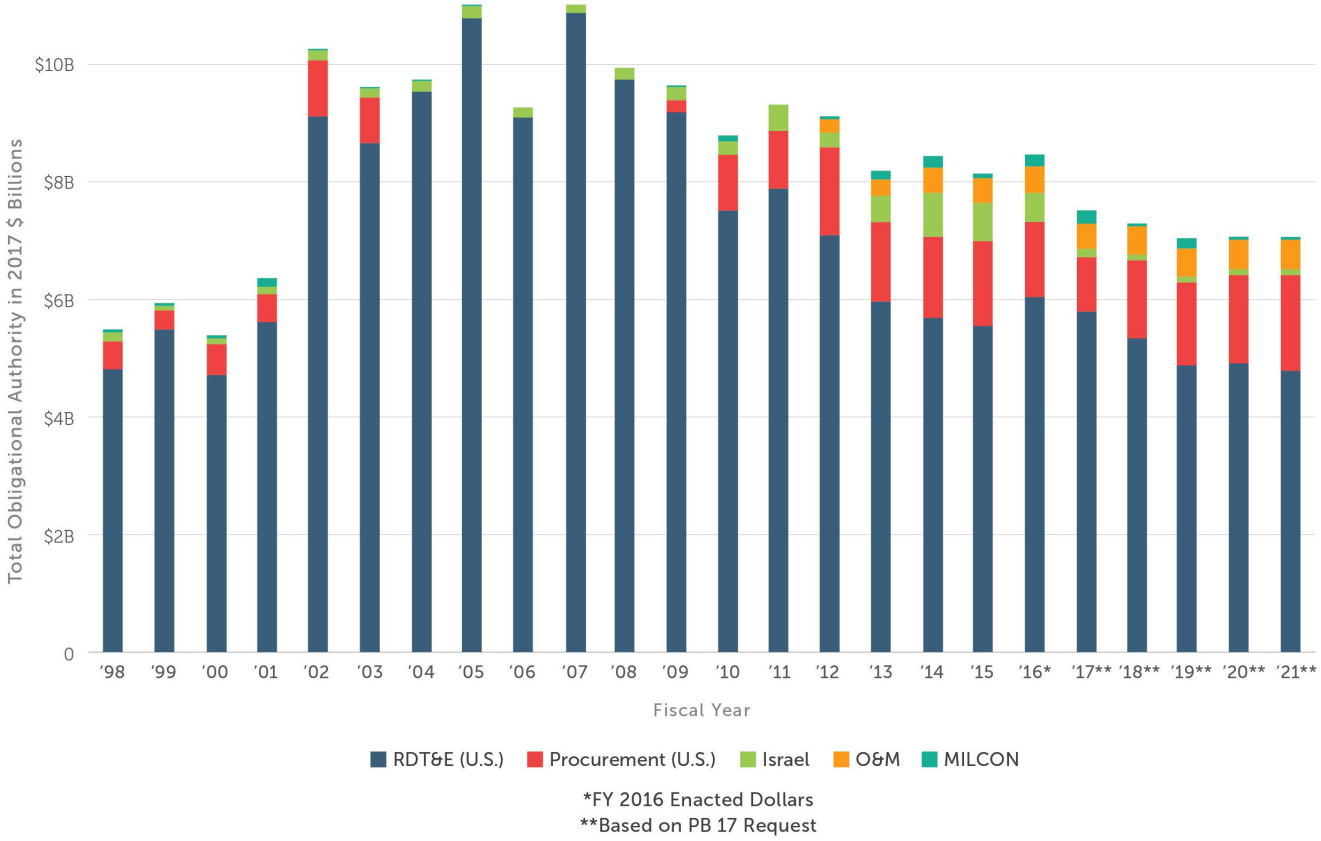
The first element of strain on MDA's budget is of course its reduced topline. Between FY2007 and FY2017, the MDA budget has fallen by over 20 percent, with no sign of near-term relief. The Bipartisan Budget Act of 2015 caps will continue to take a toll on future spending, reflected by MDA's FY2017 request of $7.5 billion. These lower levels now continue into the Future Years Defense Program (FYDP) (see Figure I.2).[11]

9. Ashton Carter, "Remarks at National Press Club" (speech, National Press Club, Washington, DC, May 7, 2013), Department of Defense, http://archive.defense.gov/Speeches/Speech.aspx?SpeechID=1775.

10. Andrea Shalal, "Pentagon Plans Work on New Missile Defense Interceptor," Reuters, February 25, 2014, http://www.reuters.com/article/us-usa-budget-missile-idUSBREA1P03F20140226.

11. Data for this study were compiled using budget materials on the Department of Defense Comptroller website. Each president's budget includes an actual spent total from two fiscal years prior, a final congressional appropriated amount for the prior fiscal year, and a request along with the Future Year's Defense Program (FYDP). For years the data are available, the actual spending total (total obligational authority) was used rather than appropriated or requested amounts. For inflation adjustments, the FY2017 Green Book was used to calculate figures in FY2017 dollars. Inflation adjustments were done using the overall GDP deflator.

Figure I.3. MDA Budget Categories, 1998–2021

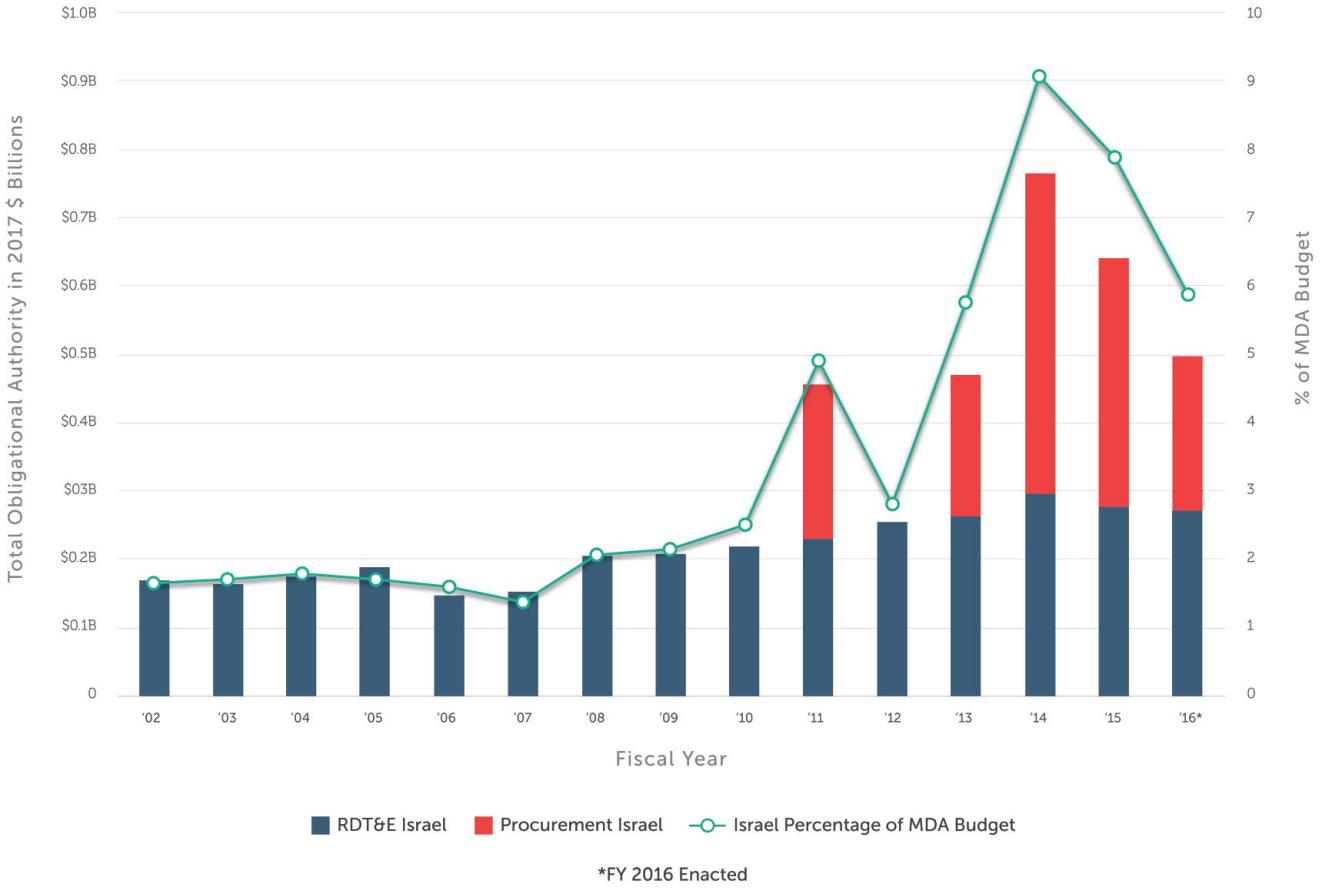


Major cuts to MDA topline funding were evident as early as 2006, when the agency's budget was reduced by over a billion dollars, following heavy capital investments for fielding homeland defenses. Funding rebounded in 2007 to its peak historical level of $9.4 billion, but optimistic projections of MDA's budget growing in the outyears never materialized, despite being presented in the annual FYDP. Instead, MDA funding projections have steadily fallen, with the deepest one-year cut felt in 2010.

The second budget strain is from the expansion of MDA's responsibilities to include an increasing proportion of system procurement and operations. The maturity of the systems has brought this on naturally. This expansion directed the result of MDA's failure to transfer greater procurement and operations responsibility to the Services, as initially intended with MDA's creation. Systems that have now been operationally deployed for years, indeed over a decade—Ground-based Midcourse Defense (GMD), THAAD, and Aegis/Standard Missile (SM)—are still occupying significant percentages of MDA's budget, and as such are arguably squeezing out investments in new technology (see Figure I.3).

The third potential strain on MDA's budget that this study has identified is from missile defense–related foreign assistance to Israel. Since 2009, the portion of MDA's budget spent on Israeli missile defense programs has quadrupled. Much of the more recent increase has come from procurement of Israeli systems and interceptors like Iron Dome. While codevelopment, coproduction, and coinvestment with Israel can yield substantial benefits for American missile defenses, the

Figure I.4. Missile Defense Aid to Israel: Historical Amounts and Percentage of MDA Budget



current trends and sometime failure to increase MDA's topline to fully cover increased assistance for Israel risk putting U.S. and Israeli missile defense priorities into competition (see Figure I.4).

These three sources of pressure—a shrinking budgetary topline; failure to transfer increasing procurement and O&M responsibilities to the military Services; and increased foreign assistance—have together created a source of competition within the MDA budget, squeezing R&D, and they show no signs of easing. Meanwhile, missile threats continue to grow, and "those interceptors need to be procured by somebody."[12] The question, of course, is whether MDA is properly resourced to do all it is being asked to do.

Rather than a surprise, some elements of the current squeeze were predicted. In 2008, for instance, a congressionally mandated report noted that MDA's rapid development and deployment of initial capabilities "has been less successful in fostering the planning and preparation needed to adequately address future operations of deployed systems and follow-on procurement and

12. Vice Admiral James Syring, "Ballistic Missile Defense System Update" (speech, Center for Strategic and International Studies, Washington, DC, January 20, 2016), http://csis.org/files/attachments/160119_ballistic_transcript.pdf.

sustainment."[13] The study furthermore identified some of the predictable consequences: "pressures for continued deployments of current capabilities can have an adverse impact on investments in RDT&E needed to increase capability to deal with a wide range of possible threats."[14] These warnings about competition among colors of money have not only proven out, they have been exacerbated by defense budget caps and increased foreign missile defense assistance.

Although MDA is hardly unique within DoD in being asked to do more with less, there are practical limits to what can be done under these strains. Indeed, a decision point is approaching, presumably leading toward one of three paths:

- *Evolution and Expansion:* One option is for MDA's topline to be adjusted to reflect the addition and ongoing retention of these missions. MDA might thus more formally assume some of the characteristics of a Combat Support Agency (CSA). Still further consolidation might take the form of a ballistic missile defense command.
- *Back to basics*: A second path is for MDA to shed some of these new roles and missions, such as with the orderly transfer of procurement and operational responsibilities to the Services, and disaggregating missile defense foreign assistance funds. This would allow MDA to return to its traditional Defense Advanced Research Projects Agency (DARPA)-like focus on R&D.
- *Increased Risk:* A final possibility is that the current budget strains will not be resolved, and MDA's ability to improve qualitative capabilities will further suffer, challenging its ability to "outpace the threat." The ensuing risk to the U.S. homeland and deployed forces may be mitigated with other investments, managed in some way, or simply accepted.

When a new administration takes office in 2017, the time may be ripe to review the choices, priorities, and challenges facing MDA and embrace a version of one of these first two paths.

13. Larry D. Welch, et al., *Study on the Mission, Roles, and Structure of the Missile Defense Agency* (Alexandria, VA: Institute for Defense Analyses, 2008), ES-2.

14. Ibid., III-2.

01

MDA's Reduced Topline

Key points:

- MDA's budget has fallen 23 percent from 2007 to 2016 in inflation-adjusted dollars.
- The effect of MDA's decreased topline is exacerbated by increased demand for new tasks and activities.
- Continuing annual reductions below the previous year's projections complicate long-term planning and execution, reflected by a sustained pattern of budget requests below the previous FYDP.

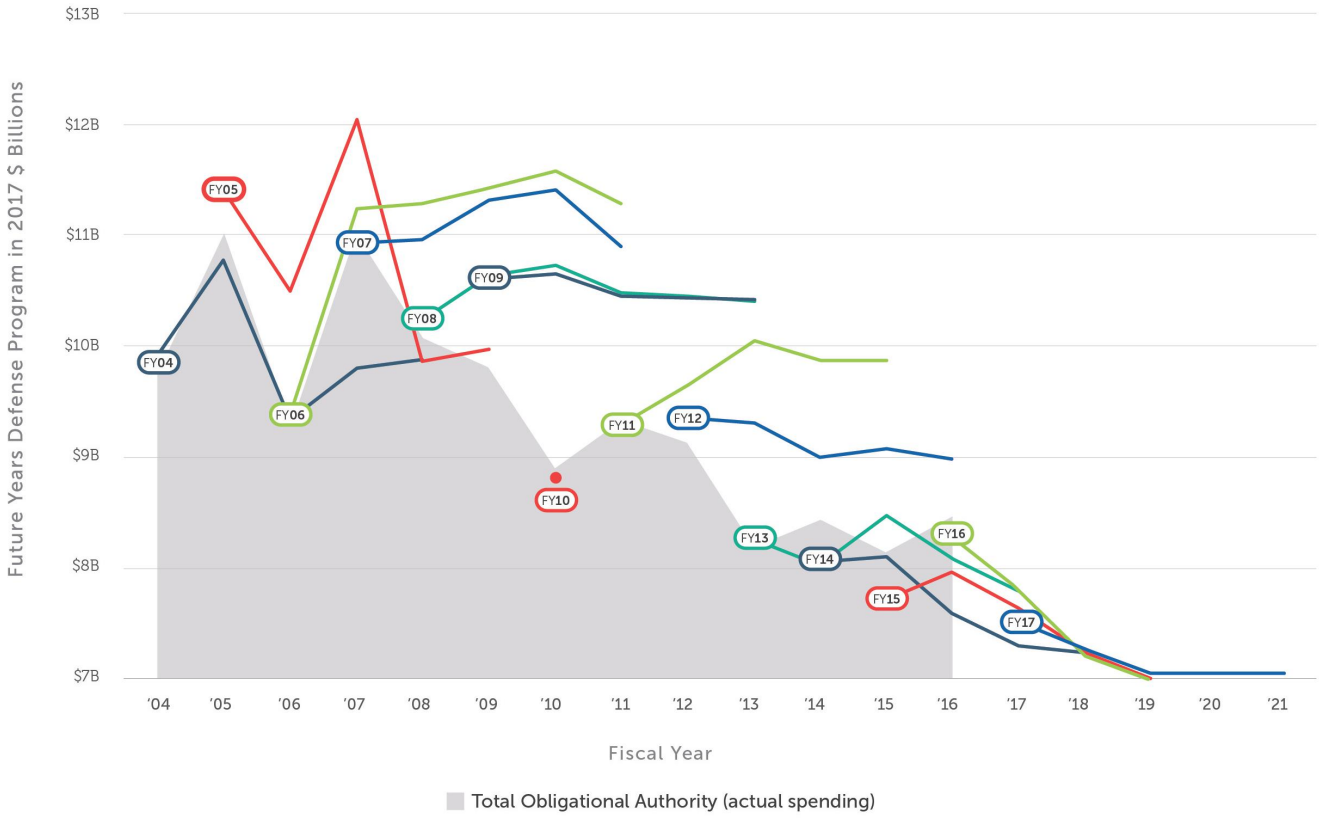
Cuts to the topline of MDA's budget strain its resources by forcing every dollar into fiercer competition. As the topline comes down, MDA is asked to do more with less merely to meet current directives. The addition of more missions only exacerbates this competition for increasingly scarce dollars.

Comparing actual MDA spending to the projected FYDPs proposed in the annual presidential budget requests provides some further illustration of the trend downward (see Figure 1.1).

Cuts to MDA topline funding are evident as early as 2006, when the agency's budget was reduced by over a billion dollars, from $8.8 billion in 2005 to $7.7 billion, but this was largely anticipated, given early and significant capital investments for GMD and other programs. Funding rebounded in 2007 to a peak level of $9.3 billion, but optimistic projections of growing MDA budgets in the out years of the FYDP never materialized. Instead, MDA funding steadily fell, dipping to $7.9 billion in 2010. The most significant year-to-year cut came between 2009 and 2010, coinciding with a new administration. The topline rebounded in 2011 and 2012 to about $8.4 billion. More recently, a boost came in 2016 to support new kill vehicle development.

The more common pattern, however, is a shortfall between FYDP projections and actual enactments, which over time can have a corrosive effect on programs, resulting in changes to

Figure 1.1. MDA Actual Spending and Future Year Defense Plans, 2004–2017



schedules and requirements to accommodate the revised budget targets. In every year from 2006 to 2013, MDA consistently received less actual funding than had been estimated in the previous year's FYDP (see Figure 1.2).

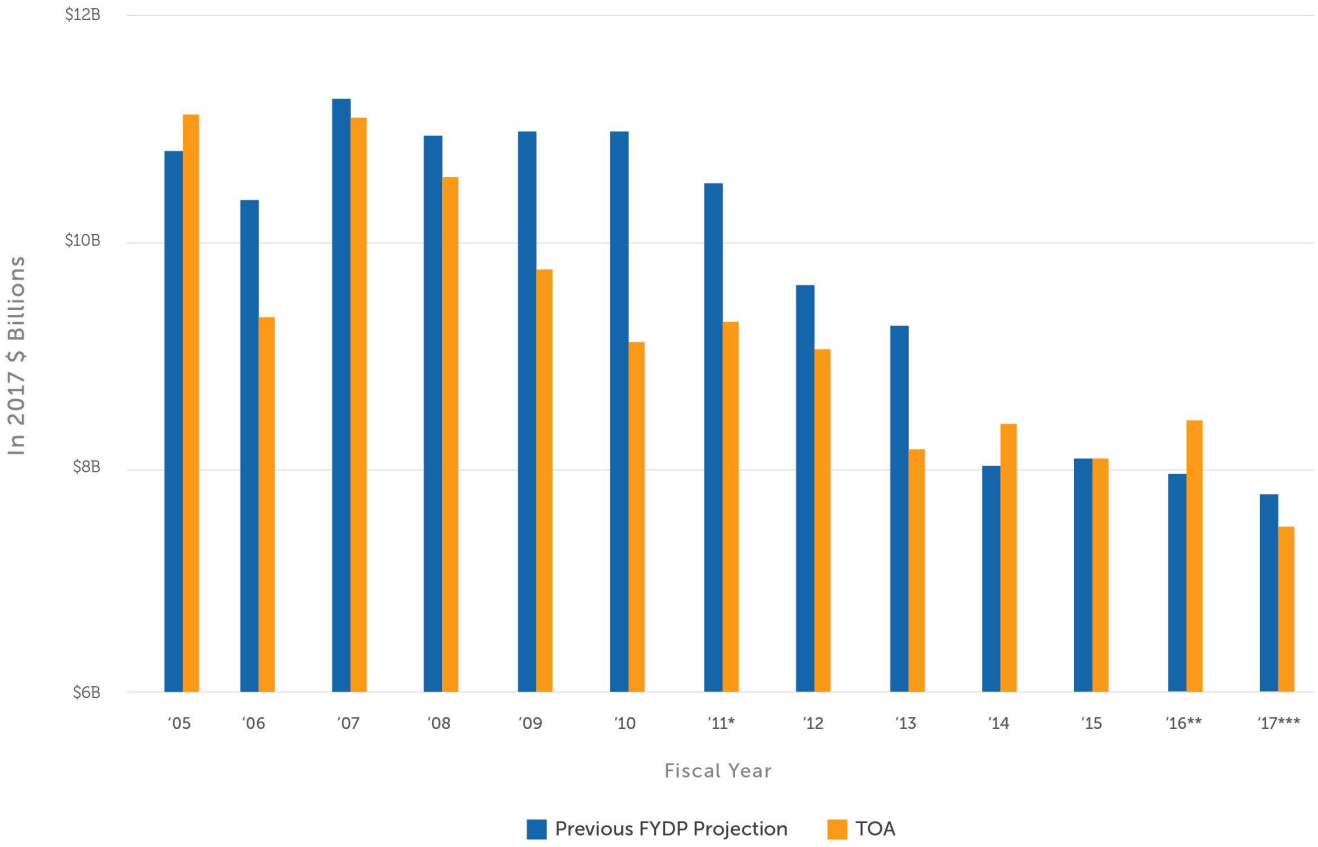
An additional factor has been the Budget Control Act, which began to impact budgets in 2012. Caps put in place by the Budget Control Act played a significant part, having cumulatively contributed to about a $1 trillion cut in defense spending over a 10-year period.[1] In 2013, budget caps took effect and MDA funding fell to $7.7 billion, including a cut of $668 million in the third quarter of 2013 due to sequestration, the impact of which is still felt today.[2] A series of deals in Congress have kept actual funding above the original budget cap levels each year, including a return to an $8.3 billion topline in the 2016 enactment.[3] MDA's proposed 2017 budget represents a 9.6 percent

1. Todd Harrison, *Defense Modernization Plans through the 2020s: Addressing the Bow Wave* (Washington, DC: CSIS, 2016), http://csis.org/files/publication/160126_Harrison_DefenseModernization_Web.pdf.

2. *Ballistic Missile Defense Policies and Programs: Hearing before the Senate Armed Services Subcommittee on Strategic Forces*, 114th Cong (April 13, 2016) (Statement of Senator Jeff Sessions).

3. These include the American Taxpayer Relief Act of 2012, the Murray-Ryan compromise budget deal, and the Bipartisan Budget Act of 2015.

Figure 1.2. Comparison of MDA FYDP Estimates and Actual Spending



* Last FYDP Estimate from FY2009 PB because FY2010 PB did not include FYDP
**Based on FY2016 Enactment
***FY2017 PB

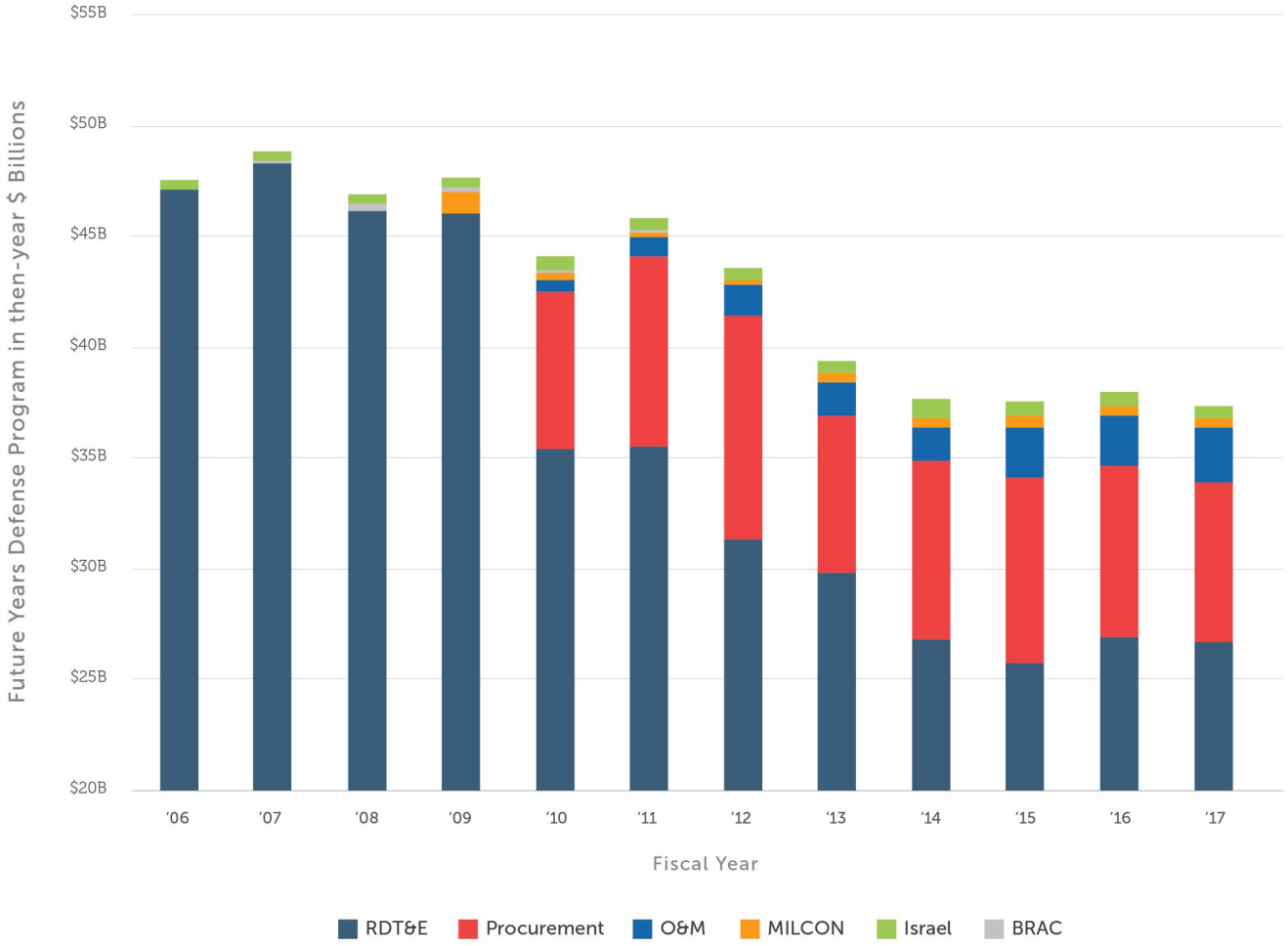
reduction compared to its 2016 levels, and a 3.8 percent reduction from the 2016 FYDP projection for 2017. Vice Admiral James Syring, MDA director, has termed these cuts as MDA's "share" of department-wide budget cuts.[4]

MDA's topline is not the total metric of sufficiency, of course. Certain capital investments like those to stand up homeland missile defense, for instance, need not be repeated. It could be argued that as these programs mature, less is required to advance their capabilities. All things being equal, therefore, some topline reductions for MDA could well make sense relative to the agency's historical highs.

Nevertheless, by all accounts both regional and homeland missile threats continue to grow and become more complex, and continued focus on research and development is essential to outpace

4. Vice Admiral James Syring, "Department of Defense Press Briefing by Vice Admiral Syring on the FY 2017 Missile Defense Agency Budget in the Pentagon Press Briefing Room," February 9, 2016, http://www.defense.gov/News/News-Transcripts/Transcript-View/Article/654038/department-of-defense-press-briefing-by-vice-adm-syring-on-the-fy-2017-missile.

Figure 1.3. MDA FYDP Trends by Funding Category



these threats. MDA's topline reductions, however, are accentuated by several other trends, and by increasing roles and tasks acquired and retained by the agency, most notably by responsibilities for procurement and operations (see Figure 1.3).

02

MDA's Expanded Role

Key points:

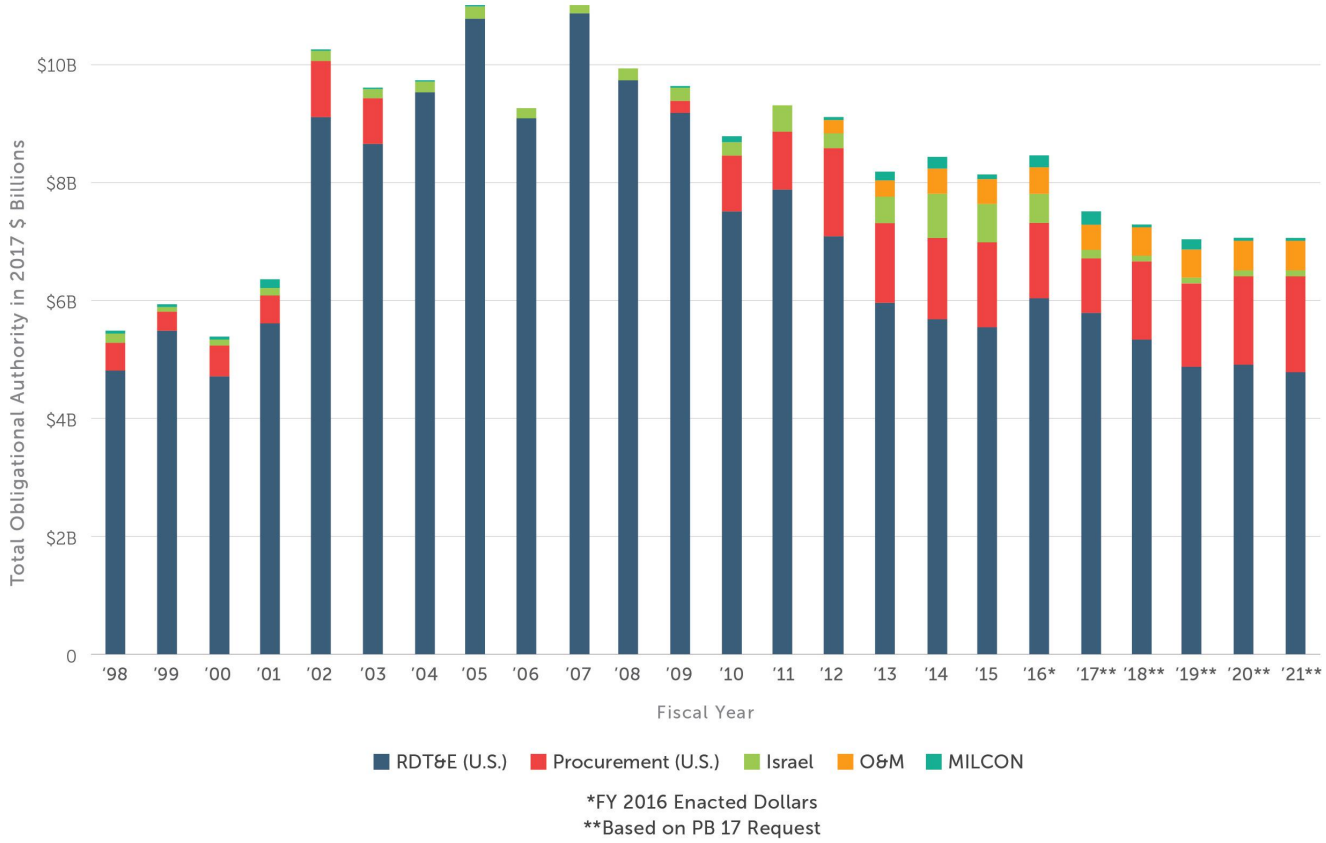
- As missile defenses have matured, MDA has spent more on procurement, military construction, and operations to support the fielding of systems and meet Service requirements.
- An increase in fielded systems has in turn increased operations and maintenance costs.
- These additional tasks have heightened competition within MDA's budget.
- Plans for increased deployments for Aegis/SM, THAAD, and GMD systems in the next five years will further sharpen this tension.

As missile defenses have matured and been fielded, MDA's scope of activities has naturally expanded as well. The agency's historical focus on research and development has faced increasing challenges from more urgent procurement and operational needs to support deployments and warfighter requirements that come with increased fielding of defenses, including Aegis/SM, THAAD, and GMD. In particular, MDA's budget has seen a relative reduction in focus from RDT&E and greater emphasis on other colors of money, namely, procurement, operations, and military construction. While this evolution and expansion may make very good sense at the margin, it also represents a change from the original intention for MDA at its creation, one that carries opportunity costs. Expectations of future demands for procurement, operations, and construction must be faced squarely so as to appreciate the problem. The attempt to have MDA do more of these activities with fewer resources while still outpacing the threat is likely to be unsustainable.

To understand the appearance of these new activities and the new colors of money, one must first understand MDA's budget history. From 2004 to 2008, virtually the entire MDA budget was classified as RDT&E, taking advantage of special acquisition authorities given to the agency for the deployment of GMD for homeland missile defense.[1] To be sure, significant "procurement-like,"

1. Donald Rumsfeld, "Missile Defense Program Direction," Office of the Secretary of Defense Memo, January 2, 2002, http://fas.org/ssp/bmd/d20020102mda.pdf.

Figure 2.1. Budget Categories for the Missile Defense Agency



"operations-like," and "construction-like" activities took place during this early period. In the absence of MDA's special authorities, these might otherwise have been categorized as procurement, military construction, or operations.

The appearance around 2009 of separate categories for procurement, operations, and construction was in part a function of the 2008 defense authorization bill, which curtailed some of MDA's special authorities and prevented MDA from using RDT&E funds for military construction or procurement.[2] This legislative change accounts for the reappearance of procurement and O&M accounts in 2009–2010.[3] Between 2009 and 2010 the procurement budget expanded from $207 million to $836 million with the addition of new TPY-2 radars. THAAD procurement nearly quadrupled.

Between 2007 and 2010, the RDT&E account declined from 96.7 percent to 84.6 percent of the overall budget. Some 85 cents of every MDA dollar were still classified as RDT&E in 2010, but the

2. *National Defense Authorization Act for Fiscal Year 2008*, Public Law 110–181, 110th Congress (January 28, 2008), https://www.congress.gov/110/plaws/publ181/PLAW-110publ181.pdf. Previously the secretary of defense had the authority to use RDT&E assets for "emergency or contingency deployment." Rumsfeld, "Missile Defense Program Direction."

3. This restriction initially allowed MDA to continue purchasing GMD systems from RDT&E while pushing THAAD and Aegis into a separate procurement line. Items precluded were military construction activities and procurement or advance procurement of long-lead items. *National Defense Authorization Act for Fiscal Year 2008*.

trend has since continued downward. As discussed below, the internal competition between colors of money has also had a more substantial effect on the reduced emphasis for basic research and development—the R&D within RDT&E.

The 2012 increase for U.S. (versus Israeli) missile defense procurement included an increase of around $500 million, going from $867 million to $1.36 billion in 2012.[4] This trend continued, and in 2014, MDA's RDT&E account hit its lowest point, at 67.4 percent. The following year, non-Israel procurement peaked at $1.41 billion in 2015, representing 17.9 percent of MDA's budget.

Spending in 2016 tempered this trend, with only 15.3 percent of the budget allocated for procurement of U.S. systems. The 2017 request lowers it further. As MDA director Syring noted, "where we took risk was in interceptor procurement."[5]

In the 2017 budget request, RDT&E funding currently stands at 77.1 percent. This rebound appears to be temporary, with RDT&E currently projected to decrease to 69.1 percent in 2019.

In a sense, the agency's growing budget squeeze is partly a result of its own success at developing deployable missile defense systems. When missile defense was young, the lack of deployable systems left little need to fund procurement and operations. In another sense, the trend reflects a degree of normalcy as procurement-like or operations-like expenditures are classified as such.

More is going on here, however, than simple accounting or reassigning programs to the appropriate colors of money. Today, the Services are reliant on MDA's O&M and procurement expenditures, and this trend is bound to continue. Service requirements for missile defense are continually increasing, but without corresponding budgets.[6] As MDA director Syring pointed out, "we have systems that are maturing into production. . . . Now it's a matter of numbers. That starts to chew up bigger parts of that topline."[7] This greater demand for MDA to support procurement of mature systems affects MDA's research and development focus, but the competition also affects the ability of MDA to procure and maintain the number of assets that the Services require.

Cutting the MDA topline means that these several activities necessarily compete even more with one another for scarce dollars. Testifying in 2009, General Larry Welch predicted that MDA "will always see the demand for more procurement of what they regard as mature systems as competing with the need for RDT&E."[8] That prediction has proven correct; indeed, these pressures have grown to a degree greater than perhaps could have been foreseen.

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4. This figure would have been higher had the entire procurement enactment of $1.66 billion for FY2012 been spent.

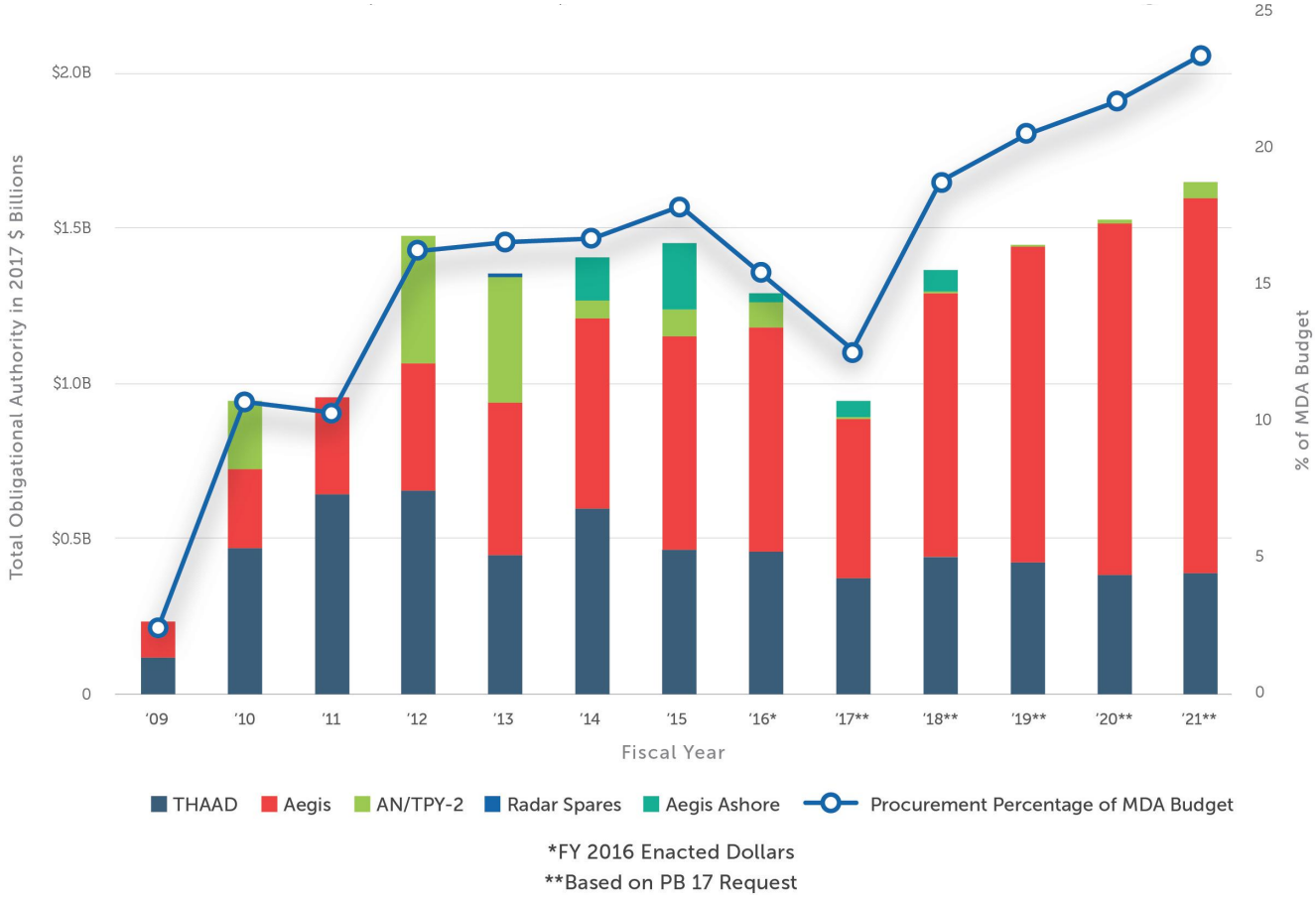
5. Vice Admiral James D. Syring (USN), "Department of Defense Press Briefing by Vice Adm. Syring on the FY 2017 Missile Defense Agency Budget in the Pentagon Press Briefing Room," February 9, 2016, http://www.defense.gov/News/News-Transcripts/Transcript-View/Article/654038/department-of-defense-press-briefing-by-vice-adm-syring-on-the-fy-2017-missile.

6. Brigadier General Kenneth Todorov (USAF, ret.), "Full Spectrum Missile Defense" (speech, Center for Strategic and International Studies, December 4, 2015), http://csis.org/files/attachments/151204_full_spectrum_transcript.pdf.

7. Vice Admiral James Syring, "Ballistic Missile Defense System Update" (speech, Center for Strategic and International Studies, Washington, DC, January 20, 2016), http://csis.org/files/attachments/160119_ballistic_transcript.pdf.

8. Larry D. Welch, *Future Roles and Missions of the Missile Defense Agency: Hearing before the House Armed Services Subcommittee on Strategic Forces* (statement, 111th Cong., March 26, 2009).

Figure 2.2. Procurement (U.S. Assets): Amounts and Percentage of MDA Budget



*FY 2016 Enacted Dollars
**Based on PB 17 Request

PROCUREMENT

As demonstrated with the 2017 budget request, competition within MDA budgets can hurt overall procurement. SM procurement absorbed $103 million of the 2015 Bipartisan Budget Act reductions, and overall Aegis procurement included a $373 million reduction relative to the projection from the 2016 request. For THAAD, current funding levels keep the completion of a seventh THAAD battery on track by 2018, but there is still no plan to meet the Army's stated requirement for nine batteries. Permanent deployments in Guam and potentially in South Korea will likely further strain THAAD supply in light of increasing Combatant Commander demand.

It could be that the continued rise of procurement in the foreseeable future will slope downward in the post-2020 period, when an increased number of Aegis/SM, THAAD, and GMD assets will have been deployed. If so, the stress on procurement and the failure to transfer responsibility to the Services may have a graceful resolution. This hope, however, is probably in tension with continued advances in the quantity and complexity of foreign missile threats, so additional quantities and new types of systems to be procured may be just beyond the current FYDP horizon.

The post-2009 trend for procurement represents more than mere accounting adjustments or nominal distinctions. Both the real dollars and the percentage of MDA's budget going toward procurement also reflect an expanded role for the agency.

OPERATIONS AND MAINTENANCE

Another MDA account seeing relatively new growth is O&M. The size of the O&M budget approximately doubled between 2012 (when it became a separate line of the MDA budget) and 2016. Whereas procurement of developing systems might be more in line with the intended focus of MDA, the addition and expansion of O&M are an indicator of MDA's beginning to transition to a different role.

As with procurement, some but not all of this new growth is a phantom, a function of past inclusion within the RDT&E account. Early "operations-like" line items in the MDA budget include the THAAD program, as part of a cost-sharing program with the Army, with a kind of division of labor: "MDA is responsible for the sustainment of the missile defense unique or developmental items and the U.S. Army is responsible for the sustainment of the common items."[9] Another example occurred in 2008–2009, when MDA used RDT&E funds to create a TPY-2 site in Israel.[10] The budget request for FY2012 notes that the money was directly transferred out of RDT&E, illustrating that MDA had been paying for operations-like programs inside that account.[11] The movement into procurement or O&M also brings less flexibility, however, such as the ability to redirect interceptors slated for deployment into testing should the need arise.

Continuing cost drivers in the O&M budget have been TPY-2 radar deployments and GMD (which only began to be labeled as O&M in 2015).[12] A little more than $10 million a year also goes to sustaining Aegis systems as of 2015, mostly sustainment of SM-3 interceptors. The 2016 enactment for Aegis O&M quadrupled from the 2015 amount, from $11.6 million to $46.1 million.

MDA's projections for its internal O&M budget continue to rise, but future O&M responsibilities could outpace MDA's budget projections. According to historic trends, O&M funding needs to grow at about 3 percent *above* inflation to meet *current* needs.[13] The MDA FYDP between 2017 and 2021 currently projects an average of 3.0 percent annual growth, adjusted for inflation.

This projection leaves little margin, since it may not be enough to compensate even for the currently projected growth in procurement. Deployed Aegis/SM, THAAD, and GMD defenses, for

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9. MDA, *Fiscal Year 2014 Budget Estimates: Missile Defense Agency (MDA)* (Washington, DC: MDA, 2013), 663, http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2014/budget_justification/pdf/01_Operation_and_Maintenance/O_M_VOL_1_PART_1/MDA_OP-5.pdf.

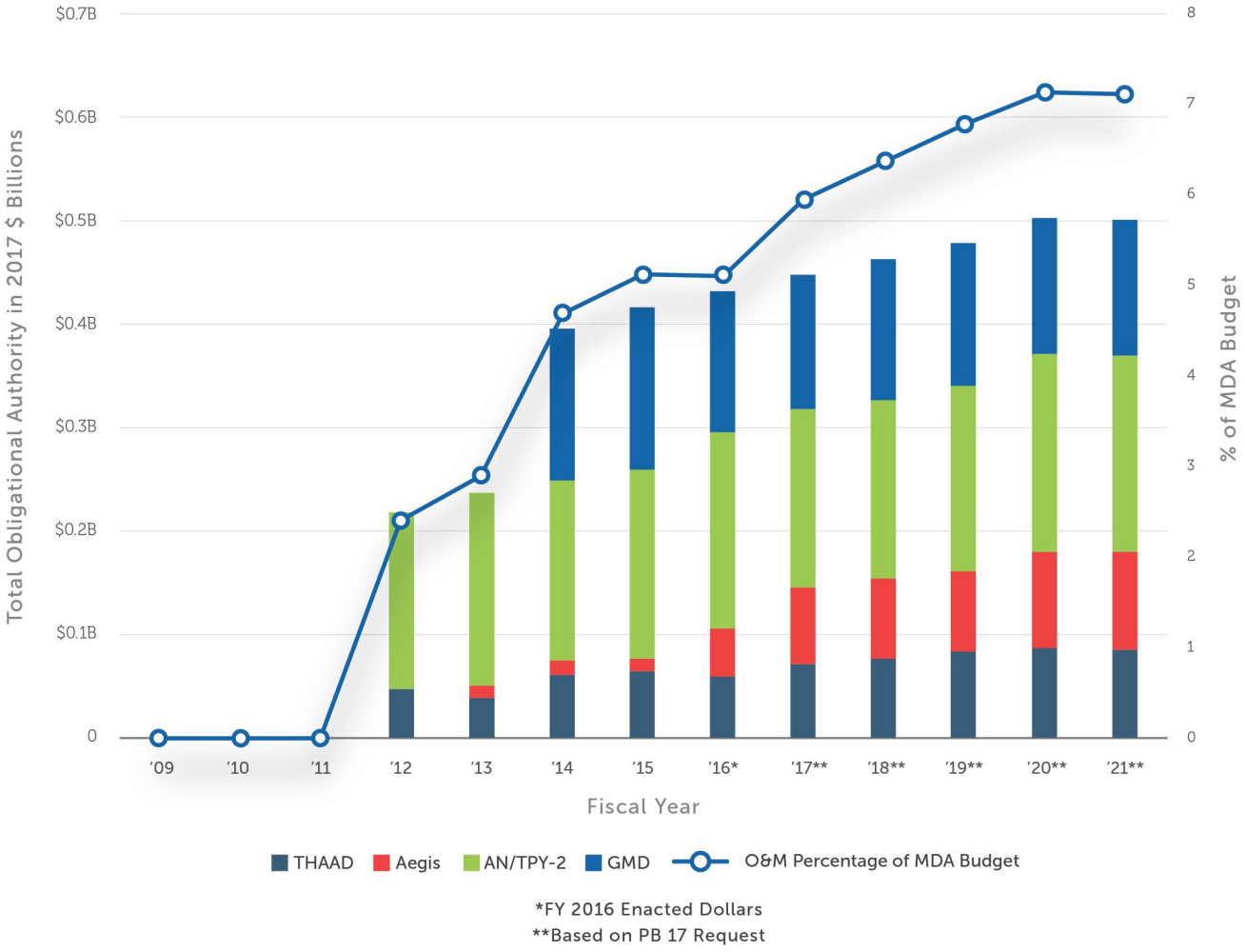
10. MDA, *Fiscal Year (FY) 2010 Budget Estimate: Missile Defense* Agency (Washington, DC: MDA, 2009), 2, http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2010/budget_justification/pdfs/03_RDT_and_E/Vol_2_MDA/PE-0603884C-Sensors.pdf.

11. MDA, *Fiscal Year (FY) 2012 Budget Estimate: Missile Defense Agency* (Washington, DC: MDA, 2011), http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2012/budget_justification/pdfs/01_Operation_and_Maintenance/O_M_VOL_1_PARTS/O_M_VOL_1_BASE_PARTS/MDA_OP-5_FY_2012.pdf.

12. MDA, *Fiscal Year 2015 Budget Estimate: Missile Defense Agency* (Washington, DC: MDA, 2014), http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2015/budget_justification/pdfs/01_Operation_and_Maintenance/O_M_VOL_1_PART_1/MDA_PB15.pdf. See also MDA, *Fiscal Year 2014 Budget Estimates*.

13. Todd Harrison, *Analysis of the FY 2017 Defense Budget* (Washington, DC: CSIS, 2016), 20–22, https://csis-prod.s3.amazonaws.com/s3fs-public/publication/160426_Harrison_AnalysisFY2017DefenseBudget_Web.pdf.

Figure 2.3. Operations and Maintenance: Amounts and Percentage of MDA Budget



instance, continue to grow; in the next few years, there will be nearly double the number of THAAD batteries (from four available batteries to seven by 2019) and nearly a half-over increase of deployed Ground-based Interceptors (GBIs) (up 46.7 percent from 30 to 44 by 2017). Besides the interceptors themselves, Fort Greely will have a new missile field coming online in 2017, the Long Range Discrimination Radar (LRDR) will come online after 2020, and the deployed at-sea time for the Sea-based X-band radar (SBX) could well rise for both testing and East Coast deployment. As more defenses are deployed and more components become operational, O&M costs are likely to continue to rise.

In a macro sense, much of this rise in procurement and operations spending is quite natural given the maturity of the programs. The significance of the rising procurement and operations accounts relative to the overall budget, however, depends on an understanding of the pace of transferring these responsibilities to the Services, at least as intended. MDA has not disaggregated the several operational missile defense programs from the single Ballistic Missile Defense System (BMDS) Major Defense Acquisition Program, and instead of transferring procurement and operational

responsibilities to the Services, they have largely but not entirely remained within MDA. The decisions for MDA to retain rather than transfer these tasks to the Services may well make sense, but will in the future bring increasing tensions, especially in light of a declining topline. Indeed, the more MDA retains and expands its role in this area, the more it begins to look something like a Combat Support Agency.

03

Failure to Transfer Budget Responsibility

Key points:

- MDA was created with the idea that the Services would take up procurement and operations of BMD systems once fielded. While there may be very good reasons why further transfer has not occurred, the pace has been slower than originally expected.
- MDA's liberal acquisition authorities help expedite development at the front end, but may have provided a disincentive for subsequent transfer.
- Higher-level attention from Congress, the secretary of defense, and the White House is necessary.
- Further transfer to the Services may not be the right solution if the capabilities were expected to languish in favor of other Service priorities.

MDA's charter is to "develop, test, and field an integrated, layered, ballistic missile defense system (BMDS) to defend the United States, its deployed forces, allies, and friends against all ranges of enemy ballistic missiles in all phases of flight."[1] The emphasis on development, testing, and fielding presupposes that the U.S. (or allied) military services would at some point take over both procurement and operations of missile defense systems once fielded.[2] That presumption was explicit at the creation of MDA, and in principle still remains. Yet the transfer of actual procurement authority has not taken place for any major program—Aegis/SM, THAAD, or GMD—as previously occurred with PATRIOT. For now, therefore, procurement responsibility remains with the agency.

The basic division of labor with the Services was indicated in a January 2002 memo by the secretary of defense creating MDA: "Budgeting for RDT&E is the responsibility of MDA; budgeting for

1. MDA, "MDA Mission," http://www.mda.mil/.

2. Lieutenant General Ronald T. Kadish, "Reorganization of the Missile Defense Program" (statement before the Senate Armed Services Committee, Strategic Forces Subcommittee, March 13, 2002), http://www.mda.mil/global/documents/pdf/ps_kadish13mar02.pdf.

procurement is the responsibility of the Services."[3] MDA would retain its focus on research and development, and some initial responsibility as the programs matured, and when ready the Services would assume procurement, operations, and maintenance.

In practice, however, the transition of procurement in particular has labored under a variety of pressures, both defense-wide and unique to MDA and the missile defense mission. With the addition of the mission to deploy long-range defenses also came the problem of how and on what timeframe to transfer them.

Three broad phases were presupposed: development, transition, and procurement. MDA would manage the development and transition phases, and the Services would take over procurement in the third phase. In 2002, Lieutenant General Ronald Kadish, MDA director, explained the process thusly:

> Our revised approach to acquisition now specifies three broad phases: Development, Transition, and Procurement. As Director, MDA, I have oversight and responsibility for managing the first two phases, Development and Transition. . . . During the Transition Phase, the Services take on increasing responsibilities, as elements move closer to production and possible deployment. At the start of the third phase, Procurement, the Services pick up responsibility for managing the production, fielding, training, and support of the elements of the BMD System and their components. Budgeting during this phase is divided. The MDA will budget for RDT&E funds, and the Services will budget for procurement, operation and support funds.[4]

By 2006, significant maturity had been reached in the several programs, and the undersecretary of defense for acquisition, technology, and logistics authorized the transfer of BMDS programs to the Services.[5] Despite this authorization, however, much of this transfer has not taken place. Although the Services frequently proclaim the importance of the ballistic missile defense mission, their budgets for missile defense assets have not reflected it.[6]

Given recent budgetary pressures on the Services, this might be an especially difficult time to make the transfer, absent high-level prioritization from the secretary of defense, Congress, or the White House. If MDA did not retain the responsibility to procure missile defense systems, it could well be that the Services would allow those capabilities to languish at the expense of other

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3. Donald Rumsfeld, "Missile Defense Program Direction," Office of the Secretary of Defense Memo, January 2, 2002, http://fas.org/ssp/bmd/d20020102mda.pdf.

4. Kadish, "Reorganization of the Missile Defense Program."

5. DoD, "Ballistic Missile Defense Agency 2006 Transition and Transfer Plan" (Washington, DC: DoD, 2006). Cited in Government Accountability Office (GAO), *Missile Defense: Actions Needed to Improve Planning and Cost Estimates for Long-Term Support of Ballistic Missile Defense* (Washington, DC: GAO, 2008), http://www.gao.gov/assets/290/281517.pdf.

6. While the U.S. Army and Navy have actively invested in systems for cruise missile and air defense, Service programs related to ballistic missile defense are often dual use, such as the Army's PATRIOT or the Navy's Air and Missile Defense Radar.

priorities.[7] As retired Rear Admiral Archer Macy, former director of the Joint Integrated Air and Missile Defense Organization, has remarked, "BMD is not a prime mission area of the Services."[8] In this context, MDA's retention of procurement may therefore be important to preserve these still-young capabilities.

PATRIOT PRECEDENT

To be sure, MDA's recent procurement is not without precedent. Theater missile defense programs like PATRIOT, for instance, were procured by BMDO, but at modest levels. Although the creation of SDIO in 1984 had consolidated many missile defense–related programs from the Services, PATRIOT would later return to the Army, at Congress's direction.

Most procurement in the 1990s and early 2000s supported the PATRIOT family (see Figure 3.1). The below graph illustrates the accelerating trend in the use of BMDO to procure theater missile defense assets for the Services between FY1996 and FY2003. Congress, however, directed the transfer back to the Army—where it had previously been originated, decades before SDI, as SAM-D.[9]

Here one sees a precedent of passing missile defense procurement back to a Service, and a precedent of Congress settling disputes about whether the Services or a defense-wide office or agency should procure important systems. Whether PATRIOT modernization has received the same attention and focus in the Army that it might have in a missile defense–centric entity is an open question. PATRIOT procurement and RDT&E funding have declined since they were transferred from BMDO to the Army in 2003 (see Figure I.2). Indeed, a future administration may wish to reassess transferring PATRIOT modernization efforts back from the Army into a missile defense-centric organization like MDA.

SPECIAL ACQUISITION AUTHORITY DISINCENTIVIZES TRANSFER

A further wrinkle in the story comes from special acquisition authorities granted to MDA to facilitate the development and deployment of homeland defenses. These very authorities may create further disincentives to transferring procurement from MDA to the Services.[10] MDA's more relaxed

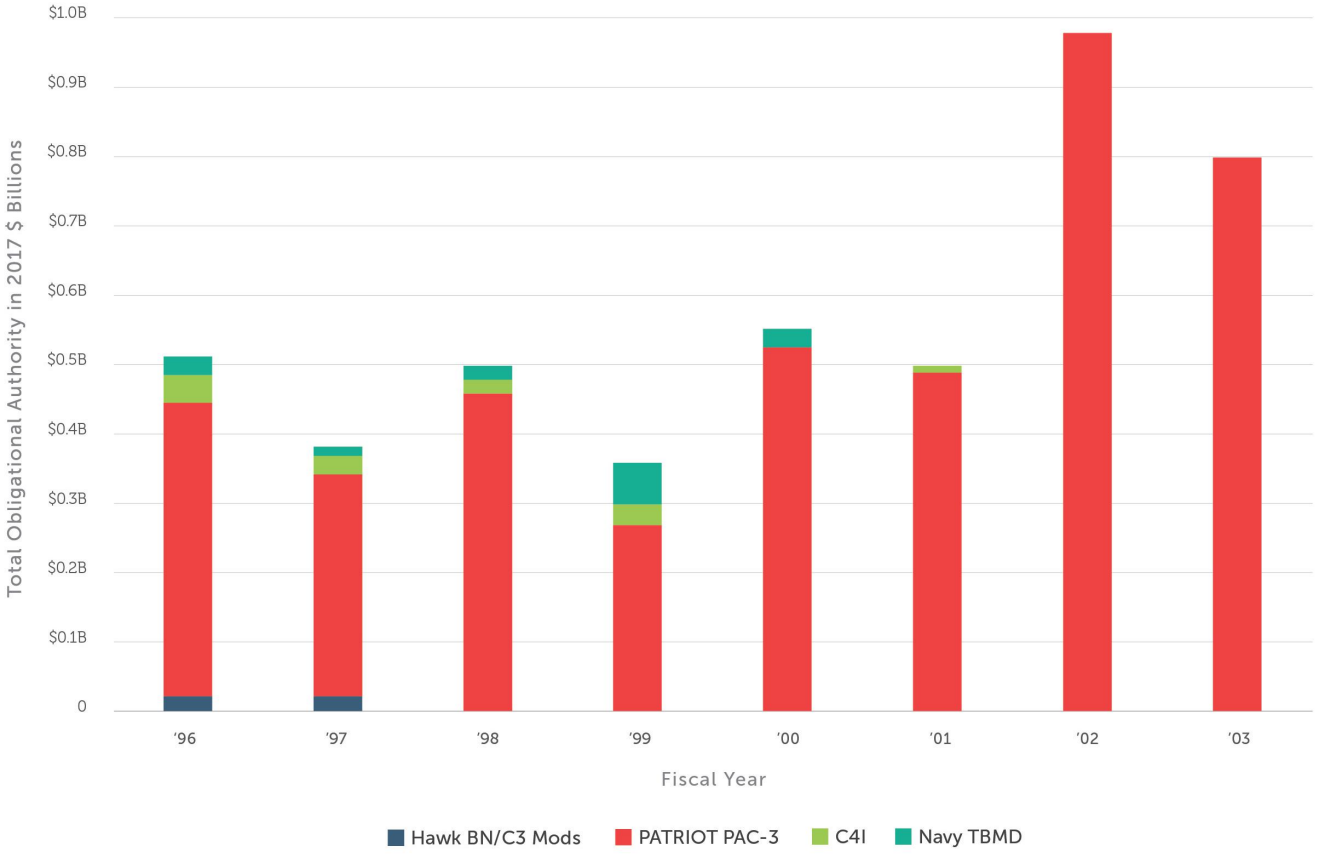
7. Archer Macy, "Full Spectrum Missile Defense" (speech, Center for Strategic and International Studies, Washington, DC, December 4, 2015), http://csis.org/files/attachments/151204_full_spectrum_transcript.pdf.

8. Ibid.

9. Department of the Army, "FY 2003 Budget Submission: Missile Procurement, Army," February 2002, http://asafm.army.mil/Documents/OfficeDocuments/Budget/BudgetMaterials/fy03/pforms//missiles.pdf; Department of the Army, "FY 2004/FY 2005 Biennial Budget Submission: Missile Procurement, Army," February 2003, http://asafm.army.mil/Documents/OfficeDocuments/Budget/BudgetMaterials/fy04-05/pforms//missiles.pdf.

10. The House Armed Services Committee (HASC) report language for FY2017 includes a provision that seeks to preserve MDA's special authorities, specifically citing the 2002 Rumsfeld memo and MDA's charter, DoD Directive 5134.09., *H.R. 4909—FY17 National Defense Authorization Bill*, House Armed Services Subcommittee on Strategic Forces, April 27, 2016, http://docs.house.gov/meetings/AS/AS00/20160427/104832/BILLS-114HR4909ih-STR.pdf.

Figure 3.1. Earlier BMDO/MDA Procurement, 1996–2003



acquisition authorities have allowed the Services to argue that the system would not meet their stricter requirements. At the margin, therefore, allowing MDA to acquire a given asset seemingly helps ensure that greater quantity will be procured.[11]

MDA's distinct authorities, known as capabilities-based acquisition, facilitate the creation of a baseline system, and then the development of continuous upgrades. This authority is also tied to the distinct problems of missile defense, by permitting greater flexibility for deployment and for responding to ever-evolving missile threats. As MDA director Kadish explained in 2002 congressional testimony:

> Missile defense has perhaps more uncertainties in this regard than many other mission areas. We do not want to alter our baseline every time we recognize a change in the threat. Such changes could ripple through the program and likely cause significant delay and cost. So instead of a point threat, we are setting a wider range of boundaries for adversarial capabilities over time in defining our own needed capabilities. The baseline we set must be able to deal with surprises and changes in the threat. A capability-based approach

11. GAO, *Missile Defense.*

> allows us to adjust to those changes in ways that the traditional requirement-based approach does not.[12]

These special acquisition authorities granted to MDA explain why nearly all the agency's funds were classified as RDT&E between 2004 and 2008 (see Figure I.3), but they also explain MDA's difficulty in shedding the procurement and operations responsibilities.

That special arrangement contributed to a sense in Congress around 2007–2008 that the agency required more oversight. In response, Congress mandated a study on the roles and missions of MDA in the 2008 National Defense Authorization Act.

Prepared by the Institute for Defense Analyses (IDA) and co-led by General Larry D. Welch and David L. Briggs, the report concluded:

> The approach that allowed MDA to rapidly develop and deploy an initial set of capabilities has been less successful in fostering the planning and preparation needed to adequately address future operations of deployed systems and follow-on procurement and sustainment. Under this approach, the MDA is functioning as the research, development, test, and evaluation (RDT&E); procurement; testing; initial fielding; and operating entity. The Military Departments that will eventually assume responsibility for operating and sustaining the BMDS have not been heavily involved in preparing to assume these responsibilities. This has made it difficult to incorporate Service perspectives and to transfer functions for individual systems within the BMDS to the Lead Services as directed by the basic guidance for BMDS development and deployment.[13]

In short, the very authorities that allowed for sooner deployment might inhibit, or serve as a convenient reason to delay, the transfer of procurement responsibility in a difficult budget environment.

The IDA report also noted that the budgetary trends driving MDA attention away from an R&D focus could adversely affect research and development. "The pressures for continued deployments of current capabilities can have an adverse impact on investments in RDT&E needed to increase capability to deal with a wide range of possible threats."[14]

In response to the IDA report and additional GAO attention, Congress held a hearing in March 2009. There, Welch predicted that the contest between MDA and the Services would continue "until we resolve the issue of who is responsible for research, development, test, and evaluation (RDT&E) and who is responsible for procurement."[15] Welch also pointed to a potential

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12. Kadish, "Reorganization of the Missile Defense Program."

13. Larry D. Welch et al., *Study on the Mission, Roles, and Structure of the Missile Defense Agency* (Alexandria, VA: Institute for Defense Analyses, 2008), III-3.

14. Ibid.

15. *Future Roles and Missions of the Missile Defense Agency: Hearing before the House Armed Services Subcommittee on Strategic Forces*, 111th Cong. (March 26, 2009) (statement of Larry D. Welch).

path forward, namely, by prioritization and stewardship of the missile defense mission from the White House or the secretary of defense:

> I was once a service programmer and service chief, and I remember funding a lot of things that I didn't think were very important, but the Secretary of Defense did think they were important, and therefore, they were funded. Now, if that is not the case in the Department of Defense anymore, we are in very serious trouble, but I believe it is. . . . The services have their priorities, and there are other priorities set by the Secretary of Defense and the President, and those are overriding and should be overriding.[16]

Another obstacle in transferring the programs has been the decision to retain the various missile defense systems as a single Major Defense Acquisition Program, the BMDS, rather than breaking Aegis/SM, THAAD, and GMD into separate acquisition programs.[17] Such an approach may more effectively address the unique challenges of the missile defense mission, to be sure, but on the other hand maintaining it as a single program has arguably made it more difficult to transfer to the Services.

In sum, there may well be good reasons for delaying transfer, and for retaining procurement with MDA, but that comes at a cost that must be absorbed elsewhere within the missile defense enterprise, and in particular within the agency. As a practical matter, the Services have displayed a preference for other priorities and in some cases a cultural disinclination to absorb the missile defense mission. Absent a topline increase, however, especially in light of a falling topline, every dollar MDA spends to procure and sustain missile defense assets comes at an opportunity cost, in particular to research and development necessary to outpace evolving threats.

MDA director Syring observed in January 2016, "Our charter is to start to transition those programs to the services when we can. . . . But the way I think about it is that those missiles, those interceptors, need to be procured by somebody."[18] This statement represents a kind of summary of MDA's rising up to meet the needs of the larger missile defense problem amid a budget-constrained environment. The question, however, is the relative opportunity cost for MDA to do so, and what the long-term retention of procurement and operations responsibility will mean for MDA's future identity.

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16. Ibid.

17. "The Secretary by memorandum of January 2, 2002, determined that the current Service missile defense ORDs [Offices of Research and Development] are not consistent with the proposed BMDS development program objectives and cancelled them. With the exception of PAC-3, the programs (but not the contracts) associated with these ORDs are hereby cancelled. All of the cancelled programs become elements of the single developmental program for the Ballistic Missile Defense System, which will be a Major Defense Acquisition Program (MDAP)." E. C. Aldridge Jr., "Ballistic Missile Defense Program Implementation Guidance," Office of the Secretary of Defense Memo, February 13, 2002.

18. Vice Admiral James Syring, "Ballistic Missile Defense System Update" (speech, Center for Strategic and International Studies, Washington, DC, January 20, 2016), http://csis.org/files/attachments/160119_ballistic_transcript.pdf.

04

Foreign Assistance to Israel

Key points:

- Assistance for Israeli missile defense occupies an increased percentage of MDA's budget.
- Congressional plus-ups for Israeli missile defense are not always accompanied by a corresponding topline plus-up.
- This funding structure puts U.S. missile defense and Israeli missile defense in competition.
- Even if Israeli missile defense RDT&E stays within MDA, aid for Israeli missile defense procurement could be transferred to the Foreign Military Financing account.

A third potential strain on MDA is a growing percentage of the budget regularly allocated to Israel programs, what might be called Israeli missile defense foreign assistance. Among other things, cooperation with Israel has yielded better understanding of combat conditions and concepts of operation applicable to U.S. missile defense deployments. Although cooperation with allies represents an important area of cooperation and technology advancement, the quantity of foreign assistance is significant. While international cooperation, co-development, and coproduction can represent a significant source of savings, they are not automatic. Absent clearer guidance and prioritization, foreign assistance can compete with, and even undercut, development of U.S. missile defense systems.

Between 1998 and 2012, funding for cooperative research and development efforts took up 1 percent to 3 percent of the MDA budget. Along with the expanding number of Israel cooperative programs, MDA's Israel-specific research and development budget rose to around 3.5 percent in 2011, during the Israel-Gaza conflict.

The main component of the increased spending on Israeli missile defense was the addition of procurement funds, initially for Iron Dome and then expanding to other Israeli systems as they have matured, which in 2014 took up 5.5 percent of the total MDA budget. In 2011, for instance, MDA spent an additional $204 million dollars to purchase four Iron Dome batteries, more than doubling

Figure 4.1. Missile Defense Aid to Israel: Presidential Budget Requests, Congressional Additions, and MDA Topline Adjustments, 2006–2017

what was spent on cooperative Israel RDT&E the previous year. The 2013 budget again spiked to $441 million due to the return of procurement and an expansion in the David's Sling research budget carried over from 2012.

In 2014, funding for Israeli missile defense reached its peak of $729 million, driven by a $445 million investment to procure Iron Dome batteries and interceptors, representing 9 percent of MDA's budget that year. While not driven by a particular conflict, funding remained up in 2015, at $620 million. The 2016 enacted appropriations reduced the Israel-specific funding to $488 million, but it also introduced David's Sling and Arrow to the procurement account.

As with previous requests, the 2017 presidential budget request contains notional amounts for Israel, which by way of comparison with past funding is modest for both 2017 and future years.

These notional figures, however, are typically revised upward by Congress.[1] Sometimes the increase is over and above the MDA topline, but in a number of years the Israel plus-up has not been accompanied by a corresponding plus-up for MDA's bottom line (see Figure 4.1).

If Congress continues the course of recent years, 2017 assistance will be significantly increased above the budget request of $146 million. In its markup of the 2017 defense authorization act, the House Armed Services Committee approved $600.8 million for Israeli missile defense programs, $450 million more than the president's request.[2] The markup accommodates the increase with an addition to the proposed MDA topline rather than through cuts, but there is no guarantee that this plus-up will hold through the whole budget process.

One possible path to avoid competition, however, would be to transfer Israeli missile defense foreign assistance to another account, namely, to Foreign Military Financing (FMF). Israel is the only country that can receive U.S. military aid for purchases from non-U.S. defense firms.[3] News reports suggest that this move is being contemplated but does not yet appear to be reflected in legislative language. Such a move could alleviate some of the growing tension between U.S. and Israeli missile defense priorities. Unless Congress carefully stewards the combination of Israel and U.S. dollars at every stage, Israeli missile defense and U.S. missile defense dollars will compete with one another.

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1. When asked about the 2017 budget request for Israeli missile defense, Senator Lindsey Graham said, "This is a game they play," suggesting that the department submits a lower request with knowledge that Congress will add money. Julian Pecquet, "Obama and Congress Hurtle toward Showdown over Israel Missile Defense," *U.S. News & World Report*, April 29, 2016, http://www.usnews.com/news/articles/2016-04-29/obama-and-congress-hurtle-toward-showdown-over-israel-missile-defense.

2. *H.R. 4909—FY17 National Defense Authorization Bill Chairman's Mark*, April 27, 2016, http://docs.house.gov/meetings/AS/AS00/20160427/104832/BILLS-114HR4909ih-FC.pdf.

3. Jeremy Sharp, *U.S. Foreign Aid to Israel* (Washington, DC: Congressional Research Service, 2015), 6, https://www.fas.org/sgp/crs/mideast/RL33222.pdf. Without this special legislative status, Israel would not be able to use FMF money to purchase Rafael-produced Iron Dome components. Currently, 26.3 percent of Israel's FMF funds may be used for domestic defense purchases.

05

The Squeeze on Research and Development

Key points:

- Increased procurement and budget pressures challenge the focus on research and development necessary to outpace evolving missile threats.
- MDA's special acquisition authorities have proven instrumental for the flexible deployment of these new capabilities, but they also encourage procurement-like and O&M-like activities to remain within the RDT&E line.
- The actual research and development (R&D) focus within the larger RDT&E line is therefore less than meets the eye.

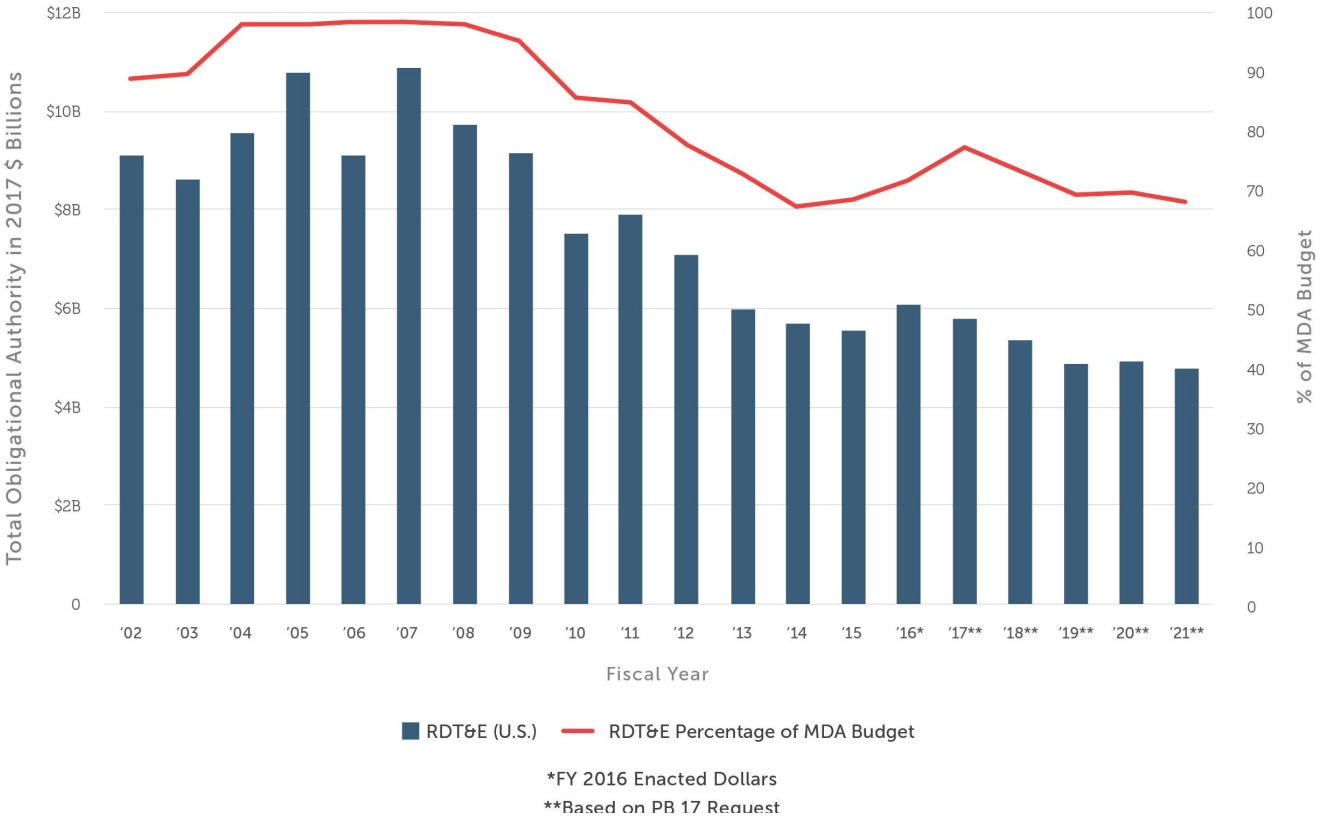
From the earliest days, research and development has always been at the center of missile defense's institutional existence—as has the competition with activities other than research and development. The confluence of the above trends, however, has put an underappreciated pressure on MDA's RDT&E focus, and in particular R&D (see Figure 5.1).

MDA and congressional leadership have begun to warn about this squeeze. The chair of the Senate Armed Services Subcommittee on Strategic Forces has noted "the erosion of MDA's research and development budget."[1] The House Armed Services Committee recently emphasized the need to "restore the focus of the agency on research and development."[2] Brigadier General Kenneth Todorov, MDA's former deputy director, has likewise observed: "That's our seed corn. We

1. *Ballistic Missile Defense Policies and Programs: Hearing before the Senate Armed Services Subcommittee on Strategic Forces*, 114th Cong. (April 13, 2016) (statement of Senator Jeff Sessions).

2. House Armed Services Committee, National Defense Authorization Act for Fiscal Year 2017, "Report of the Committee on Armed Services House of Representatives on H.R. 4909 together with Additional Views," H.R. Rep. No. 114–537 (2016).

Figure 5.1. RDT&E (U.S.): Amounts and Percentage of MDA Budget, 2002–2021



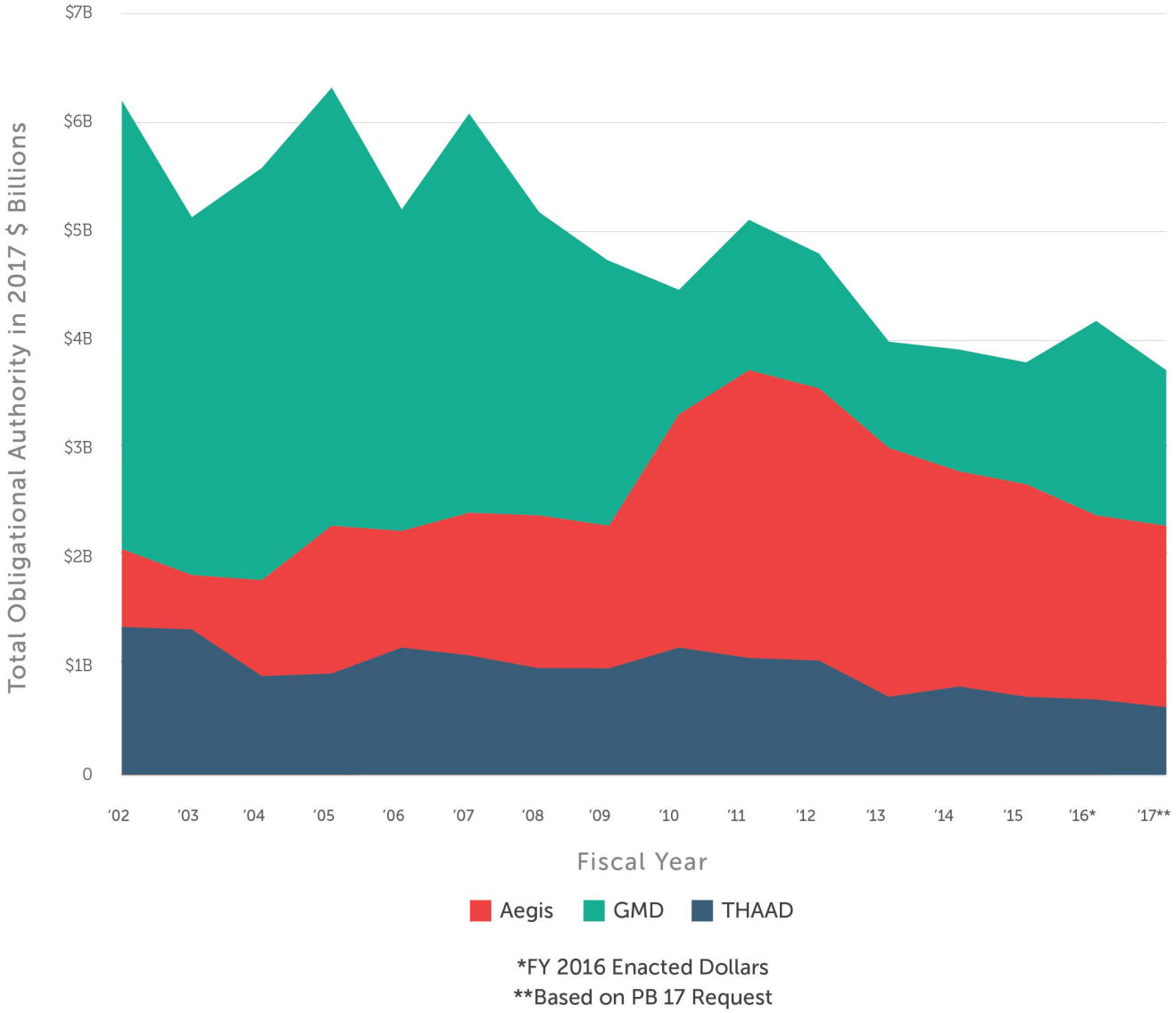
have to have the fortitude to stay with those programs that will lead to a lot of great things in the future, but we've got to stick with it."[3]

The growth in procurement and operations budgets and MDA's declining topline have resulted in a significant squeeze on RDT&E funding and an overall reduction in funding for modernization. In many cases, these funding cuts exist even between the enacted budgets of the Congress and the actual money spent in a fiscal year, signifying that MDA has been forced to assume previously unexpected costs. In 2011, for example, the GMD program lost about $100 million just in the transition from enacted dollars to dollars spent, due to congressional reductions.

The largest single-year cut in RDT&E funding came in 2010, when MDA received $1.4 billion less than the previous year for research and development. This reduction in part reflected the Obama administration's choice to elevate regional missile defense and deemphasize homeland missile defense. After a rebound in the topline in 2011, the trend continued in 2012, when multiple major RDT&E programs were hit by cuts. GMD lost $102 million between 2011 and 2012, and Aegis took a $392 million cut over the same period. Another reduction hit RDT&E in FY2013: GMD was cut by $220 million, Aegis by $181 million, and THAAD by $179 million. Topline growth in 2014

3. Brigadier General Kenneth Todorov, "Consolidating Our Gains, Looking to the Future" (speech, Air Force Association, Reserve Officers Association and National Defense Industrial Association Capitol Hill Forum, June 18, 2015), http://www.afa.org/informationfor/corporate/huessybreakfastseries#Seminar_Schedule3.

Figure 5.2. MDA Major Modernization Programs, 2002–2017



"Modernization" here includes appropriations for procurement and RDT&E.

provided a small reprieve from deeper RDT&E cuts, but they soon returned. Between 2014 and 2015, GMD lost $201 million, THAAD was cut by $71 million, and Aegis $124 million.

One result of these trends has been the decline of the overall modernization budgets (procurement plus RDT&E) of the major MDA programs (Figure 5.2). GMD has been the hardest hit, falling from a peak modernization budget of $3.25 billion in 2005 to $923.5 million in 2013 before rebounding to $1.75 billion in 2016. THAAD has remained relatively steady, but fell from a modernization peak of $1.05 billion in 2010 to $674.6 million in 2016. Even Aegis, which saw significant modernization growth from 2010 to 2012, has declined from a peak $2.4 billion in 2011 to $1.7 billion budget in 2016.

Strains on research and development have real-world effects. One example is the so-called track gate anomaly in the kill vehicle for the fleet of Ground-based Interceptors (GBIs). The error was

first noticed in flight testing in 2001, but was initially assessed to be caused by electromagnetic interference, and at any rate it had not then impaired intercept.[4] Eventually, MDA discovered that the anomaly was caused by vibrations from the thrusters disrupting the inertial measurement unit (IMU), giving the kill vehicle an inaccurate threat picture. This anomaly resulted in a failed GMD test in December 2010.[5] In response, MDA upgraded the IMU firmware and devised a "cradle" to isolate it and reduce vibrations, but the solution could not be demonstrated in flight testing until January 2013 and an intercept test in June 2014.[6] MDA demonstrated an upgraded system of divert thrusters to reduce vibrations and mitigate the effects of the track gate anomaly in a January 2016 flight test, representing a more permanent solution to the issue with the GMD kill vehicle.[7] The episode raises the question whether with earlier focus on modernization, MDA might have been able to resolve the issue sooner and improve GBI fleet reliability.

MDA's testing budget, the "T" in RDT&E, is another area where a modest budget squeeze has appeared, at least for particular programs (see Figure 5.3). Funding for GMD testing has fallen from $341.4 million in FY2008 to a $78.5 million request in the FY2017 budget. THAAD testing received $230.2 million in FY2008, was cut to $14.1 million in FY2014, and rebounded to $109.4 million in FY2015. To be sure, MDA has increased investment in targets over time to improve the sophistication of tests and expand the ranges of test missiles, and this increase has kept the total level of MDA testing budgets relatively consistent. Yet new systems are also receiving fewer testing dollars. Testing budget pressures are likely to continue with the evolution of the programs, since longer-range, more complex, and more realistic testing exercises are also more expensive than shorter-range and simpler ones.

LESS R&D THAN MEETS THE EYE

Although MDA's RDT&E budget rebounded to 77 percent in 2017, the portion of that account devoted to advanced technology or other research and development is in some ways less than meets the eye, most notably because of the account's continued retention of what might be called "procurement-like" and "operations-like" activities. According to GAO's estimate, $1.5 billion of the RDT&E budget in FY2005 went to acquiring interceptors and radars and to upgrade existing BMDS elements and components—17 percent of MDA's budget that year.[8]

Another more recent example of an "operations-like" allocation in the RDT&E budget is the Sea-Based X-band Radar (SBX). Between 2017 and 2021, MDA plans to spend $372 million for tasks including "operation and sustainment of the vessel" and "operation and sustainment of the XBR

4. Vice Admiral James D. Syring, "Homeland Missile Defense" (slide presentation, 2014 Space and Missile Defense Symposium, August 13, 2014), http://www.ucsusa.org/sites/default/files/attach/2014/11/slides-jd-syring-symposium.pdf.

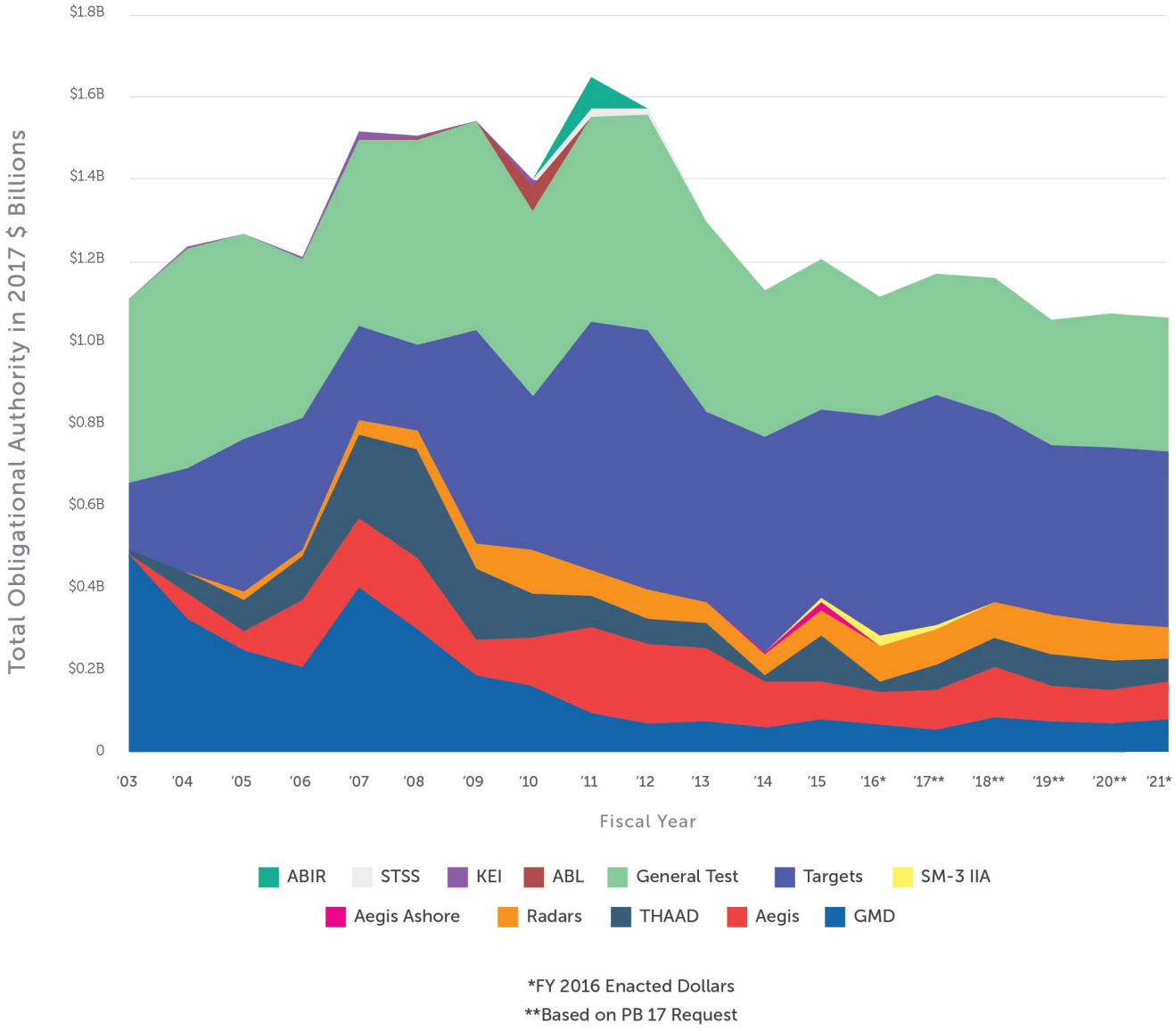
5. Ibid.

6. Ibid.

7. Jen Judson, "Homeland Missile Defense System Successful in Non-Intercept Flight Test," *Defense News*, January 29, 2016, http://www.defensenews.com/story/defense/air-space/2016/01/28/homeland-missile-defense-system-successful-non-intercept-flight-test/79496944/.

8. GAO, *Defense Acquisitions: Actions Needed to Ensure Adequate Funding for Operation and Sustainment of the Ballistic Missile Defense System* (Washington, DC: GAO, 2005), 14, http://www.gao.gov/assets/250/247606.pdf.

Figure 5.3. MDA Selected Program Testing Budgets, 2003–2021

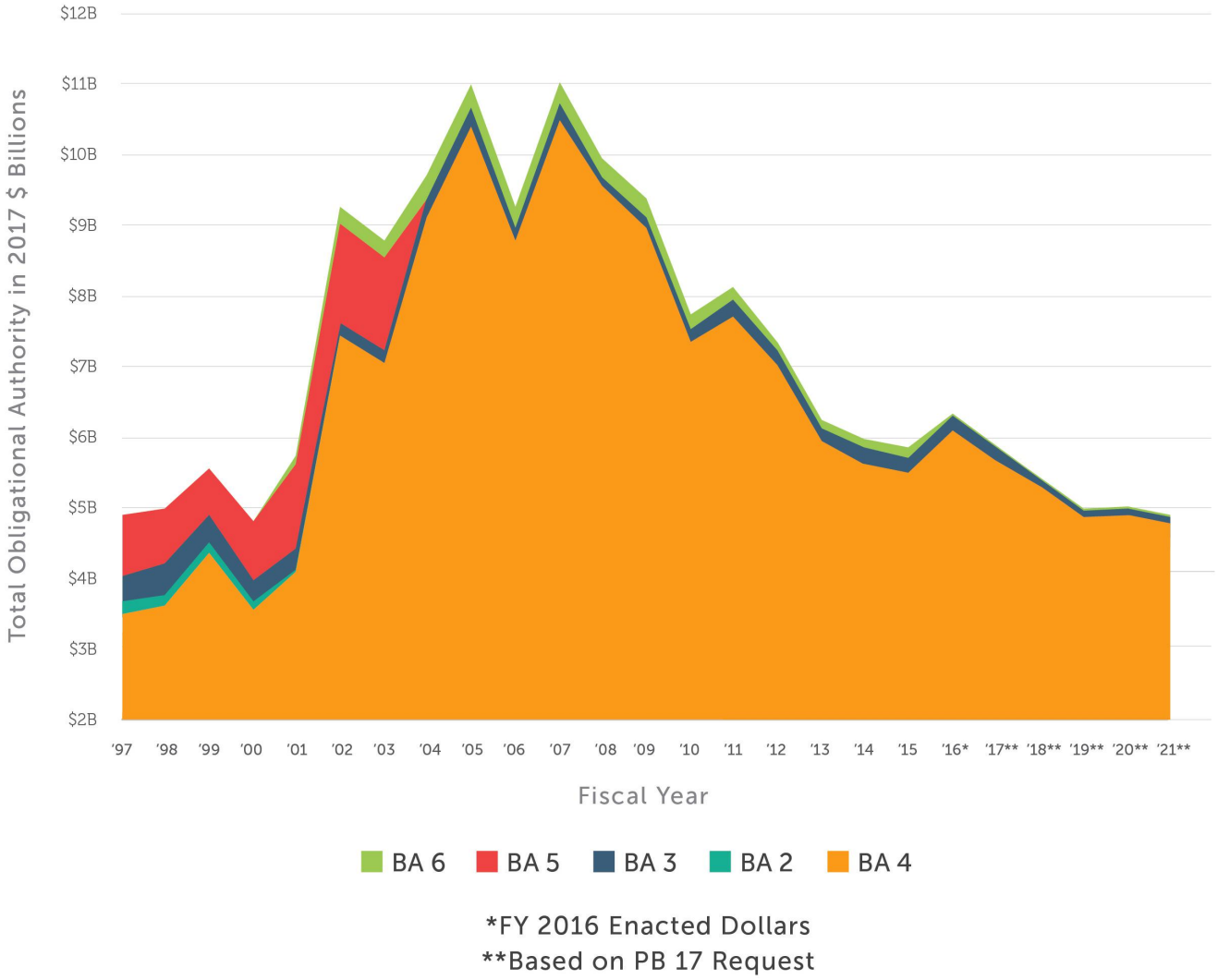


Only includes budget lines designated for testing. Does not include a calculated cost of interceptors purchased for the purpose of testing.

[X-band Radar]."[9] SBX technically remains in a test and operational support status, so it apparently does not meet qualifications to move into the O&M account. The addition of these various procurement-like and operations-like amounts helps to contextualize the overall amounts devoted to RDT&E. GMD-related activities have also recently been reclassified within the agency's overall

9. Department of Defense (DoD), *Department of Defense Fiscal Year (FY) 2017 President's Budget Submission*, "Missile Defense Agency Defense-Wide Justification Book Volume 2a of 2 Research, Development, Test & Evaluation, Defense-Wide" (Washington, DC: DoD, 2016), 2a-613, http://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2017/budget_justification/pdfs/03_RDT_and_E/MDA_RDTE_MasterJustificationBook_Missile_Defense_Agency_PB_2017_1.pdf.

Figure 5.4. MDA Budget Activities within RDT&E, 1997–2021



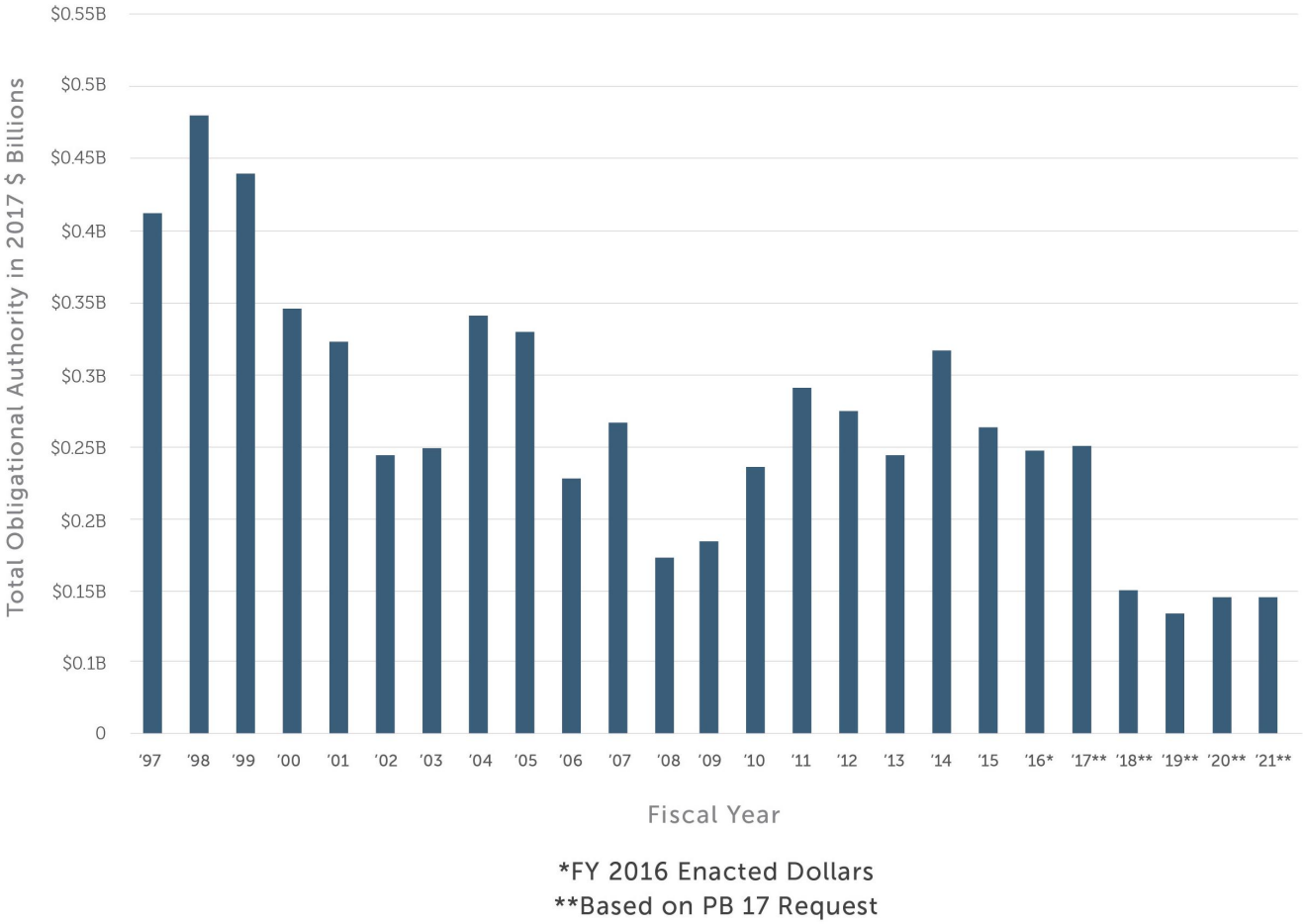
budget, most notably kill vehicle–related efforts moved from procurement (where they were in FY2016) to RDT&E in the FY2017 budget.[10]

Another indication of the decreased focus on more basic research and development (R&D) within the RDT&E budget can be seen by examining the allocations for different Budget Activities (BA) within the account. The several budget activities represent different stages of the R&D process. Budget Activity 1 is the most fundamental, 2 is more advanced, and so on. For MDA, however, almost all RDT&E allocations fall under Budget Activity 4, which is devoted to more advanced component development and prototypes (see Figure 5.4).[11]

10. For example, the FY2016 budget request included a line for GMD procurement in FY2017, but that line disappeared in the 2017 request, despite the intention to deploy an additional 14 GBIs by the end of 2017.

11. Budget Activity 4 is defined as "efforts necessary to evaluate integrated technologies, representative modes, or prototype systems in a high fidelity and realistic operating environment." DoD, *DoD Financial Management Regulation*, "Research, Development, Test and Evaluation Appropriations," chap. 5, vol. 2B, 5-2, http://comptroller.defense.gov/Portals/45/documents/fmr/archive/02barch/CHAPTER05.PDF.

Figure 5.5. MDA's RDT&E Budget Activity 3, 1997–2021



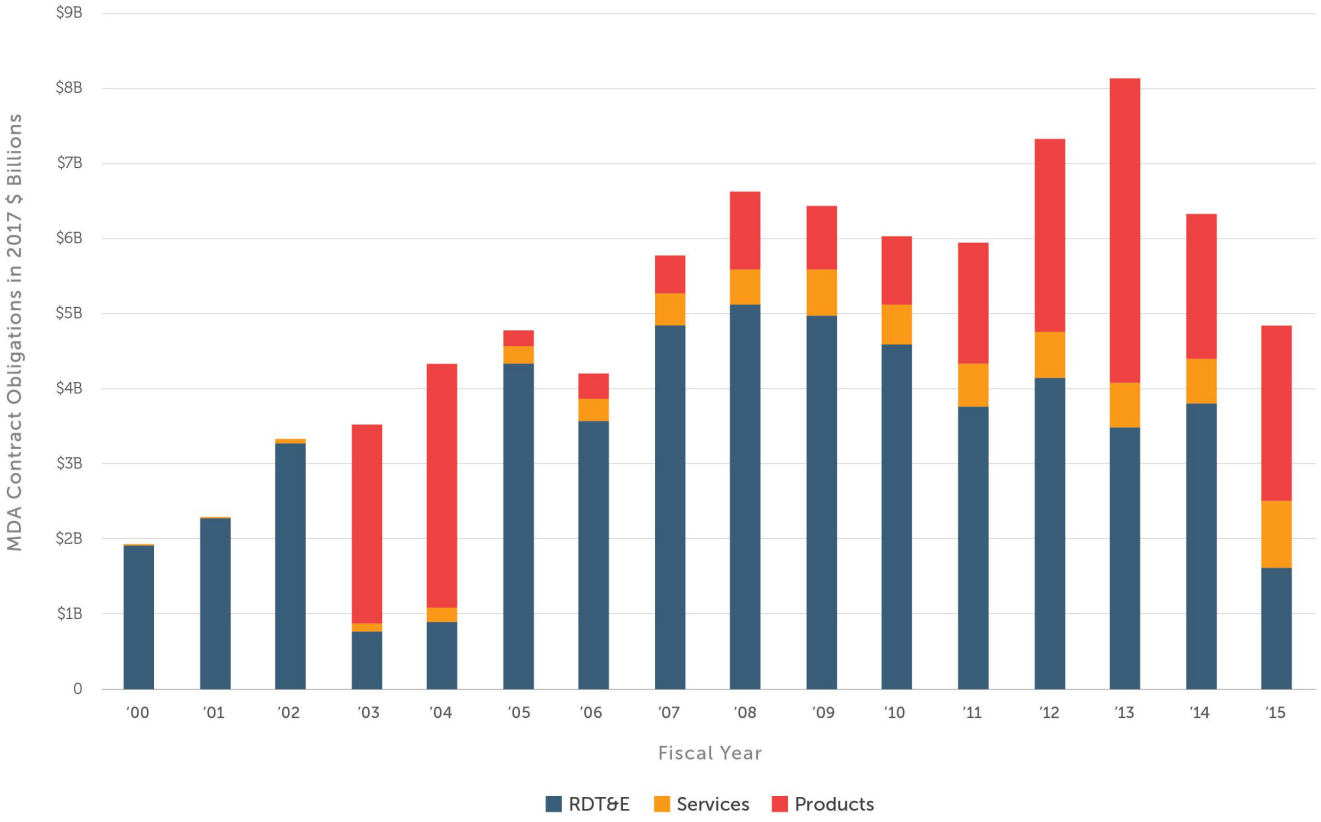
Budget Activity 3, which includes advanced development and integration, has experienced intermittent funding over time, vacillating between $100 million and $250 million per year since 2002 (Figure 5.5).[12] The recent trend and FYDP projections, however, are certainly downward. These could be a reflection of past development success and the natural maturing of past investments (into Budget Activity 4), but they could also reflect underinvestment in new technologies for the future.

Yet another representation of the real-world squeeze on R&D is seen not from the technical color of money classifications, but rather from an analysis of the contract obligations that MDA undertakes, and whether they may be categorized as products, services, or R&D.[13] This approach peels back the layers of MDA's acquisition authorities to describe the objects of MDA's funding, regardless of the colors of money. From this perspective, MDA's peak in true R&D came in 2008 and 2009, but has since fallen off, a period that coincides with increased responsibility for

12. Budget Activity 3 is defined as "all efforts that have moved into the development and integration of hardware for field experiments and tests. The results of this type of effort are proof of technological feasibility and assessment of operability and producibility rather than the development of hardware for service use." DoD, *DoD Financial Management Regulation*, chap. 5, vol. 2B, 5-2.

13. Jesse Ellman et al., *Defense Acquisition Trends, 2015: Acquisition in the Era of Budgetary Constraints* (Washington, DC: CSIS, 2016), 82, https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/160126_Ellman_DefenseAcquisitionTrends_Web.pdf.

Figure 5.6. MDA Contract Obligations by Area, 2000–2015



procurement and operations. Comparing 2008 and 2015, MDA R&D contract obligations fell from $4.5 billion to $1.6 billion, a reduction of 65 percent. During the same time period, MDA contracts for products grew from $866 million to $2.25 billion, an increase of 151 percent. While topline contract obligations grew to a peak of $7.6 billion in 2013, 49.7 percent of those contracts went to purchasing final products instead of R&D (see Figure 5.6).

Again, the confluence of these several trends is the result of a wide array of circumstances and decisions. The expanding roles taken on MDA may, indeed, make a lot of sense, as may foreign assistance to Israel for its missile defense efforts. During a recent hearing of the Senate Armed Services Subcommittee on Strategic Forces, subcommittee chairman Jeff Sessions remarked,

> The erosion of MDA's research and development budget is more significant than I had realized, frankly. . . . I'm not prepared to criticize . . . the fact that MDA is now doing procurement and other things—it might be good—but it seems to be coming straight out of their research budget, which I think is something we need to be aware of, as we go forward.

This report has attempted to identify and describe these several trends and the evolving and maturing roles taken on by MDA in a time of budgetary constraint. The expansion of activities is understandable, but it also comes at a cost, one that may be unsustainable with the continued decline of MDA's topline.[14]

14. *Ballistic Missile Defense Policies and Programs* (statement of Sessions).

06

Possible Paths Forward

The combination of the several trends described above has resulted in a squeeze on MDA's budget and its ability to outpace developing missile threats. These trends include the reduced budget topline, failure to transfer O&M and procurement budget responsibilities to the Services, and increased foreign assistance to Israel.

This confluence threatens to leave the United States without the necessary missile defense assets to meet the missions laid out for MDA and outpace the rapidly developing threat. The several trends contribute to a significant squeeze on not only RDT&E but also procurement and operations.

Several potential paths could be taken to resolve the problems highlighted here. Specifically, these include evolution and expansion of MDA's charter, a contraction of its charter to return its focus to research and development, or tacit acceptance of the problems as they have manifest themselves, with the attendant risk.

EVOLUTION AND EXPANSION

One path forward is for MDA's means to be increased proportionate to its expanding ends. This path would embrace rather than fight the experience of the last decade. DoD could expand MDA's charter and budget to make it responsible for procurement and O&M.

MDA's identity could potentially even be expanded to become something like a Combat Support Agency (CSA), retaining the acquisition authorities but receiving a boost to its topline to account for the increased activities related to procurement and operations. Such a vision might even evolve to have the agency procure and maintain missile defense assets deployed with units across the Services at the request of combatant commanders, perhaps even into a BMD Command, not unlike U.S. Special Operations Command (SOCOM). An example of an analogous organization is the Joint Improvised-Threat Defeat Agency, which supports combatant commanders in

countering improvised explosive devices.[1] Such an effort would certainly require coordination but would remove the need to work out transfer criteria for assets to move out of MDA.[2] One potential difficulty of this path, however, is that MDA as a CSA would face pressures to increase its attention to immediate warfighter needs at the expense of future-looking "seed-corn" investments, thereby continuing or compounding current stresses on R&D. There is also no guarantee that formally accepting these missions into MDA's charter would ensure sufficient funds or high-level political support.

BACK TO BASICS

A second path is for MDA to take a "back to basics" approach that would keep the agency focused as "the DARPA of missile defense" and prioritize transfer of procurement and operations responsibility for mature programs to the Services. Such an action, likely possible only with secretary of defense–level action, would allow MDA to return to its traditional focus on RDT&E. The biggest question here is whether, beyond THAAD and Aegis, GMD should be so transferred. As the only system dedicated for homeland missile defense, GMD has had a special status within MDA's focus. Transferring it out to a Service, such as the Air Force, would probably require significant attention from both executive and legislative branches of government, to steward its continued focus and ensure that it is not traded for other programs. The experience of the PATRIOT transfer and the Army's relative neglect of PATRIOT modernization suggests that such stewardship will require legislation and oversight by Congress.

Such an approach would "allow MDA to return to its roots and be the true leader in developing new technologies through rigorous research and development efforts."[3] It would require both improved methods of communication between the Services and MDA over the criteria for transfer of programs and better adjudication when disputes arise. This would also require some reconciliation of the different acquisition processes followed by MDA and the Services to facilitate smoother transfer of resources and make sure that MDA assets meet stricter Service acquisition criteria. Previous efforts through the Missile Defense Executive Board to engage Services early in the process of asset development and define Memorandums of Agreement on transfer criteria have so far been

1. Terri Moon Cronk, "Combat Support Agency Counters Worldwide IED Threats," *DoD News*, April 6, 2015, http://www.defense.gov/News-Article-View/Article/604411.

2. Future decisionmakers will have to consider whether MDA should retain its near-exclusive focus on the *ballistic* missile defense mission, or expand to address this broader suite of cruise missile, air defense, and hypersonic threats. One alternative would be to expand it into an integrated air and missile defense agency of sorts, to respond to expanding demand for defense from cruise missiles and unmanned aerial vehicles. Such a decision would also free up resources from the Services that are already working on these problems. Just as SDIO previously consolidated ballistic missile defense programs spread across DoD, there are currently a number of cruise missile and air defense programs pursued by the Services. At the same time, consolidation may not be an efficient or effective way to meet the several and distinct air defense challenges of the Services, and could have the adverse effect of undermining MDA's focus on the particular and challenging task of ballistic missile defense.

3. Kenneth E. Todorov, "Missile Defense: Getting to the Elusive 'Right Side of the Cost Curve,'" CSIS, April 2016, https://csis-prod.s3.amazonaws.com/s3fs-public/publication/160408_Todorov_MissileDefense_Web_0.pdf.

ineffective in advancing the goal of allowing MDA greater focus on its foundational RDT&E mission.

A solution to Service-Agency tensions and zero-sum budget problems like this probably requires department-level or higher resolution. At the end of the day, the interceptors have to be procured by somebody. High-level support from the White House or the secretary of defense is a means to ensure that the mission is prioritized, whether by MDA or the Services.

The related issue of missile defense support to Israel poses a similar zero-sum problem. The current agreement on military aid to Israel expires in FY2018, providing an opportunity to renegotiate the terms to include missile defense asset procurement in the base military aid program. One option would be to support Israeli missile defense efforts through Foreign Military Financing in the International Affairs Budget, rather than from within MDA. Alternatively, support to Israel could remain within the MDA budget, but congressional appropriators might carefully fence U.S. dollars to ensure that assistance for Israeli missile defense programs do not compete with dollars for American systems.

INCREASED RISK

The third path is simply to accept the problem, along with increased risk. This status quo approach would be more like the first option in terms of MDA's growing responsibilities, but without the increased topline proportionate to them. The likely consequence of such a path would be increased risk and increasing challenges to "outpace the threat."

Accepting increased risk is hardly a strategy at all, but there is no question that path could be taken. Indeed, one might say it already has been, as the result of failing to address the current trends and strains described above.

The serious choice therefore is between the first and second paths: either making MDA leaner and more focused or making it larger and more comprehensive. This choice hangs ultimately upon the question of its identity—its roles, missions, and relation to the Services. Either the first or second path may require topline increases to the missile defense efforts, whether in or out of MDA. At bottom, the squeeze on R&D is fundamentally about the overall topline allocated to missile defense efforts, wherever they are located.

The ballistic missile threats to the United States and its allies are not diminishing. In the coming years, North Korea could well enter into serial production of intercontinental ballistic missiles. Iran has also shown no sign of abandoning its long-range efforts. It could be quite difficult and costly to face significantly greater threats in, say, 2025, and attempt to catch up. Outpacing rather than chasing these threats will require continued stewardship of R&D, and of science and technology—what Secretary Carter has called the "seed corn"—and on ensuring that this effort is not squeezed out by necessary procurement and operations, or by rising foreign assistance demands.

When a new administration takes office in 2017, it will need to review the choices, priorities, and challenges facing MDA and the missile defense mission more broadly. The agency's charter was

last updated in 2009, and this too may require an update.[4] This review process could take place in the form of a successor to the 2010 *Ballistic Missile Defense Review*, or it might assume some other form. The identity of MDA and the several strains identified here should be key topics for consideration in such a review.

4. William J. Lynn III, *The Missile Defense Agency (MDA)*, DoD Directive 5134.09 (Washington, DC: Office of the Deputy Secretary of Defense, 2009), http://www.dtic.mil/whs/directives/corres/pdf/513409p.pdf.

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ISBN 978-1-4422-5965-2