

MAY 2017

A photograph of soldiers in a military vehicle, possibly an armored personnel carrier, with a large fire in the background. The soldiers are wearing helmets and camouflage uniforms. The vehicle has a mounted machine gun. The fire is bright orange and yellow, with many vertical flames. The sky is a pale blue.

# The Army Modernization Imperative

A New Big Five for the Twenty-First Century

PROJECT DIRECTOR  
Andrew Hunter

AUTHORS  
Rhys McCormick  
Andrew Hunter

CSIS

CENTER FOR STRATEGIC &  
INTERNATIONAL STUDIES

A Report of the  
CSIS DEFENSE-INDUSTRIAL INITIATIVES GROUP



MAY 2017

# The Army Modernization Imperative

A New Big Five for the  
Twenty-First Century

PROJECT DIRECTOR

Andrew Hunter

AUTHORS

Rhys McCormick  
Andrew Hunter

A REPORT OF THE  
CSIS DEFENSE-INDUSTRIAL INITIATIVES GROUP

**CSIS** | CENTER FOR STRATEGIC &  
INTERNATIONAL STUDIES

ROWMAN &  
LITTLEFIELD

Lanham • Boulder • New York • London

# About CSIS

For over 50 years, the Center for Strategic and International Studies (CSIS) has worked to develop solutions to the world's greatest policy challenges. Today, CSIS scholars are providing strategic insights and bipartisan policy solutions to help decisionmakers chart a course toward a better world.

CSIS is a nonprofit organization headquartered in Washington, D.C. The Center's 220 full-time staff and large network of affiliated scholars conduct research and analysis and develop policy initiatives that look into the future and anticipate change.

Founded at the height of the Cold War by David M. Abshire and Admiral Arleigh Burke, CSIS was dedicated to finding ways to sustain American prominence and prosperity as a force for good in the world. Since 1962, CSIS has become one of the world's preeminent international institutions focused on defense and security; regional stability; and transnational challenges ranging from energy and climate to global health and economic integration.

Thomas J. Pritzker was named chairman of the CSIS Board of Trustees in November 2015. Former U.S. deputy secretary of defense John J. Hamre has served as the Center's president and chief executive officer since 2000.

CSIS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely those of the author(s).

## Acknowledgments

This report was made possible by the generous support of General Dynamics, DRS Technologies, and L-3 Technologies.

© 2017 by the Center for Strategic and International Studies. All rights reserved.

ISBN: 978-1-4422-8015-1 (pb); 978-1-4422-8016-8 (eBook)

Center for Strategic & International Studies  
1616 Rhode Island Avenue, NW  
Washington, DC 20036  
202-887-0200 | [www.csis.org](http://www.csis.org)

Rowman & Littlefield  
4501 Forbes Boulevard  
Lanham, MD 20706  
301-459-3366 | [www.rowman.com](http://www.rowman.com)

# Contents

<b>iv</b>	List of Figures and Tables
<b>v</b>	Executive Summary
<b>1</b>	<b>CHAPTER 1</b>   Introduction
<b>3</b>	<b>CHAPTER 2</b>   Army Modernization Budget Outlook: The Army Modernization “Triple Whammy”
<b>13</b>	<b>CHAPTER 3</b>   Army Modernization Strategy Outlook: A Lack of Consensus about Priorities
<b>21</b>	<b>CHAPTER 4</b>   Today’s Geostrategic Environment
<b>38</b>	<b>CHAPTER 5</b>   Setting Priorities for the Future Army: Recommendations for Developing a New Army Modernization Strategy
<b>63</b>	<b>CHAPTER 6</b>   Conclusion
<b>66</b>	About the Authors

# List of Figures and Tables

## FIGURES

- 4** 2.1. Army Modernization Total Obligation Authority, 2008–2016
- 4** 2.2. Army Modernization Total Obligation Authority, 1951–2016
- 6** 2.3. Army Modernization TOA, Projected PB12 POM vs. Enacted TOA
- 6** 2.4. Army Procurement TOA, Projected PB12 POM vs. Enacted TOA
- 7** 2.5. Army RDT&E Total Obligation Authority, Projected 2012 FYDP vs. Actuals
- 8** 2.6. Canceled Army Acquisition Program Sunk Costs, 1995–2009
- 9** 2.7. Army RDT&E Total Obligation Authority, 1954–2021
- 10** 2.8. Army R&D Contract Obligations by Stage of R&D, 2000–2015
- 11** 2.9. Army Modernization Total Obligation Authority, 2015–2021
- 17** 3.1. PB 2017 POM, Army Procurement by Capability Portfolio
- 18** 3.2. PB 2017 POM, Army RDT&E by Capability Portfolio
- 25** 4.1. Russian IADS vs. NATO Strike Capabilities
- 28** 4.2. Russian Long-Range Strike Capabilities vs. NATO IAMD and PODs

## TABLES

- 5** 2.1. Comparison of Army Modernization Drawdowns
- 7** 2.2. Comparison of PB12 vs. Actual Enacted TOA (Constant FY17 \$ Billions)
- 16** 3.1. Competing Stated Army Modernization Priorities

# Executive Summary

The U.S. Army currently faces a difficult truth: without changes to its modernization strategy, the Army risks losing qualitative tactical overmatch. A lost procurement decade and recent, significant modernization funding declines have resulted in an Army inventory that remains heavily leveraged on the “Big Five” programs, originally procured in the 1970s and 1980s. Meanwhile, technology proliferation has made potential state and nonstate adversaries increasingly capable; shrinking the U.S. overmatch advantage and in some cases surpassing it. While current, and projected future Army modernization funding is below historical averages, necessitating increased modernization funding to ensure continued U.S. qualitative tactical overmatch, the Army’s modernization problem cannot be fixed only by increasing modernization funding. Additional funds also need to be accompanied by an updated Army modernization strategy that presents a compelling case for modernization funding and sets clear priorities for fulfilling future operational requirements.

The goal of delivering to the Army the key capabilities it needs is best accomplished by adopting an Army modernization strategy that adds capabilities to the Army’s large force of fielded systems across five major areas including: electronic warfare, air and missile defense, cross-domain fires, advanced protection, and logistics. These capabilities will require, and can further leverage, the Army’s substantial investment made in the last two decades in networking and situational awareness. The Army can obtain the fastest, most pervasive improvement in its force by progressively fielding these improvements in regular, sizable increments. In addition, the Army’s modernization strategy should explicitly set aside room in the Program Objective Memorandum (POM) for quickly developing, prototyping, and deploying capabilities in response to emerging threats and opportunities. Because the Army’s technology pipeline currently has serious gaps, some of these capabilities may need to leverage developments undertaken outside of the Army’s technology development process by adapting mature designs to meet the Army’s needs. Although this modernization strategy would not rule out some limited investment in efforts to develop new platforms, as many of the Army’s platforms will eventually need to be replaced, such investments should be undertaken only to the extent that they do not undermine the strategy’s central approach.

This report characterizes the context and nature of the Army's modernization challenge and recommends ways the Army can maximize the effectiveness of its modernization budget going forward. From this analysis, the study team identified the following key findings informing and recommendations for addressing the Army's modernization imperative.

## ARMY MODERNIZATION OUTLOOK FINDINGS

1. *The Army is experiencing a modernization triple-whammy.* Historic budget drawdowns, the failure of many programs in the Army's most recent modernization cycle, and unprecedented declines in research, development, test, and evaluation (RDT&E) have left the Army in a precarious position.
2. *Current Army modernization is insufficient and below historical averages.* The FY17 POM projects Army modernization funding that is approximately \$7 billion below its historical average and about \$9 billion below a conservative estimate of the average modernization funding level during periods of increasing budgets.
3. *Under current plans, there is little budget relief on the way.* Over the course of the Future Years Defense Program (FYDP), planned Army modernization funding remains just above the existing levels.
4. *Even if the Army could afford new platforms, the Army has limited options.* At the moment, the Army does not have any significant new platforms in the development pipeline. Additionally, notable failed acquisition programs such as the Future Combat System have hollowed out the Army's System Development and Demonstration (6.5) R&D accounts over the past six years.
5. *The current Army modernization strategy has these approaches:* accept increased risk, minimize new platform development, continue early-stage science and technology on select technologies, improve and/or sustain the existing inventory, and divest select platforms.
6. *A lack of consensus exists about the Army's top modernization priorities.* Whether it is the Army's stated priorities, the President's Budget (PB) 2017 POM, or anecdotal evidence from interviews, there is a lack of consensus and understanding of the Army's top modernization priorities across the broader defense enterprise.

## TODAY'S GEOSTRATEGIC ENVIRONMENT FINDINGS

1. *Today's geostrategic challenge is a kaleidoscope of challenges characterized not by a singular threat, but by a multitude of wide-ranging threats.* Challenges and threats include, but are certainly not limited to, the Islamic State of Iraq and Syria (ISIS) and similar Islamic extremist groups, China, Russia, North Korea, and increasingly sophisticated nonstate actors.
2. *Russia is the greatest pacing threat for the United States Army given operational challenges and the proliferation of Russian arms sales.* For the Army, the Russian threat currently presents the most stressing combination of Anti-Access/Area Denial (A2/AD-enabling) systems, advanced

ground combat capabilities, and nonkinetic effects. Additionally, the proclivity of Russian arms sales to regimes hostile to the United States means that likely future conflicts will involve some combination of Russian equipment and tactics, even if Russia itself is not directly involved.

3. *The Russians have either equaled or surpassed certain U.S. capabilities in A2/AD, ground combat, and nonkinetic operations necessitating additional Army investment.*
  - a. The Russian A2/AD CONOPS is a sophisticated, layered, redundant, multi-domain network that hinders the U.S. ability to project power in Europe and presents challenges to certain fundamental assumptions about the Army and its role in the joint force. In a potential future conflict with Russia, the Army will not necessarily be able to rely on the joint force to provide certain capabilities that the Army is dependent on. Instead, the Army will need to develop its own indigenous capabilities for operating in A2/AD environments.
  - b. Comparing ground combat capabilities, the United States retains a diminished lead in combat vehicles while the Russians have surpassed the U.S. in indirect fire capabilities. However, the American soldier remains the Army's asymmetric advantage over the Russians.
    - i. Comparing the Abrams and its Russian counterparts, the Abrams remains the better tank on paper, but logistical challenges make it difficult to realize the Abrams's full combat effectiveness in the European area of responsibility (AOR).
    - ii. Russian indirect fire capabilities today are superior to those of the United States. Comparing conventional artillery systems, the Russians not only outrange the United States, but can also fire at a greater rate. The capability gap between American and Russian rocket artillery is smaller than between conventional artillery, but Russian advantages in range and types of munitions outweigh the U.S. precision advantage.
  - c. Russian nonkinetic capabilities, particularly in electronic warfare (EW) and cyber operations, significantly outpace the limited current capabilities the U.S. Army could bring to a future conflict.

## SETTING PRIORITIES FOR THE FUTURE ARMY: RECOMMENDATIONS FOR DEVELOPING A NEW ARMY MODERNIZATION STRATEGY

Given the mismatch between threats, budgets, and the current Army modernization strategy, addressing the future security environment requires the Army to reevaluate its approach and devise a new modernization strategy. CSIS identified six overarching recommendations, each accompanied by more specific recommendations, to help guide this process.

### 1. Develop a Clearly Articulated, Focused Modernization Strategy

Senior Army leadership must develop an updated, clearly articulated, and focused modernization strategy that demonstrates and prioritizes development of the most important capabilities. The Army's

modernization strategy does not need to be inclusive of every capability, nor should it be. A focused modernization strategy does not preclude investments in other areas, it just ensures critical capabilities receive the necessary funds in an era of limited resources. The Army should use the ongoing Strategic Portfolio Analysis and Review (SPAR) to rebalance the Army modernization portfolio to reflect the newly developed modernization strategy.

## 2. Make Army Modernization a Higher Priority

To address the future security environment's challenges, Congress and the new presidential administration must make Army modernization a higher priority and increase funding to address gaps in Army capabilities. As shown by the study team's historical and POM analyses, remedying the Army's capability shortfalls is likely to require significantly increased funding. While the overall Army modernization topline is likely to increase under the new administration, a significant portion of that increase is likely to come from increased procurement spending to equip a force structure increase. As such, Army modernization requires not just an increase in the overall topline, but an increase in spending that addresses current capability gaps. Furthermore, simply attempting to shift the current level of funding around the entire Army modernization portfolio, discounting any increased funds for procurement associated with growing the size of the force, insufficiently addresses the current geostrategic threats, given that few "low-hanging fruits" remain and the Army's modernization portfolio is already stretched nearly as thin as possible.

As force structure grows, the Army should equip this force structure with fully modernized capabilities, rather than just piecing together older, on-hand equipment to fill out the force. For example, instead of procuring the current-generation Stryker variant, the Army should procure an upgraded Stryker model featuring mature technologies that have already been proven available, relevant, effective, and mature. Procuring existing variants extenuates existing capability shortfalls, as this approach consumes critical modernization funding without actually addressing current capability shortfalls.

## 3. Focus on Capability Gaps, Not Platforms

The Army is unlikely to have sufficient funding to invest in developing, testing, and procuring new platforms for the foreseeable future. Given funding limitations, the Army should not focus on specific platforms, but instead on crosscutting capabilities necessary for future conflicts. As previously mentioned, the Army cannot afford to modernize everything and should instead prioritize the most critical crosscutting capabilities it needs to fight tomorrow's fight. In the vein of General Creighton Abrams, CSIS recommends the Army prioritize the following five capabilities, as the "New Big Five for the Twenty-First Century":

- *Electronic Warfare*: On future battlefields, the Army needs to be capable of operating both offensively and defensively across the electromagnetic spectrum, yet Colonel Jeffery Church, chief of electronic warfare on the Army Staff, has described the EW portfolio as "empty." Neglect since the end of the Cold War has left the Army's EW capabilities critically behind those of potential adversaries. Furthermore, little relief is under way under current plans as current EW investment totals just 0.8 percent and 1.6 percent of the Army's procurement and RDT&E budgets, respectively, and leaves the Army without a new offensive jammer until 2023.

The Army should significantly increase EW funding in the coming years to not only accelerate production of new capabilities, but also to fund production of critical capacity indigenous to the Army.

- *Air and Missile Defense:* Given post–Cold War divestments and global technological trends, the U.S. Army lacks sufficient Air and Missile Defense capabilities, which should be a top five Army modernization priority. In particular, the Army’s nearly completely lacks Short-Range Air Defense capabilities within the Brigade Combat Team and should prioritize Indirect Fire Protection Capability Increment 2 development. Additionally, potential improvements such as Integrated Air and Missile Defense Battle Command System development and a new interceptor loading system would significantly improve the PATRIOT missile defense system capabilities.
- *Cross-Domain Fires:* Given the trends in the future operational environment, the Army needs to invest in cross-domain fires, or “lethal and non-lethal effects against targets in all domains (air, land, sea, cyber, and space) at increased range, with greater effect, and in spite of attempts to disrupt cyber, electromagnetic spectrum, or space systems.”<sup>1</sup> This encompasses investments in improvements to existing systems, such as was done with the Army Tactical Missile System, and the investment in new capabilities that include, but are not limited to, Anti-Tank Guided Missiles, Multiple Launch Rocket System warhead variants, and nonkinetic effects in the cyber, space, and electromagnetic domains.
- *Advanced Protection:* The rapid proliferation of advanced munitions such as advanced rocket-propelled grenades and anti-tank guided munitions by both state and nonstate actors threatens to outpace U.S. defensive capabilities barring investment in advanced protection systems. The Army should prioritize procurement of operationally usable active protection systems to address immediate capability gaps, while over the long term, work toward developing indigenous capabilities.
- *Logistics:* Logistics, while not glamorous, offers the Army some of largest potential to improve on capability and lower operational costs in return for its investment, given recent commercial-sector advances in autonomous and semi-autonomous driving assist kits, 3-D printing, unmanned vehicles, nanotechnology, and robotics. Investments in logistics bring not just increased fuel-efficiency, but actual increases in military effectiveness given future operational necessity and the benefits that come from reduced operational risks and potential rebalances to the composition of Total Army.

#### 4. Make Army Acquisition More Agile by Focusing on Continuous Innovation

The history of military innovation demonstrates that most successful innovations are not the result of revolutionary scientific advances but a continuous, evolutionary process. However, Army acquisition efforts since the 1990s have focused mostly on developing “leap-ahead” technologies such as Future Combat System that ended in failure. Rather than shooting for leap-ahead technologies, the

---

1. Army Capabilities Integration Center, *The Urgency of Modernization (draft)* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2016).

Army should instead focus its acquisition efforts on progressively fielding capability improvements in regular, sizable increments as new technologies and systems prove available, relevant, effective, and mature. When combined and iteratively upgraded, these progressively fielded capability improvements can potentially prove revolutionary, while simultaneously more rapidly delivering critical capabilities to the warfighter.

## 5. Ensure Room for Newly Emerging Opportunities and Challenges

The pace of technological advancement and the rapidly changing global security environment necessitate that the Army's budget and acquisition processes accommodate newly emerging challenges and opportunities. By leaving room in the budget, continuing efforts like the Army Rapid Capabilities Office, and finding ways to better reward and incentivize industry innovation, the Army can respond to emerging geopolitical and technological changes more rapidly than the traditional acquisition process permits.

## 6. Align Human Capital with Updated Modernization Strategy

Implementing an updated Army modernization strategy requires ensuring the Army's human capital aligns with the updated strategy. Without properly aligned human capital, an updated modernization strategy provides little value to the warfighter. The Army needs to ensure that it retains not only the acquisition officials and "thought leaders" who will help implement these recommendations, but also ensure the force writ large possesses the knowledge, skills, and experience necessary to operate future technological advances.

# Introduction

The Army currently faces a difficult truth: without changes to its modernization strategy, the Army risks losing qualitative tactical overmatch. A lost procurement decade and recent significant modernization funding declines have resulted in an Army inventory that remains heavily leveraged on the “Big Five” programs originally procured in the 1970s and 1980s. Meanwhile, technology proliferation has made potential state and nonstate adversaries increasingly capable, shrinking the U.S. overmatch advantage and in some cases surpassing it. Lieutenant General H. R. McMaster, then Director, Army Capabilities Integration Center (ARCIC) and Deputy Commanding General, Futures, U.S. Army Training and Doctrine Command (TRADOC), warned in April 2016 testimony before the Senate Armed Services Committee (SASC) Airland subcommittee that the Army is “outranged and outgunned by many potential adversaries.”<sup>1</sup> While there is far more to success in land combat than the range and size of artillery and other guns, it is nonetheless significant that U.S. overmatch has been so eroded. This situation emboldens potential aggressors and undermines the confidence of allies that the United States will be fully willing and able to follow through on its security commitments in the future.

Ensuring continued U.S. qualitative tactical overmatch cannot be fixed by simply increasing modernization funding. While increased modernization funding is necessary to address this challenge, additional funds needs to be accompanied by an updated Army modernization strategy that presents a compelling case for modernization funding by setting clear priorities for fulfilling future operational requirements. A well-prioritized, flexible modernization strategy is essential in a time when the nature of land warfare appears to be changing, as is the case today. And if the “fundamental change in the character of ground warfare” that Army senior leaders

---

1. Sydney J. Freedberg, “McMaster: Army May Be Outnumbered and Outgunned in Next War,” *Breaking Defense*, April 6, 2016, <http://breakingdefense.com/2016/04/mcmaster-army-may-be-outnumbered-and-outgunned-in-next-war/>.

believe to be imminent proves true, the importance of updating the Army's modernization strategy only increases.<sup>2</sup>

## SCOPE AND OBJECTIVES

This report seeks to characterize the context and nature of the Army's modernization challenge and recommend ways the Army can maximize the effectiveness of its modernization budget going forward. Over the course of 2016, the CSIS study team conducted this research, hosting a series of working groups in Washington, DC, to discuss how the Army can address today's challenges and prepare for future missions through strategic use of modernization funding. Participants included experts from across the Army, other parts of government, industry, and other defense community experts. In addition, CSIS analyzed the history of Army modernization budgets to evaluate what it takes to achieve modernization in the Army and to determine how today's budget compares to past efforts. CSIS also analyzed the Army Program Objective Memorandum (POM) to determine what priorities the current budget establishes. It is clear from this analysis that there are serious gaps in modernization funding, particularly in the research and development funding required to design and develop new systems. The study team believes that making the case for this additional funding requires a clear and compelling modernization strategy for the Army, and that such a strategy is best articulated in terms of the critical technologies required to achieve overmatch and how they can be proliferated throughout the force, rather than in terms of individual Army platforms. This approach is not meant to imply that platform development is completely unnecessary, but rather to clearly prioritize modernization funding on meeting the Army's future operational requirements in both the near and far term in a changing security environment.

This report is organized into the following chapters:

*Chapter 2: Army Modernization Budget Outlook: The Army Modernization "Triple Whammy,"* characterizes the context and nature of the Army's modernization challenge, beginning with an assessment of the Army's modernization budget and the impact of the recent defense drawdown.

*Chapter 3: Army Modernization Strategy Outlook: A Lack of Consensus about Priorities,* assesses the Army's current modernization strategy and how it prioritizes future investment and divestments.

*Chapter 4: Today's Geostrategic Environment,* analyzes the global threats currently pacing Army modernization efforts. It provides a comparison of current relative Russian and U.S. Army capabilities as a means of guiding changes to the Army's modernization strategy.

*Chapter 5: Setting Priorities for the Future Army: Recommendations for Developing a New Army Modernization Strategy,* provides both specific capability recommendations and recommendations to the Army acquisition system necessary to better foster access to emerging innovations.

*Chapter 6: Conclusion,* summarizes the report's findings and recommendations and provides final thoughts on Army modernization.

---

2. Michelle Tan, "Army Leaders: Service Must Look to the Future While Training for Today," *Defense News*, October 3, 2016, <http://www.defensenews.com/articles/army-leaders-service-must-look-to-the-future-while-training-to-fight-today>.

# Army Modernization Budget Outlook: The Army Modernization “Triple Whammy”

The following sections characterize the context and nature of the Army’s modernization challenge beginning with an assessment of the Army’s modernization budget and the impact of the recent defense drawdown. The chapter concludes by assessing the Army’s current modernization strategy and how that strategy prioritizes future investment and divestments.

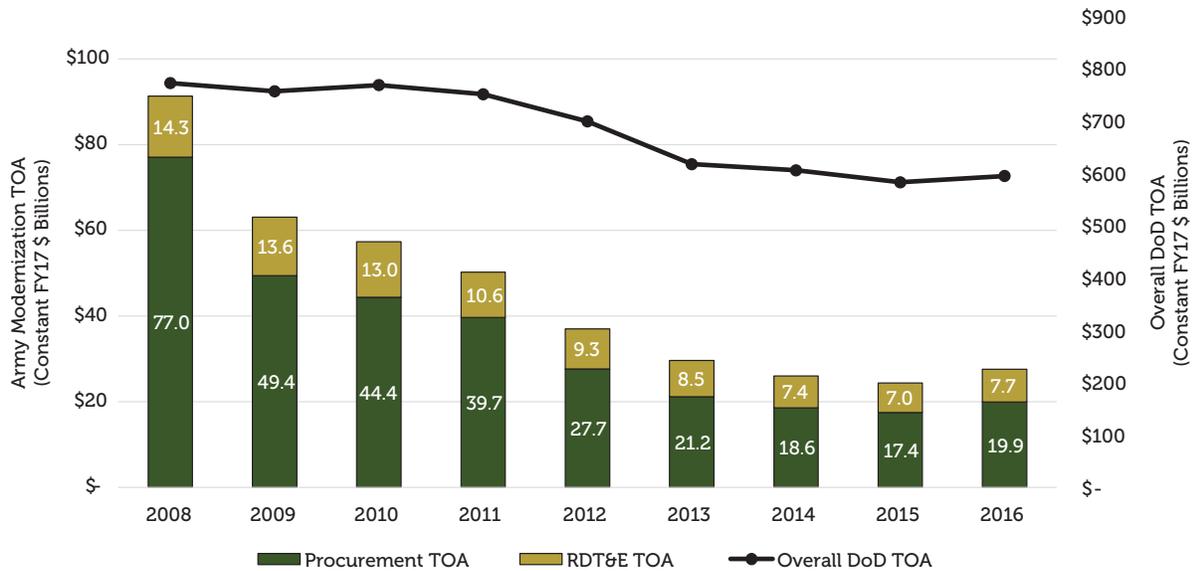
While the international security environment experienced fundamental changes in recent years, the Army modernization budget has simultaneously declined significantly. As the overall Department of Defense (DoD) budget fell by \$177 billion (a 23 percent decline) between 2008 and 2016, Army modernization (procurement plus RDT&E) total obligation authority (TOA) declined by 70 percent over that same period as the Army elected to protect readiness and force structure. Historically, the Army spends, on average, 21 percent of its overall yearly budget on modernization activities. During the most recent drawdown, as a share of the overall Army budget, modernization fell from 31 percent in 2008 to 18 percent in 2016. Figure 2.1 shows the decline in the overall DoD TOA and Army modernization TOA between Fiscal Year (FY) 2008 and FY 2016.

As shown in Figure 2.2, the current Army modernization drawdown follows the historical trend of sharp reductions to the modernization budget following a period of growth. Additionally, current Army modernization funding is approximately \$7 billion below its historical average and about \$9 billion below a conservative estimate of the average modernization funding level during periods of increasing budgets. However, previous CSIS analysis discovered that instead of following historical trends, “This most recent Army modernization drawdown is a triple whammy for the Army; not only have they taken a larger percentage cut than previous cuts, but those two previous drawdowns came after the Army had already modernized much of the force.”<sup>1</sup> Table 2.1 shares the comparison of Army modernization drawdowns.

---

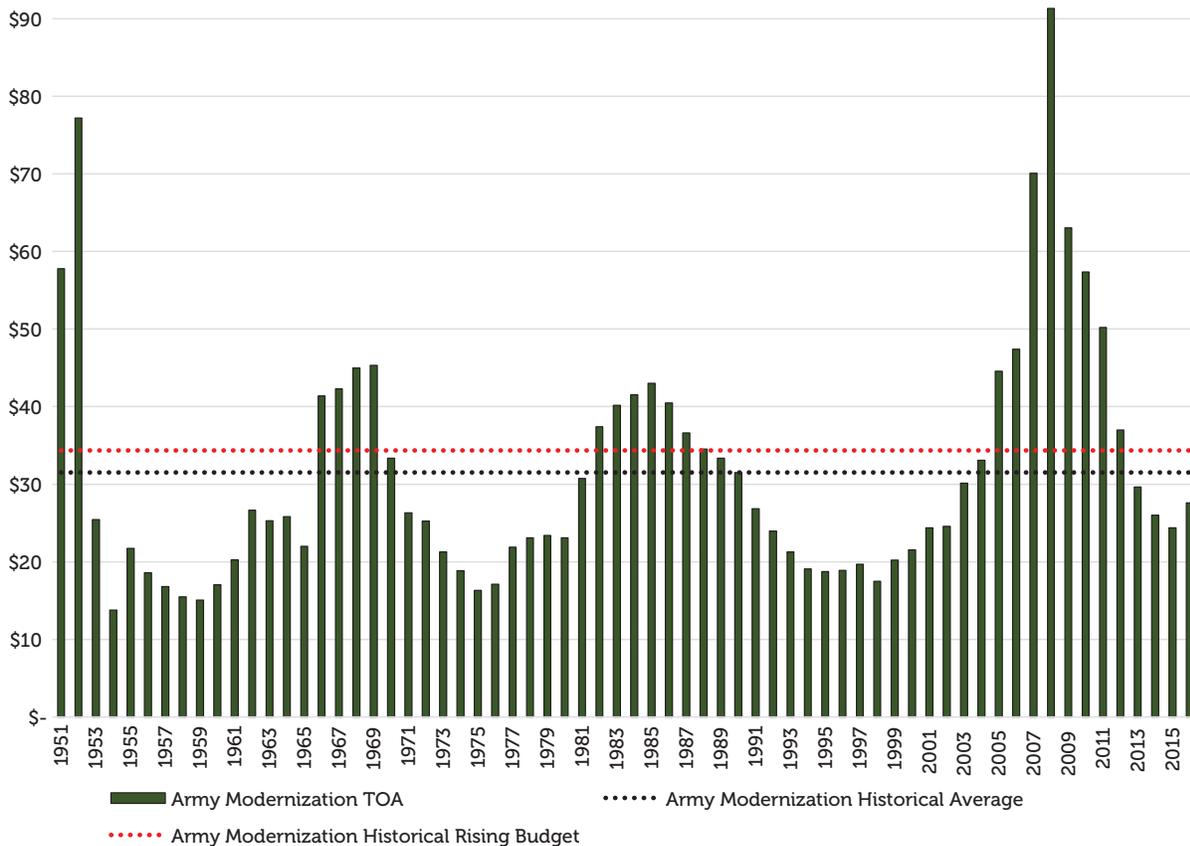
1. Rhys McCormick, “The Army Modernization Challenge: A Historical Perspective,” CSIS Defense 360, March 2016, <http://defense360.csis.org/army-modernization-challenge-historical-perspective-2/>.

**Figure 2.1. Army Modernization Total Obligation Authority, 2008–2016**



Source: Department of Defense, "National Defense Budget Estimates for Fiscal Year 2017 (Green Book)," Office of the Undersecretary of Defense (Comptroller), March 2016; CSIS analysis

**Figure 2.2. Army Modernization Total Obligation Authority, 1951–2016**



Source: Department of Defense, "National Defense Budget Estimates for Fiscal Year 2017 (Green Book)"; CSIS analysis.

**Table 2.1. Comparison of Army Modernization Drawdowns**

	Procurement	RDT&E	Total Army Modernization
Drawdown 1: 1969–1975	–74%	–29%	–64%
Drawdown 2: 1985–1998	–70%	–17%	–59%
Drawdown 3: 2008–2015	–78%	–52%	–74%

Source: McCormick, “The Army Modernization Challenge: A Historical Perspective.”

The following sections expand on this initial analysis by exploring the deeper data trends within each of the three whammies. This analysis looks at the effect of the 2011 Budget Control Act on the sharp reductions to the Army modernization accounts, the costs of the lost procurement decade, and RDT&E trends beyond the topline. Finally, it concludes by looking at planned future Army modernization budgets to include an assessment of what might happen with Army modernization in the new presidential administration.

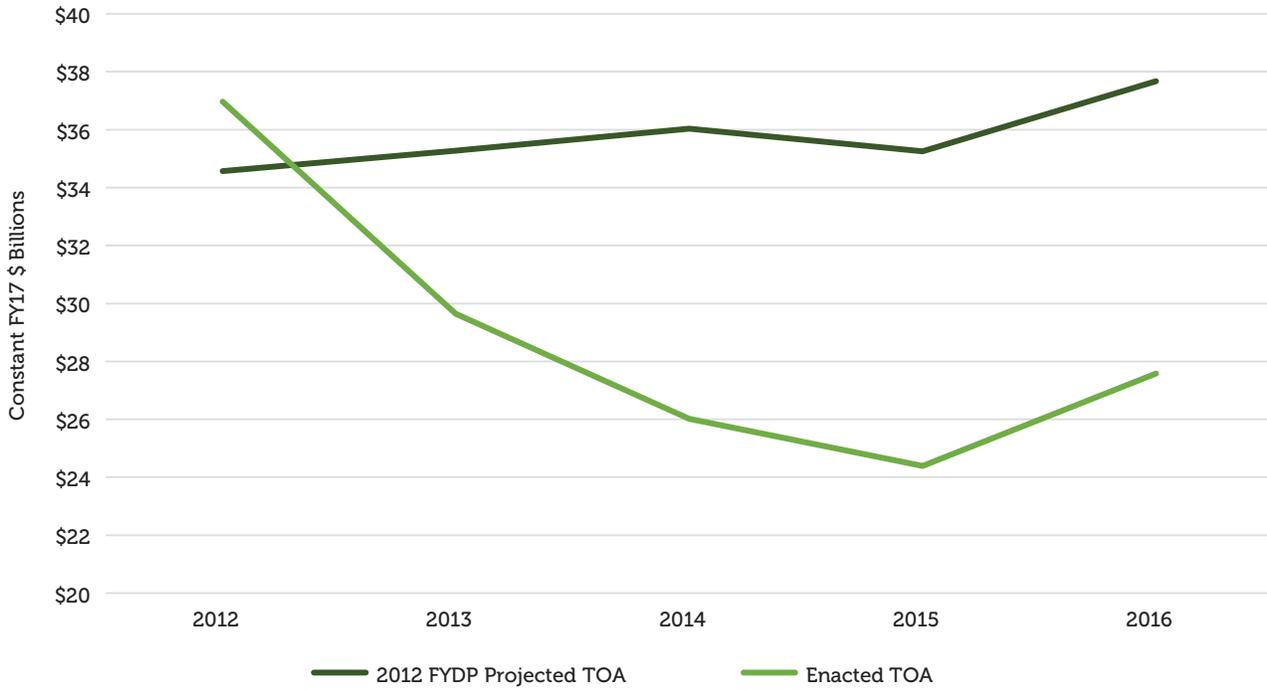
## WHAMMY ONE: RECENT DRAWDOWN LARGER THAN PREVIOUS DRAWDOWNS

As compared to the previous drawdowns, this most recent Army modernization drawdown was larger than historical averages. With the wars in Afghanistan and Iraq winding down, declines in Army modernization funding were to be expected, but the 78 percent decline was larger than expected. Why, then, did the Army modernization decline more significantly than expected? One of the significant drivers of decreases in Army modernization funding was the 2011 Budget Control Act (BCA), which imposed limits on defense spending beginning in FY 2013. The following sections explore the impact of the 2011 BCA on Army modernization by comparing the POM projections in the FY 2012 President’s Budget (PB) and what was appropriated in those years.

When the 2011 BCA caps went into place the Army made a deliberate choice to sacrifice and take risks in modernization accounts in order to preserve force structure and readiness. Figure 2.3 shows the difference in Army Modernization TOA between projected POM in the President’s Budget for FY 2012 (2012–2016), the last defense budget submission prior to the enactment of the 2011 BCA caps, and the actual TOA enacted in those years. The gap between PB12’s Future Years Defense Program (FYDP) and actual enacted TOA totaled \$34.22 billion in constant FY 2017 dollars, a 19 percent shortfall.

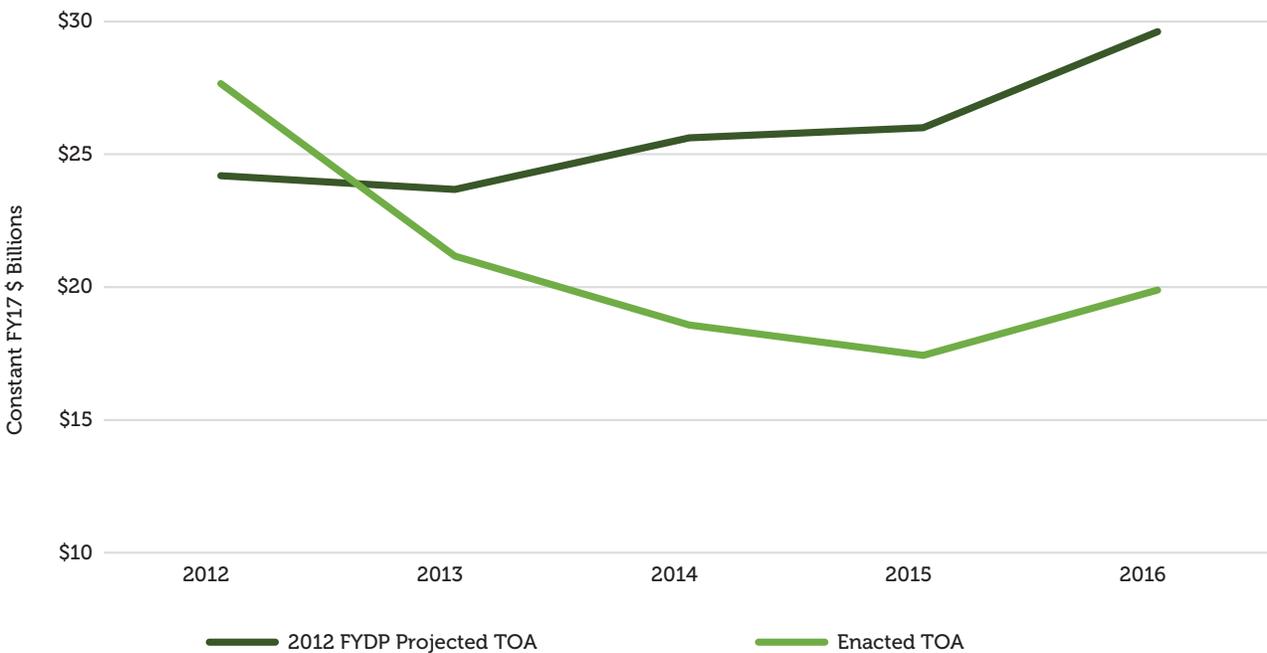
Figure 2.4 shows the difference in Army Procurement TOA between PB12’s FYDP projection and actual appropriations. The gap between PB12’s projections and enacted TOA totaled –\$24.35 billion, 19 percent less than planned. Figure 2.5 shows the difference in Army Modernization

**Figure 2.3. Army Modernization TOA, Projected PB12 POM vs. Enacted TOA**



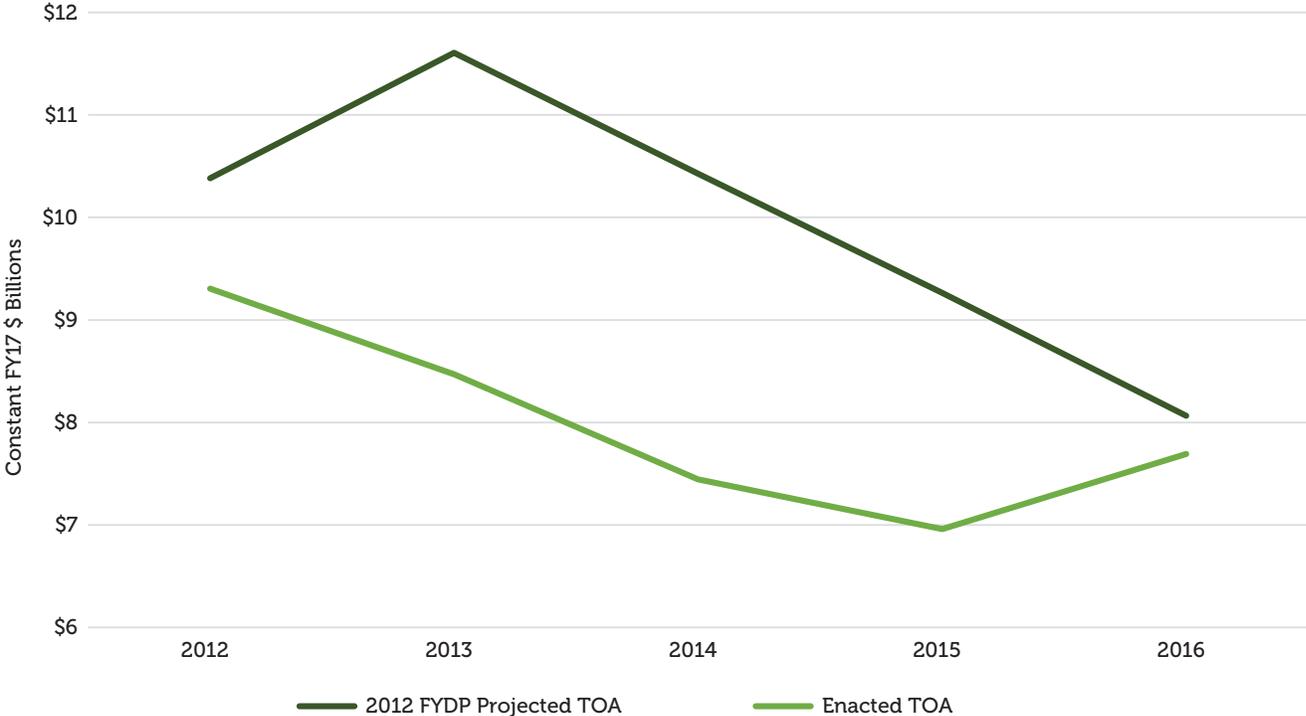
Source: Department of Defense, "National Defense Budget Estimates for Fiscal Year 2012 (Green Book)," Office of the Undersecretary of Defense (Comptroller), March 2011; Department of Defense, "National Defense Budget Estimates for Fiscal Year 2017 (Green Book)"; CSIS analysis.

**Figure 2.4. Army Procurement TOA, Projected PB12 POM vs. Enacted TOA**



Source: Department of Defense, "National Defense Budget Estimates for Fiscal Year 2012 (Green Book)"; Department of Defense, "National Defense Budget Estimates for Fiscal Year 2017 (Green Book)"; CSIS analysis.

**Figure 2.5. Army RDT&E Total Obligation Authority, Projected 2012 FYDP vs. Actuals**



Source: Department of Defense, “National Defense Budget Estimates for Fiscal Year 2012 (Green Book)”; Department of Defense, “National Defense Budget Estimates for Fiscal Year 2017 (Green Book)”; CSIS analysis.

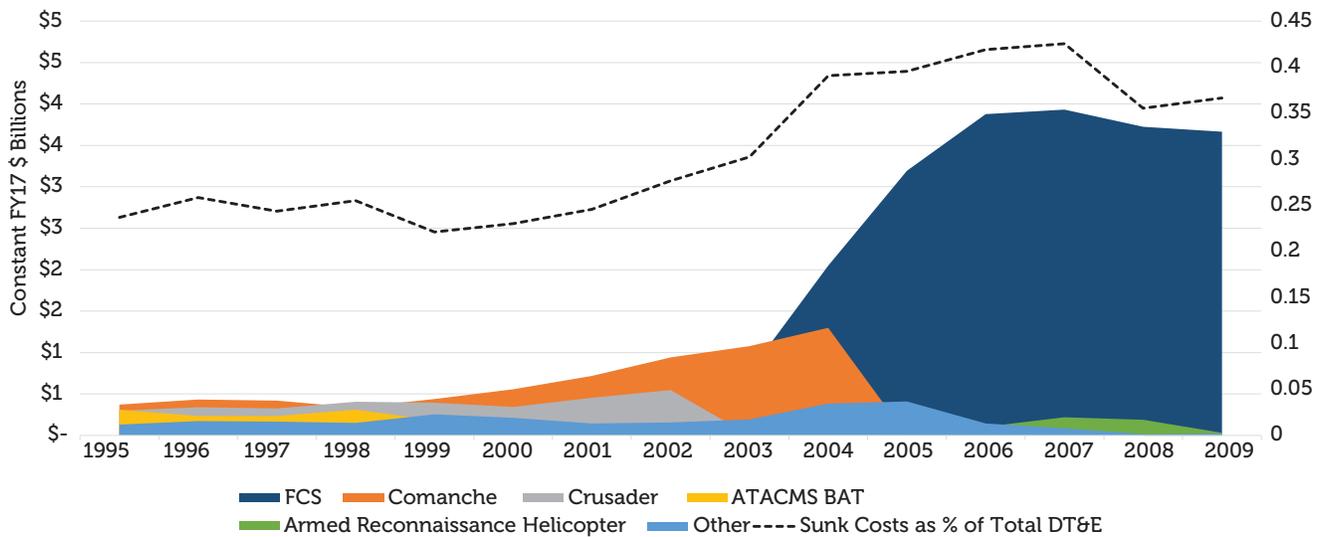
**Table 2.2. Comparison of PB12 vs. Actual Enacted TOA (Constant FY17 \$ Billions)**

	PB12 Sum	Enacted TOA Sum	Difference	Percent Difference
Army Modernization Topline	\$178.8	\$144.6	-\$34.2	-19%
Army Procurement	\$129.1	\$104.7	-\$24.4	-19%
Army RDT&E	\$49.7	\$39.9	-\$9.9	-20%

Note: Numbers may not add up due to rounding.

TOA between PB12’s projected FYDP (2012–2016) and the actual TOA enacted in those years. Instead of the planned \$49.74 billion RDT&E TOA in PB12, actual TOA enacted between 2012 and 2016 totaled just \$39.87 billion, a 20 percent difference. Table 2.2 summarizes the differences between the Army’s projected PB12 POM Modernization TOA and the TOA enacted in those years.

**Figure 2.6. Canceled Army Acquisition Program Sunk Costs, 1995–2009**



Source: Secretary of the Army, *Army Strong: Equipped, Trained, and Ready, Final Report of the 2010 Army Acquisition Review* (Washington, DC: Department of the Army, 2011), <http://breakingdefense.sites.breakingmedia.com/wp-content/uploads/sites/3/2011/07/213465.pdf>.

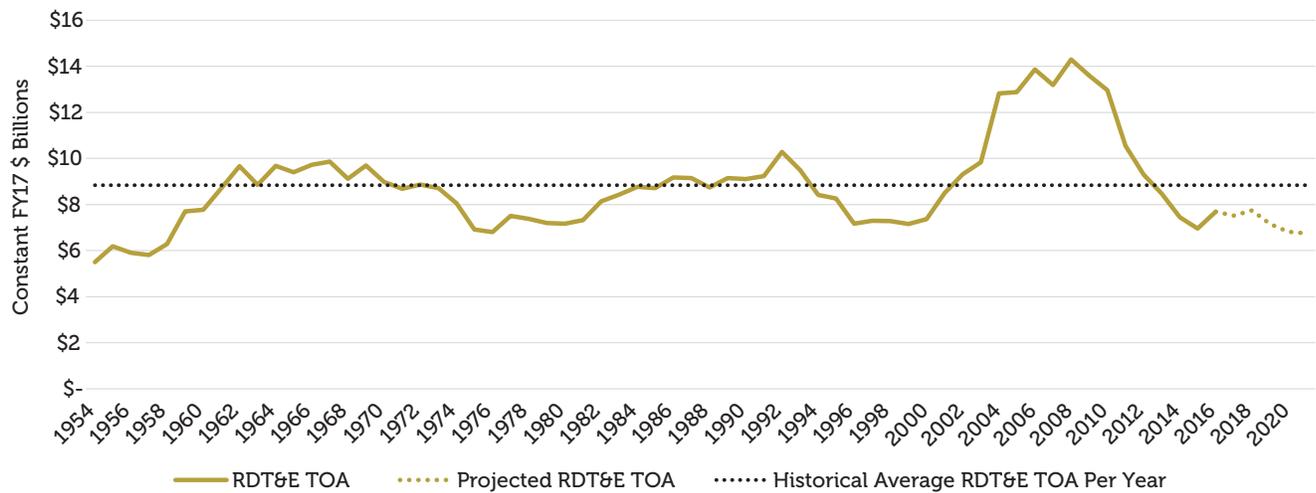
## WHAMMY TWO: PREVIOUS DRAWDOWNS CAME AFTER ARMY HAD ALREADY MODERNIZED

Historically, Army modernization has declined after most of the force had already been modernized. Prior to the 1969–1975 drawdown, the Army had mostly finished modernizing in accordance with the new flexible response doctrine. In the 1980s, the Army had already largely completed development and procurement of the “Big Five” systems—M1 Abrams, M2 Bradley, Apache AH-64 Helicopter, UH-60 Black Hawk Helicopter, and the Phased Array Tracking Radar for Intercept on Target (PATRIOT) missile system. However, the most recent drawdown followed a “lost Army modernization decade” in which several major defense acquisition programs were canceled during development. While the Army did procure some new systems, such as Stryker, Mine-Resistant Ambush-Protected Vehicles (MRAP), and Gray Eagle, over this period, most of its top-priority, high-profile programs ended in failure. Infamous programs that were ultimately canceled include: Future Combat System (FCS), RAH-66 Comanche Armed Reconnaissance and Attack Helicopter, XM2001 Crusader Self-Propelled Howitzer, and the Armed Reconnaissance Helicopter. Figure 2.6 shows the sunk costs of failed Army Acquisition Category (ACAT) I acquisition programs between 1995 and 2009.

Between 1995 and 2009, the Army spent a total of \$36 billion, or 33 percent of its development, test, and evaluation (DT&E) funding, on modernization programs that were ultimately canceled.<sup>2</sup> Between 2004 and 2009, the Army spent somewhere between 36 percent and 42 percent of its annual DT&E funding on acquisition programs that were later canceled. Since 2009, the Army’s acquisition system has continued to encounter problems in investing substantial sums of funding

2. DT&E is defined as the RDT&E minus Science and Technology (S&T) activities.

**Figure 2.7. Army RDT&E Total Obligation Authority, 1954–2021**



Source: Department of Defense, “National Defense Budget Estimates for Fiscal Year 2017 (Green Book)”; CSIS analysis.

on programs later canceled, as in the case of the Ground Combat Vehicle (GCV). Before Secretary of Defense Chuck Hagel canceled GCV in 2014 because the vehicle was “too heavy and too expensive,” the Army spent more than \$1.2 billion on the program.<sup>3</sup> Though it was better to cancel GCV prior to production given the vehicle’s problems, the \$1.2 billion spent on the program represents a considerable opportunity cost that could have been expended on other modernization efforts.

## WHAMMY THREE: ARMY RDT&E TRENDS BEYOND THE TOPLINE

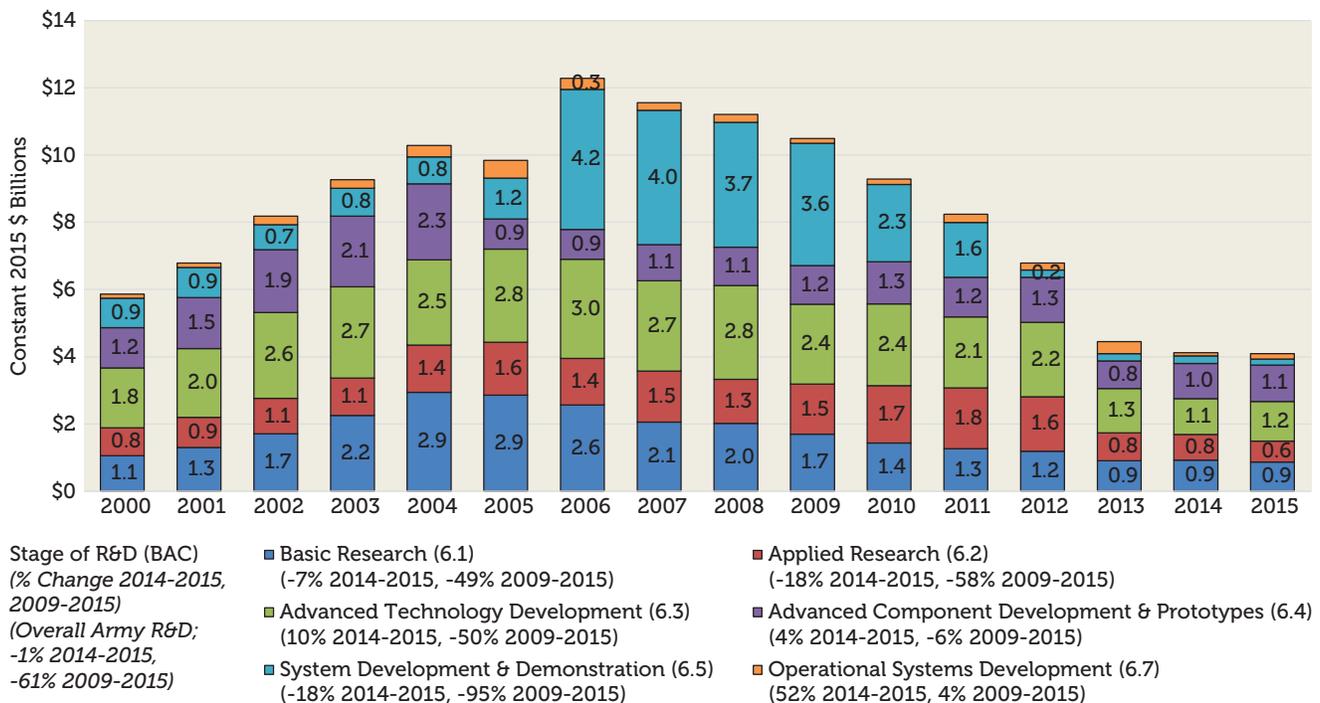
As discussed previously, during the most recent defense drawdown Army RDT&E TOA fell at rates unseen during the previous defense drawdown. However, there are other potentially worrisome Army RDT&E trends beyond the topline numbers.

As shown in Figure 2.7, under current plans, Army RDT&E is likely to remain below historic averages for the foreseeable future. Over the FYDP, the Army projects it will spend \$7.2 billion per year on RDT&E, around \$1.6 billion less than historical averages. This decreased RDT&E funding will not just be felt in the immediate future, but will only continue to reverberate well into the future.

The second potentially problematic RDT&E trend occurs in the Army’s R&D contracting portfolio. Between 2009 and 2015, Army contract obligations for R&D have declined by 61 percent, notably

3. Sebastian Sprenger, “Combat Vehicle Axing Adds to Army’s List of Programs That Went Nowhere,” *Inside Defense*, February 26, 2014, <https://insidedefense.com/inside-pentagon/combat-vehicle-axing-adds-armys-list-programs-went-nowhere>.

**Figure 2.8. Army R&D Contract Obligations by Stage of R&D, 2000–2015**



Source: Federal Procurement Data System (FPDS), [https://www.fpds.gov/fpdsng\\_cms/index.php/en/](https://www.fpds.gov/fpdsng_cms/index.php/en/); CSIS analysis.

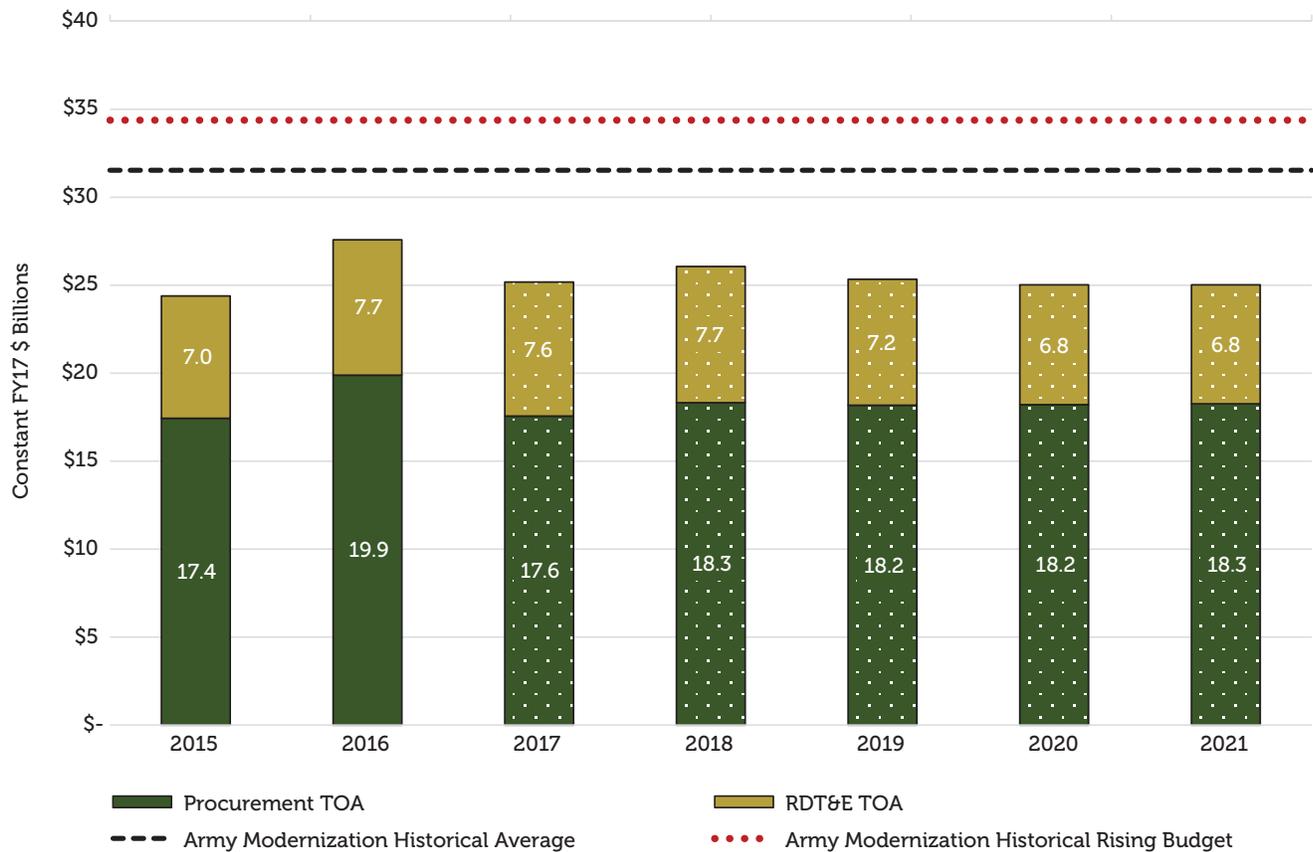
more steeply than the rate of decline for overall DoD R&D (-53 percent) over that same period. While the Army saw steep declines across most of the stages of R&D, the most notable decline is the virtual disappearance of obligations for System Development and Demonstration (SDD) (6.5); since 2009, contract obligations for SDD have plummeted by 95 percent. The initial decline in SDD contract obligations between 2009 and 2012 was the cancellation, and subsequent winding down, of the Army's failed FCS program. Since then, however, the planned follow-on to FCS, the GCV, failed in the planning stages, and the Army has struggled to define what it wants and needs in a new ground vehicle program, let alone get one into development. As a result of this failure to start and sustain new development programs, the Army finds itself in the midst of a six-year trough in its development pipeline for major weapons systems; with continued uncertainty over budgets and Army priorities, this trough seems likely to continue for the foreseeable future. Figure 2.8 shows Army R&D contract obligations by stage of R&D.

## FUTURE ARMY MODERNIZATION BUDGETS

Unfortunately for the Army, under current plans, modernization budget relief is not on the way. Figure 2.9 shows Army modernization TOA 2015–2016 and projected Army modernization TOA through the end of the FYDP.

In FY 2016, the Army modernization drawdown temporarily reversed as overall Army modernization TOA actually increased by \$3.2 billion compared to the previous year. In FY 2016, procurement TOA

**Figure 2.9. Army Modernization Total Obligation Authority, 2015–2021**



Source: Department of Defense, “National Defense Budget Estimates for Fiscal Year 2017 (Green Book)”; U.S. Army, “FY2017 President Budget’s Highlights,” Office of the Assistant Secretary of the Army (Financial Management and Comptroller), February 2016; CSIS analysis.

grew 14 percent, a \$2.5 billion increase over FY 2015. Meanwhile, Army RDT&E TOA grew by \$0.7 billion, an 11 percent increase.

However, FY 2016 does not necessarily represent a long-term reversal for Army modernization funding, as the budget is slated to decrease once again in FY17 before remaining relatively flat over the remainder of the FYDP. Over the FYDP, the Army expects to spend an average of \$25.3 billion each on Army modernization—a figure just above FY 2015 levels.

### Army Modernization Budgets in the New Administration

Much remains unknown about the specific details of the new administration’s defense policy, but increases to the Army’s budget and force structure seem likely. Throughout the campaign, the president-elect called for growing the size of the active Army to 540,000 from around 475,000 today.<sup>4</sup> However, what an increase of that size means for Army modernization fortunes remains unclear.

4. Leo Shane III and Andrew Tilghman, “Trump’s Military Will Have More Troops and More Firepower—If He Can Find the Money,” *Military Times*, November 20, 2016, <http://www.militarytimes.com/articles/donald-trump-military-spending>.

Implementing an increase of that size requires creating new brigades rather than sticking them into existing brigades.<sup>5</sup> The Army can likely equip portions of these new brigades with existing equipment in the inventory and warehouses, but will still need to buy some amount of new platforms and equipment to support the increased force structure. The question for Army modernization is: What does the Army buy? Does the Army procure more of models already in the inventory, or instead procure “modern” variants of existing platforms?

Should the Army and Congress choose to equip an increased Army force structure with legacy equipment, they risk further exacerbating existing problematic trends. Under this approach, the Army will be larger, but only further underinvested. By procuring legacy equipment, the Army only further exacerbates existing capability shortfalls, leaving continued U.S. tactical overmatch in question. The question for the Army and Congress is how to balance force structure increases with modernization investments (such as the New Big Five capabilities discussed in Chapter 5) that address capability shortfalls resulting in capability gains. Finding this proper balance between force structure increases and modernization will be a delicate balancing act for the Army and Congress, who should be prepared to potentially sacrifice some desired force structure increases for modernization funding.

## ARMY MODERNIZATION BUDGET OUTLOOK FINDINGS

1. *The Army is experiencing a modernization triple whammy.* Historic budget drawdowns, the failure of many programs in the Army’s most recent modernization cycle, and unprecedented declines in RDT&E have left the Army in a precarious position.
2. *Current Army modernization is insufficient and below historical averages.* The FY17 POM projects Army modernization funding that is approximately \$7 billion below its historical average and about \$9 billion below a conservative estimate of the average modernization funding level during periods of increasing budgets.
3. *Under current plans, there is little budget relief on the way.* Over the course of the FYDP, planned Army modernization funding remains just above the existing levels.
4. *Even if the Army could afford new platforms, it has limited options.* At the moment, the Army does not have any significant new platforms in the development pipeline. Additionally, notable failed acquisition programs such as FCS have hollowed out the Army’s SDD (6.5) R&D accounts over the past six years.

---

5. Courtney McBride, “Proposal to Boost Army Active End Strength Could Cost ‘Billions,’” *Inside Defense*, November 21, 2016, <http://insidedefense.com/daily-news/proposal-boost-army-active-end-strength-could-cost-billions>.

# Army Modernization Strategy Outlook: A Lack of Consensus about Priorities

Given the unlikelihood of significant Army modernization budget increases in the next few years, it is necessary that the Army's modernization strategy prioritize a small number of the most vital capabilities. With a large number of capability gaps and limited funding, the Army cannot afford to address every shortfall. The following sections present analysis of the Army's current modernization strategy and what that strategy says about the Army's priorities for continued technology investment and areas of divestment.

## THE CURRENT ARMY MODERNIZATION STRATEGY

The Army's current modernization strategy, as executed over the past few years, has been to accept increased risk, minimize new platform development, continue early-stage science and technology investments on select technologies, improve and/or sustain the existing inventory, and divest select platforms.<sup>1</sup> This approach is built on knowingly accepting increased modernization risk in the mid and long term.<sup>2</sup> During the most recent drawdown, the Army prioritized readiness and force structure over modernization. Reductions in the Army modernization accounts were therefore magnified, which resulted in the reduction of many Army modernization programs to

---

1. The Army calls this approach Protect, Invest, Modernize, Sustain, Divest. See U.S. Department of Defense, Department of the Army, *Army Equipment Program in Support of President's Budget 2017* (Washington, DC: Department of Defense, 2016), 2, [http://www.defenseinnovationmarketplace.mil/resources/Army\\_Equipment\\_Program2017.pdf](http://www.defenseinnovationmarketplace.mil/resources/Army_Equipment_Program2017.pdf).

2. *Military Services Challenges Meeting Readiness, Modernization, and Manning under Current Budget Limits: Hearing before the Senate Committee on Armed Services*, 114th Cong., 2nd sess. (2016) (statement of Chief of Staff of the United States Army General Mark A. Milley), 6, [http://www.armed-services.senate.gov/imo/media/doc/Milley\\_09-15-16.pdf](http://www.armed-services.senate.gov/imo/media/doc/Milley_09-15-16.pdf).

levels well below economic production rates, to near or below minimum sustaining rates.<sup>3</sup> The Army consciously chose this path, seeking to preserve the option to invest in these capabilities if future budgets improved, as demonstrated by the following excerpt from the Army's description of its equipment program for 2016:

The majority of the impact of the decrements in the PB 16 budget is to large programs that can absorb the decrement without breaking—allowing the ability to buy back schedule and quantities in the future. Some mitigation efforts include: slow engineering change proposals for Abrams and Bradley combat vehicles; slow procurement and fielding for Patriot modernization; and adjust Warfighter Information Network–Tactical (WIN-T) fielding quantities.<sup>4</sup>

Projecting forward, modernization is likely to remain a lesser priority than force structure and readiness. According to General Mark A. Milley, the current Chief of Staff of the United States Army (CSA), it will take the Army four years to meet its readiness goals, which will remain the top Army priority until sufficient readiness levels are restored.<sup>5</sup> Force structure is likely to remain a priority above modernization given the interest in increasing the size of the Army from Congress and the new presidential administration.<sup>6</sup>

Rather than develop new platforms, the current Army modernization strategy seeks to sustain or selectively modernize existing systems for the foreseeable future. The Army is pursuing this approach both because it cannot afford development of new platforms—given the constraints of the Budget Control Act of 2011 and the absence of new platform designs due to the pipeline trough—and in order to protect basic science and technology (S&T) funding. For the few new programs potentially set to begin in the next few years, such as the Mobile Protected Firepower vehicle (MPF) and Lightweight Reconnaissance Vehicle (LRV), the Army is focusing requirements on mature designs procured over long duration. Selective modernization of existing systems is taking both the form of incremental upgrades of existing capabilities, such as in the case of the Army aviation helicopter fleet, but also by finding new ways to use existing capabilities.<sup>7</sup> Low production rates ensure that deployment of upgraded equipment is prolonged over decades.

---

3. For example, the committee report accompanying the FY15 National Defense Authorization Act (NDAA) cites a two-year production gap in the Army's budget request for the Family of Medium Tactical Vehicles (FMTV), partially mitigated by Overseas Contingency Operations (OCO), followed by two years of funding to recover the production line. The committee recommends that the Army identify a sustainable steady-state production rate for FMTV going forward. H.R. Rep. 113-446, Report of the Committee on Armed Services House of Representatives on H.R. 4435, 113th Cong., 2nd sess. (2014), 23, [http://www.dtic.mil/congressional\\_budget/pdfs/FY2015\\_pdfs/Procurement\\_CRPT-113hrpt446-38.pdf](http://www.dtic.mil/congressional_budget/pdfs/FY2015_pdfs/Procurement_CRPT-113hrpt446-38.pdf).

4. U.S. Department of Defense, Department of the Army, *Army Equipment Program in Support of President's Budget 2016* (Washington, DC: Department of Defense, 2015), 12, [http://www.g8.army.mil/pdf/Army\\_Equipment\\_Program2016.pdf](http://www.g8.army.mil/pdf/Army_Equipment_Program2016.pdf).

5. *Military Services Challenges Meeting Readiness, Modernization, and Manning under Current Budget Limits*, 4.

6. In the FY 2017 NDAA, Congress increased the size of the active duty to 470,000 and President Trump has expressed an interest in an Army of 540,000.

7. *Army Modernization in Review of the Defense Authorization Request for Fiscal Year 2017 and the Future Years Defense Program: Hearing before the Subcommittee on Airland, Senate Committee on Armed Services*, 114th Cong., 2nd sess. (2016) (statement of Lieutenant General Michael E. Williamson et al.), 10, <http://www.armed-services.senate>

Finally, the Army has divested, or is in the process of divesting, a limited number of platforms including the TH-67 training helicopter, OH-58A/C Kiowa, and M113 armored personnel carrier, in order to reduce sustainment costs.<sup>8</sup>

## LACK OF CONSENSUS ON ARMY MODERNIZATION STRATEGY PRIORITIES

How the Army is currently executing its approach to modernization is reasonably clear. What remains unclear at this time is what the Army's continued technology investment and divestment priorities are. The CSIS study team found that there is a general lack of consensus about what the Army's modernization priorities are and what they should be. This lack of consensus is reflected in competing priority statements even within the Army, the FY 2017 Army Program Objective Memorandum (POM), and in conversations, public opinion polling, and roundtables conducted by the CSIS study team.

### Army Statements about Modernization Priorities

Table 3.1 shows the different stated modernization priorities that have appeared in either official Army documents over the past two years or in the National Commission on the Future on the Army (NCFA) final report.

These competing statements highlight three important findings. First, from year to year, the Army's stated priorities often change. While there is some overlap between years, priorities have been highly volatile. Second, within the Army, there can be competing priorities. For example, General David Perkins, Commander, TRADOC, and Lieutenant General McMaster are pushing the "Big 6+1" concept, while the CSA talks about the five priorities listed in the FY17 Equipment Program in testimony before Congress.<sup>9</sup> By shifting its stated priorities almost yearly and presenting competing priorities within the service itself, the Army makes it more difficult to build consensus among Congress, the Office of the Secretary of Defense (OSD), industry, and other outside constituents as to what its top priorities are and to then resource them appropriately. A consensus is starting to emerge that something along the lines of TRADOC's "Big 6+1" is the right approach, but in order to present a compelling modernization strategy in internal DoD funding deliberations and in seeking funding from Congress, the Army needs to select a limited number of top priorities and then stick with them for an extended period time.

Finally, the Army's stated priorities are often too numerous or contain categories so broad as to contain everything. Executing modernization strategies in eras of limited budgets demands ruthless

---

.gov/imo/media/doc/Williamson-Anderson-McMaster-Murray\_04-05-16.pdf; Courtney McBride, "Army Seeks Additional Capability from Current Equipment," *Inside Defense*, October 5, 2016, <https://insidedefense.com/daily-news/army-seeks-additional-capability-current-equipment>.

8. *Army Modernization in Review of the Defense Authorization Request for Fiscal Year 2017 and the Future Years Defense Program*, 10.

9. *Military Services Challenges Meeting Readiness, Modernization, and Manning under Current Budget Limits*.

**Table 3.1. Competing Stated Army Modernization Priorities**

	Big 6+1	FY 2017 Equipment Program	FY 2016 Equipment Program <sup>1</sup>	Army Equipment Modernization Strategy (2015) <sup>2</sup>	NCFA
1	Future Vertical Lift	Aviation	Network	Mobile, Protected Firepower	Aviation Survivability
2	Combat Vehicles	Network	Ground Vehicles	Lethality and Effects	Short-Range Air Defense Artillery (SHORAD)
3	Cross-Domain Fires	Integrated Air Missile Defense	Soldier Equipment	Logistics Optimization	Chemical, Biological, Radiological, and Nuclear (CBRN)
4	Advanced Protection	Combat Vehicles	Aviation	Army Aviation	Field Artillery
5	Expeditionary Mission Command/Cyber Electromagnetic	Emerging Threats <sup>3</sup>	Integrated Fire and Air Defense	Information to Decision	Army Watercraft
6	Robotics/ Autonomous Systems		Science and Technology <sup>4</sup>	Human Performance Optimization	
7	PLUS, Soldier and Team Performance and Overmatch		Intelligence and Electronic Warfare	Medical Sciences	
8				Autonomy-enabled Systems	

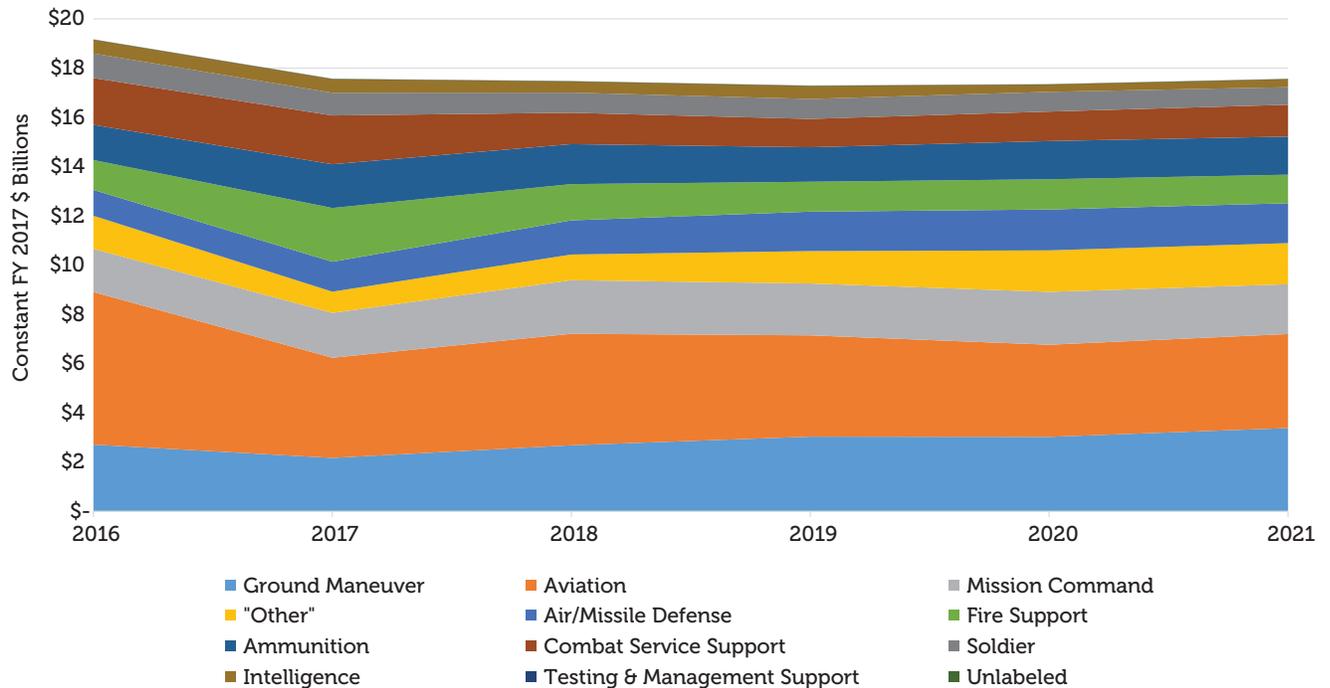
<sup>1</sup> U.S. Department of Defense, *Army Equipment Program in Support of President's Budget 2016*.

<sup>2</sup> U.S. Department of Defense, Department of the Army, *Army Equipment Modernization Strategy* (Washington, DC: 2015), 6–7, [http://www.g8.army.mil/pdf/AEMS\\_31MAR15.pdf](http://www.g8.army.mil/pdf/AEMS_31MAR15.pdf).

<sup>3</sup> Emerging threats includes all of the following: active protection systems, advanced/hybrid armor technologies, aircraft survivability, future vertical lift, long-range precision fires, directed energy weapons, cyber, integrated electronic warfare, and robotics and autonomous systems.

<sup>4</sup> Science and technology includes all of the following: cyber operations, electronic warfare/electronic protection, data to decisions, engineered resilient systems, autonomy, and human systems.

**Figure 3.1. PB 2017 POM, Army Procurement by Capability Portfolio**



Source: Department of Defense, "Fiscal Year 2017 President's Budget Submission—Army Justification Books," Office of the Assistant Secretary of the Army (Financial Management and Comptroller), February 2016; Department of Defense, "National Defense Budget Estimates for Fiscal Year 2017 (Green Book)," Office of the Undersecretary of Defense (Comptroller), March 2016; CSIS analysis.  
 Note: Numbers do not add up to Army procurement topline TOA in the FY17 Green Book due to differences between Army TOA by procurement Title and Army procurement projections by appropriation account.

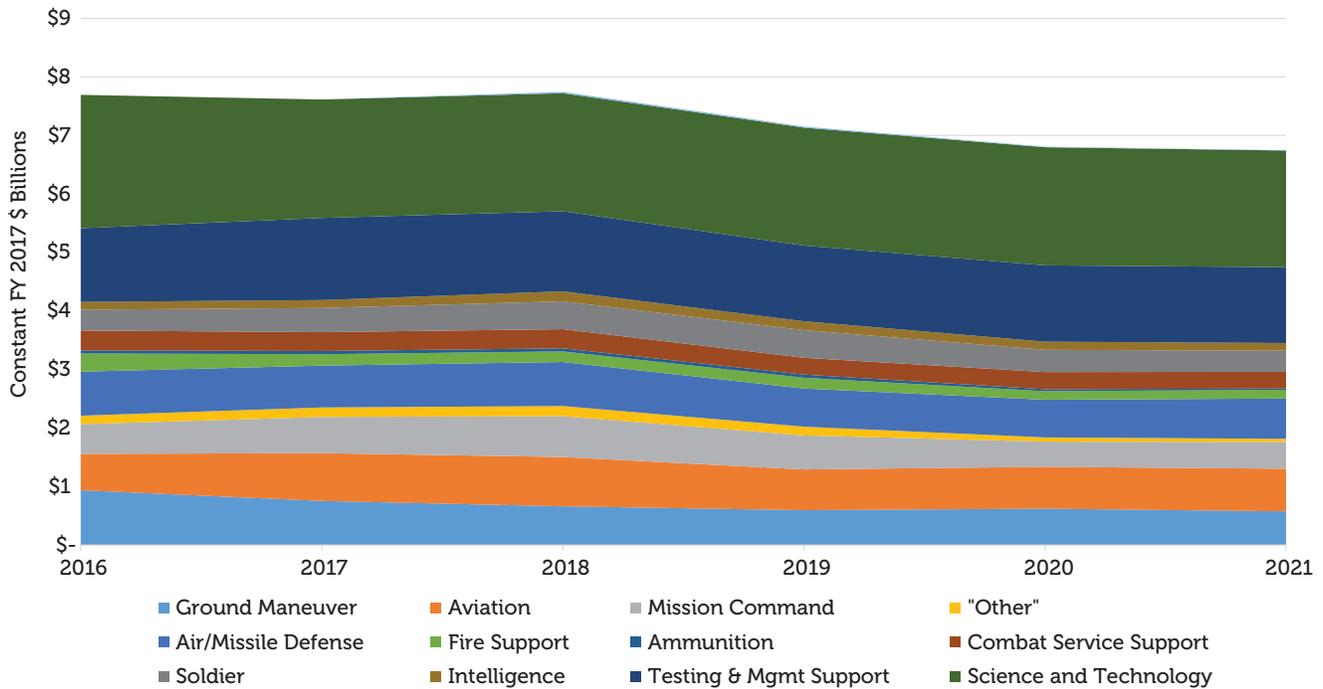
prioritization. When categories such as emerging threats include everything from future vertical lift to long-range precision fires, understanding which of those capabilities is actually the priority becomes difficult.

### CSIS Analysis of the Army PB17 POM

The CSIS study team next analyzed the Army's PB 2017 POM to assess if the actual budget says anything about the Army's priorities for continued technology investment and areas of divestment. Overall, the data show that there is little future rebalancing from today's investment structure. With few exceptions, the Army generally plans to maintain the current modernization portfolio mix over the course of the Future Years Defense Program (FYDP). Where there are changes, those changes do not seem to necessarily constitute a rebalancing within the portfolio but expected growth and decreases, given the Army's current modernization strategy. Figure 3.1 shows the Army's planned investments in procurement over the FYDP in the 2017 POM.

Across the POM, there were only a few major changes in the Army's procurement portfolio, but those changes were mostly expected given the Army's current platforms in procurement. The planned Aviation decrease in FY 2017 is not surprising given the increase in Army Aviation funding in FY 2016 to fund some of the NCFA's aviation recommendations. After the drop-off, aviation funding

**Figure 3.2. PB 2017 POM, Army RDT&E by Capability Portfolio**



Source: Department of Defense, "Fiscal Year 2017 President's Budget Submission"; Department of Defense, "National Defense Budget Estimates for Fiscal Year 2017 (Green Book)"; CSIS analysis.

remains relatively steady over the POM. Additionally, the planned growth in the Ground Maneuver capability does not represent a rebalance in the portfolio, but is the result of the Joint Light Tactical Vehicle (JLTV) increasing production. Where there does seem to be some real but relatively small growth is in the Air and Missile Defense capability portfolio. Over the POM, the Army plans on increasing Air and Missile Defense procurement funding from \$1.05 billion in FY 2016 to \$1.62 billion in FY 2021. Figure 3.2 shows the Army's planned investments in RDT&E over the FYDP in 2017 POM.

The data show that under current plans, planned RDT&E funding remains relatively steady across the POM with only two real changes to the portfolio. Over the POM, the share of RD&TE funding going toward Testing and Management support grows slightly from around 16 percent in 2016 to 19 percent in 2021. Subsequently, the Ground Vehicles portfolio falls as a share of Army RDT&E from 12 percent in 2016 to 9 percent in 2021. Outside of these changes, the other capability portfolios remained relatively steady as a share of Army RDT&E over the course of the POM. The largest capability portfolio, Science and Technology, does see a planned two-year decrease in FY 2017 and FY 2018, but that appears to be a two-year blip, as funding soon thereafter returns to previous years' funding levels.

### CSIS Interviews and Public Opinion Polling Reinforce Lack of Consensus Finding

The data presented reflects much of what the CSIS study team heard over the course of hosting interviews and working groups and observed in the results of a public survey on the future of Army



Soldiers assigned to Second Cavalry Regiment move around a tank during a squad fire range, used to train soldiers in squad fire movement drills while assaulting objectives, at Grafenwoehr Training Area, Germany, December 3, 2014. U.S. Army photo by Sergeant William A. Tanner, <https://www.flickr.com/photos/soldiersmediacenter/15323300094/>.

modernization. For example, a senior industry official at one company expressed to the CSIS study team that the company wanted to invest internal research and development (IRAD) funding on Army programs but did not know where to invest. In the CSIS public survey on the future of Army modernization, participants were asked to rate how much they prioritized 11 different capabilities. While each of the four respondent groups (Executive Branch–Military, Executive Branch–Civilian, Legislative, and Other) believed funding was insufficient to support Army modernization, the data reflected a lack of consensus between groups as to how to prioritize capabilities that was consistent with the diverse opinions expressed in the workshops and interviews conducted over the course of the study.<sup>10</sup> Though there was a consensus about electronic warfare (EW) being a top investment priority, there was disagreement among other competing priorities. For example, legislative branch respondents prioritized air and missile defense and aviation capabilities more than any other

---

10. The CSIS Survey on the Future of Army Modernization was a nonscientific public survey conducted in the summer of 2016. The results of the survey, by themselves, are not statistically significant. Rather, the survey data represent additional data points supporting what the study team heard repeatedly throughout the course of interviews and working groups. “Other” includes respondents from industry, academia, and other research communities.

respondents, particularly civilian executive branch respondents. Meanwhile, the differing groups prioritized other competing capabilities that included intelligence, surveillance, and reconnaissance (ISR) (multiple groups), ground combat systems (Executive Branch–Military), soldier and squad equipment (Executive Branch–Civilian), and command and control (Other). There is a desire in the broader defense community to help the Army highlight and remedy some of its modernization issues, but that desire is being curtailed by a lack of consensus and understanding of the Army’s modernization priorities.

## Strategic Portfolio Analysis and Review (SPAR)

In the fall of 2016, the Army launched the Strategic Portfolio Analysis and Review process to assess, compare, evaluate, and prioritize the approximately 780 Army acquisition programs that are currently ongoing. Led by Lieutenant General John M. Murray, Deputy Chief of Staff, Army G-8, the SPAR sought to create, for the first time, an analytical framework from which the Army could compare different acquisition programs when making budgeting and acquisition decisions if the Army’s modernization budget changed. For example, when making decisions about canceling or potentially accelerating programs, the Army could now compare programs across vastly different portfolios. According to Lieutenant General Murray, “The whole goal of SPAR . . . is to find room within existing resources, within existing [total obligation authority] to tackle critical capability gaps.”<sup>11</sup>

Since the SPAR process began in the fall, the Army completed its analysis phase and began briefing CSA General Milley and acting Army Secretary Robert Speer in late February 2017. The goal of these discussions is to start making trade-offs, based on this analysis, in the Army POM currently being built for FY 2019–FY 2023. Given the lack of consensus and the current trajectory of the Army POM, the ability of the SPAR to influence changes to future POMs will be a test of the Army’s ability to reach consensus about the future of its modernization strategy. Ideally, Army senior leaders should make modernization priorities explicitly and use the SPAR analysis to prioritize and rebalance within the Army modernization portfolio. Whether this proves true will ultimately be proven by the modernization portfolio contained in the Army’s FY 2019–FY 2023 POM.

## ARMY MODERNIZATION STRATEGY FINDINGS

1. The current Army modernization strategy is: accept increased risk, minimize new platform development, continue early-stage science and technology investments on select technologies, improve and/or sustain the existing inventory, and divest select platforms.
2. A lack of consensus exists about the Army’s top modernization priorities. Whether it is the Army’s stated priorities, the PB 2017 POM, or anecdotal evidence from interviews, there is a lack of consensus and understanding of the Army’s top modernization priorities across the broader defense enterprise.

---

11. Courtney McBride, “Army Leaders Identifying Priorities through SPAR Process,” *Inside Defense*, November 7, 2016, <https://insidedefense.com/daily-news/army-leaders-identifying-priorities-through-spar-process>.

# Today's Geostrategic Environment

Today's global security environment cannot be characterized by a singular threat, but by numerous, wide-ranging threats. In the Middle East, the rise and sustained existence of the Islamic State of Iraq and Syria (ISIS) and similar Islamic extremist groups, and the actions of Iran promoting conflicts throughout the region, will continue to undermine stability in the region for some time to come. Chinese maritime expansionism in the South China Seas and the growing nuclear threat presented by the Democratic People's Republic of Korea (DPRK) threatens the Asia-Pacific region. In Europe, Russian military modernization and opportunism have resulted in increased tensions between the United States and its European North Atlantic Treaty Organization (NATO) allies and Russia. Globally, nonstate actors remain an enduring challenge, particularly as the proliferation of technology increases their capability to engage the United States and its allies at home and abroad. These are just a few of the challenges of today's global security environment, which has been described as "a kaleidoscope of pressing and slow-burning challenges that did not seem to fit into any previous singular explanation of the international order."<sup>1</sup>

Given the multitude of geostrategic challenges, how should the Army define its approach to modernization? Determining the best course of action for the Army's future modernization strategy should be informed by assessments of critical operational challenges. This requires identifying the most likely future warfighting scenarios and assessing current and future investments against those scenarios in order to identify critical capability requirements.

Scholars and senior DoD officials agree that Russia presents the greatest strategic threat to the United States. As General Joe Dunford, Chairman of the Joint Chiefs of Staff, stated in testimony before the Senate Armed Services Committee, "My assessment today, Senator, is that Russia

---

1. Kathleen Hicks, Mark Cancian, Todd Harrison, and Andrew Hunter, *Defense Outlook 2016: What to Know, What to Expect* (Washington, DC: CSIS, 2016), 2, [https://csis-prod.s3.amazonaws.com/s3fs-public/legacy\\_files/files/publication/160126\\_Hicks\\_DefenseOutlook\\_Web.pdf](https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/160126_Hicks_DefenseOutlook_Web.pdf).

presents the greatest threat to our national security.”<sup>2</sup> While the U.S. Army will clearly face threats from sources other than Russia, some of which are of a different character and likely to require different responses, there are at least two aspects of the Russian threat that make it in many ways the pacing threat for the U.S. Army.<sup>3</sup> First, the Russian threat currently presents the most stressing combination of advanced military capability and denial and deception, along with nonkinetic challenges such as use of electronic warfare, social media, and other forms of information warfare. Second, Russia is a significant exporter of military capability to regimes hostile to the United States, so even conflicts that do not involve Russia directly are likely to involve some combination of Russian equipment and tactics.

Rather than directly carry out a detailed assessment of Russian capabilities, this study did a review of the literature of such studies done previously.<sup>4</sup> For a basic assessment of the most critical operational challenges relevant to the Army’s modernization strategy, this study provides a top-level assessment of Russian capabilities in order to identify potential capability gaps. Nuclear and Special Operations Forces (SOF), while important, are beyond the scope of this assessment.

Three predominant capability areas stand out in the literature comparing America’s force to potential near-peer adversaries:

1. Anti-Access/Area Denial (A2/AD)
2. Ground Combat
3. Nonkinetic Systems

In each of these three capability areas, Russian technological advances either threaten or have already eroded U.S. overmatch, presenting specific operational challenges. Furthermore, in some cases, the erosion of U.S. overmatch threatens certain fundamental assumptions about U.S. Army and joint warfighting doctrine, such as the Army’s dependence on the joint forces to perform certain missions and provide certain capabilities.

## CAPABILITY GAPS METHODOLOGICAL NOTE

From the outset, the study team acknowledges that even the best available open-source estimates of Russian military capabilities face limitations on their accuracy. Additionally, the following analysis is not intended to provide a comprehensive review of Russian military capabilities. Instead, this capability analysis seeks to provide an illustration of the kinds of adversary capabilities that will

---

2. Phil Stewart and David Alexander, “Russia Is Top U.S. National Security Threat: Gen. Dunford,” Reuters, July 9, 2015, <http://www.reuters.com/article/us-usa-defense-general-dunsmore-idUSKCN0PJ28S20150709>.

3. Courtney McBride, “Wesley: Russia Offers ‘Pacing Threat’ for Army Modernization Efforts,” *Inside Defense*, November 1, 2016, <https://insidedefense.com/daily-news/wesley-russia-offers-pacing-threat-army-modernization-efforts>.

4. This review leverages other ongoing and completed CSIS research efforts assessing Russian military capabilities. See Kathleen H. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe: Phase II Report* (Washington, DC: CSIS, 2016), <https://www.csis.org/analysis/evaluating-future-us-army-force-posture-europe-phase-ii-report>; and Kathleen H. Hicks et al., *Recalibrating U.S. Strategy toward Russia: A New Time for Choosing* (Washington, DC: CSIS, 2017), <https://www.csis.org/analysis/recalibrating-us-strategy-toward-russia>.



A CH-47 Chinook helicopter raises a white-out of blowing snow as it lands at a remote landing zone in Shah Joy district, Zabul province, Afghanistan, February 8, 2012. Helicopters provide an efficient and reliable means of transporting personnel and cargo to rural areas of Afghanistan. U.S. Army photo, <https://www.flickr.com/photos/soldiersmediacenter/6891215699/>.

shape the future potential operational environment in order to inform a future Army modernization strategy. Finally, this report does not assume that potential Russian aggression or other allied attacks on the United States or allied nations will reveal itself in a quick, severe attack. Rather, near-peer adversaries are equally if not more likely to engage in lengthy hybrid-warfare subversion campaigns with neighboring states. This report acknowledges that the U.S. Army needs to increase its capabilities to counter these “gray zone” tactics as well as those capabilities needed to deter and, if necessary, defeat near-peer conventional forces carried out through more traditional military means.

## ANTI-ACCESS/AREA DENIAL

Russia and other potential adversaries have developed a number of weapon systems and platforms that target the lynchpin of the American defense strategy: the necessity of and ability to project power abroad. These systems seek to leverage the fact that many potential conflicts are not likely to occur on or near the American homeland, instead taking place far overseas. As Deputy

Secretary of Defense Bob Work stated in 2014, “Our conventional deterrence posture, without question, is based on the assumption that we can project overwhelming power across trans-oceanic distances and exert our will on any opponent.”<sup>5</sup> However, before the United States can project power and “exert our will” on potential opponents, it needs to actually get onto the battlefield. As such, Russia and other potential adversaries have developed capabilities that, when employed in an A2/AD concept of operations (CONOPS), seek to restrict the United States’ ability to project power overseas.<sup>6</sup> These A2/AD CONOPS restrict American power projection capabilities by seeking to “prevent U.S. forces entry into a theater of operations . . . [and/or] prevent their freedom of action in the more narrow confines of the area under an enemy’s direct control.”<sup>7</sup>

The Russian A2/AD CONOPS is a sophisticated, layered, redundant, multi-domain network that includes both offensive and defensive systems. Defensively, the Russian have developed layered, technologically sophisticated Integrated Air Defense Systems (IADS) that it has been willing to sell around the world, and which it has also operationally deployed on its border with the Baltic States. Offensively, robust long-range strike capabilities can hit critical locations across almost the entire European continent. Combined, the Russian offensive and defensive systems form an impressive “thicket of overlapping and redundant A2/AD systems” that presents a challenging, but not impossible, obstacle for defense planners.<sup>8</sup> From an Army perspective, both the offensive and defensive aspects of Russia’s A2/AD network pose significant challenges for the Army and present significant implications for its role relative to the future joint force. The following sections explore the Russian offensive and defense A2/AD systems in more depth, and what those capabilities mean for the U.S. Army.

## Russian Integrated Air Defense Network

The S-300 and S-400 mobile surface-to-air missile (SAM) systems form the core of the layered, Russian IADS. The S-300 and S-400 are among the most, if not the most, advanced technological SAM systems in existence worldwide today. Featuring multiple radar systems, the S-300 and S-400 are capable of defeating a wide range of threats that include cruise and ballistic missiles and conventional aircraft at ranges of 150 miles and 250 miles, respectively. Currently, the Russian IADS has limited low-observable aircraft detection capabilities but struggles forming an accurate firing

---

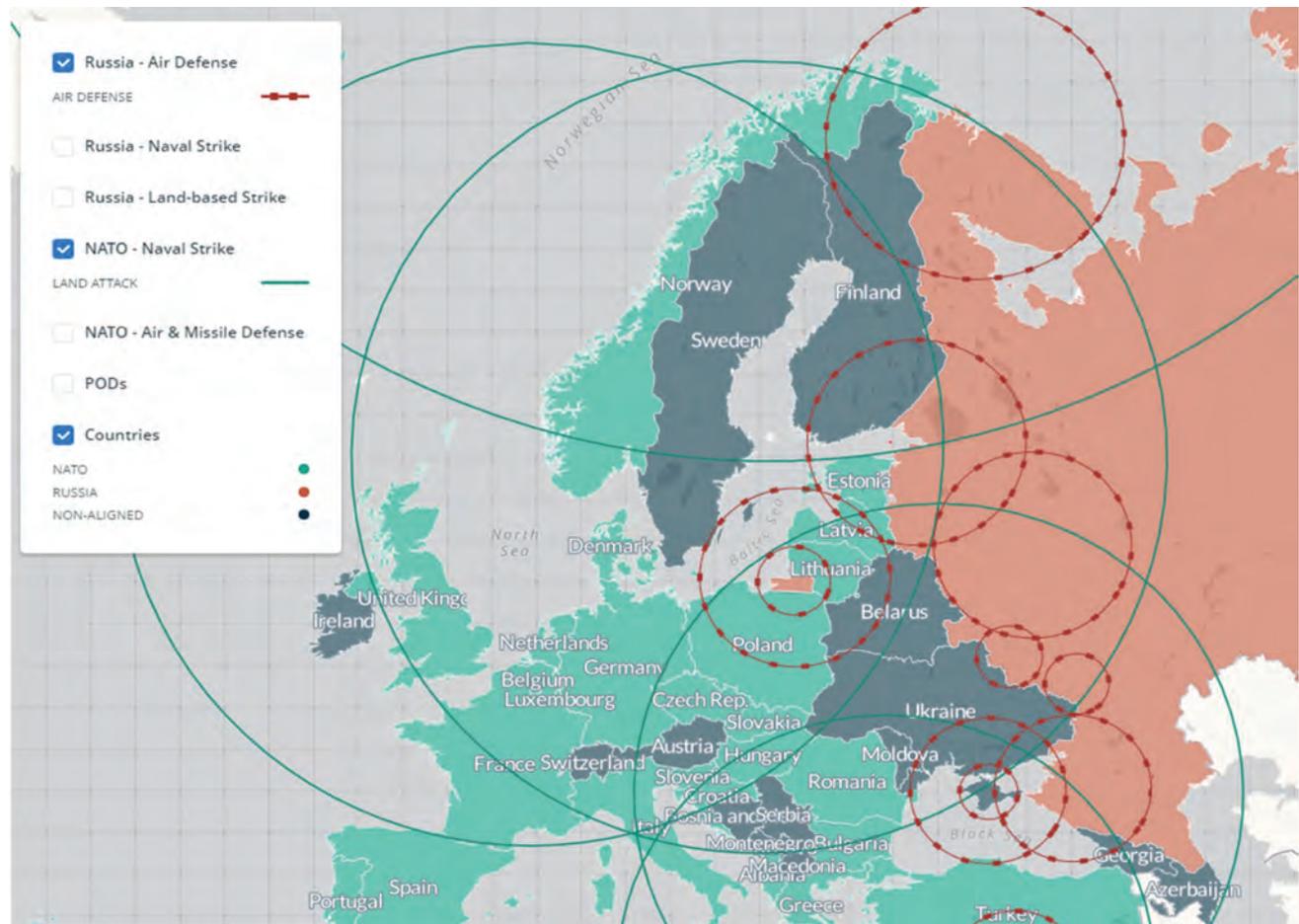
5. Robert Work, “CNAS Defense Forum” (speech, Center for a New American Security, Washington, DC, December 14, 2015), <https://www.defense.gov/News/Speeches/Speech-View/Article/634214/cnas-defense-forum>.

6. Other potential adversaries have developed similar A2/AD CONOPS, but with their own distinctive characteristics that present different operational challenges. For example, the Chinese A2/AD CONOPS takes on a more naval flare and aims to destroy U.S. bases within salvo range at the start of the conflict and prevent the U.S. Navy from entering the area of responsibility. Similarly, Iran seeks to prevent U.S. entry into the AOR, but relies more heavily on mines, small-boat swarming, and other similar techniques.

7. Andrew F. Krepinevich and Barry Watts, *Meeting the Anti-Access and Area Denial Challenge* (Washington, DC: Center for Strategic and Budgetary Assessments, 2003), 5, <http://csbaonline.org/research/publications/a2ad-anti-access-area-denial/publication>.

8. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe*, 34.

**Figure 4.1. Russian IADS vs. NATO Strike Capabilities**



Source: Ian Williams, “The Russia–NATO A2AD Environment,” CSIS Missile Threat, January 2017, <https://missilethreat.csis.org/russia-nato-a2ad-environment/>.

solution against stealth fighters.<sup>9</sup> The S-300 and S-400 IADS can be supplemented by a number of shorter and medium-range mobile air defense systems and combined with other networks, as is the case with the fixed antiballistic missile complex defending Moscow and other various projects in development.<sup>10</sup> Combined, the Russian air defense systems can be used to form a layered IADS that, while not impenetrable, could impose heavy costs on U.S. and coalition forces, raising the question if sustained air-superiority can be established in the event of conflict. Instead, the joint force might only be capable of establishing temporary air-superiority “bubbles,” areas where airpower can be temporarily established but not sustained indefinitely.

Figure 4.1 shows the Russian IADS network mapped against NATO Naval Strike capabilities. For the Army, the potential inability of U.S. and coalition forces to establish sustained air-superiority raises

9. Dave Majumdar, “America’s F-22 and F-35 Stealth Fighters vs. Russia’s S-300, S-400, and S-500: Who Wins?,” *National Interest*, August 18, 2016, <http://nationalinterest.org/blog/the-buzz/americas-f-22-f-35-stealth-fighters-vs-russias-s-300-s-400-s-17394>.

10. Christopher F. Foss and James C. O’Halloran, *IHS Jane’s Land Warfare Platforms: Artillery and Air Defence* (London: IHS Global Limited, 2012), 262.

certain fundamental questions. As previously noted, the Army Operating Concept (AOC) states that “the Army depends on the other services for strategic and operational mobility, fires, close air support [CAS], and other capabilities.”<sup>11</sup> As currently structured, equipped, and trained to fight, the Army expects to operate free from aerial attack and for the other services to provide CAS, air defense (negating the need for extensive short-range air defense or SHORAD capabilities), and certain fires in support of ground operations. Absent the establishment of sustained air-superiority, joint air assets will have difficulty merely operating in the area of responsibility (AOR), much less providing support to ground operations.

Given the challenge that advanced Russian IADS present for the joint force, the Army may need to play a larger role in the Suppression of Enemy Air Defense (SEAD) mission. Historically, the U.S. Navy (USN) and U.S. Air Force (USAF) had taken the lead in SEAD operations using a combination of stealth or radar jamming aircraft and long-range naval strikes. Only after the USN and USAF had taken out the enemy’s air defense systems would ground operations commence. In the future, given advanced Russian capabilities, waiting for sustained air-superiority may not be feasible. Instead of waiting for the establishment of sustained air-superiority that might never come, the Army will need to make initial engagements into the aforementioned temporary air-superiority bubbles. Maneuvering outside the bubble, the Army can support the joint force by working to deconstruct the adversary’s IADS from the ground. These SEAD operations require the Army to have the capability to locate, target, and fire on the adversary’s IADS positions in degraded and austere conditions. This example illustrates one potential way in which future Army operations can not only overcome challenges to the missions traditionally performed by other military services, but can also serve to enable other aspects of the joint force, a concept referred to as multi-domain battle.

## IADS Offset U.S. Advantages in Army Aviation

Though the U.S. Army’s aviation fleet remains overall qualitatively superior to its Russian counterparts, the Russian IADS significantly offsets that advantage. A 2015 RAND report concluded that “the U.S. Army is the world’s leader in terms of the size and capability of its helicopter fleet . . . [though] foreign attack and medium-lift helicopter platforms do have some niche advantages.”<sup>12</sup> However, the utility of this advantage is negligible if Army aviation assets cannot reach the battlefield. In addition to the aforementioned IADS systems, the Russian military possesses a number of more tactical air defense systems that, similar to their more strategic counterparts, form a tiered air defense system. At medium ranges (approximately 30 to 40 miles) the Buk-M2 and Buk-M3 SAM systems can target a variety of targets. At short range, the Russian Army possesses several tactical defensive systems such as Tor, or the Tunguska gun/missile system.<sup>13</sup> Combined, this

---

11. U.S. Army, *The U.S. Army Operating Concept: Win in a Complex World* (Fort Eustis, VA: TRADOC, 2014), 10, <http://www.tradoc.army.mil/tpubs/pams/tp525-3-1.pdf>.

12. John Gordon IV et al., *Comparing U.S. Army Systems with Foreign Counterparts: Identifying Possible Capability Gaps and Insights from Other Armies* (Santa Monica, CA: RAND, 2015), xv.

13. Hicks et al., *Recalibrating U.S. Strategy toward Russia*.

layered tactical air defense system results in an aviation fleet that, in the words of General Mark Milley, “is very vulnerable against a near-peer, high end.”<sup>14</sup>

## Russian Offensive A2/AD Capabilities—Long-Range Strike

In addition to Russian IADS capabilities, Russia has developed long-range strike assets that can serve to deter, impede, and potentially deny U.S. forces access to the battlefield. The current Russian A2/AD network is comprised of several advanced long-range cruise and short-range ballistic missiles, including the Kalibr, Kh-55/101, and Iskander missiles, that are capable of threatening allied bases, rear echelon forces, ships, logistical hubs, and civilian infrastructure throughout the U.S. European Command (EUCOM) area of responsibility. The Kalibr cruise missile is a family of multiplatform, sea-launched cruise missiles whose differing variants can be employed either as an anti-ship missile (AShM) or land attack cruise missile (LACM). The Kh-101 is an air-launched cruise missile featuring several counter-radar features.<sup>15</sup> Finally, the Iskander is a short-range ballistic missile designed for “theater level conflicts” and its accuracy allows it to “destroy both stationary and moving targets.”<sup>16</sup> The Kalibr and Kh-55 have ranges of between 1,500 and 2,500 kilometers (km), while the Iskander has an estimated maximum range of 500 km.<sup>17</sup>

Figure 4.2 shows the approximate ranges of Russian long-range strike capabilities mapped against NATO Integrated Air and Missile Defense (IAMD) systems and points of debarkation/embarkations (POD).

The ability of Russia’s conventional cruise missiles and ballistic missiles to threaten U.S. interests across the EUCOM AOR, particularly its prepositioned equipment and regional command and control headquarters in Germany, Belgium, and the Netherlands, presents a significant challenge. Given current U.S. and NATO IADS deployments, coalition forces are only capable of defending a limited number of sites. In the early stages of a Russo-American confrontation, Russian long-range strike capabilities would render much of the European infrastructure that is required for the United States to maneuver throughout the AOR unusable. In the case of a conflict in Europe, losing access to the roads, trains, airports, and seaports throughout NATO countries has the potential to stymie the entrance of additional forces onto the European continent and would prevent forward-deployed forces from being reinforced or resupplied, essentially crippling those forces. For the Army, the development of these threat systems signals a demand for increased investment in both logistical and IAMD capabilities to better survive long-range missile salvos designed to impede its access to the theater of operations.

---

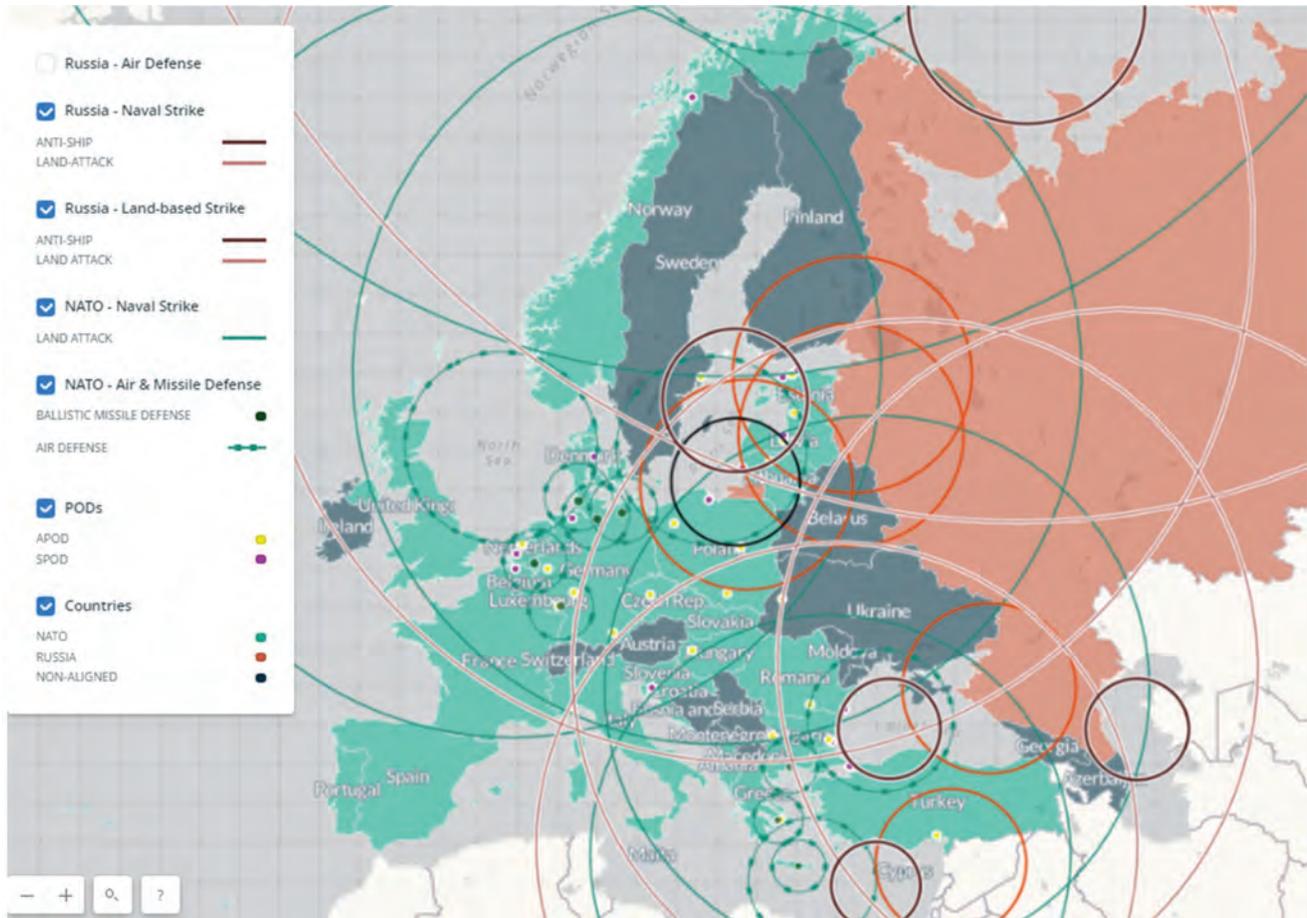
14. Sydney J. Freedberg, “Cyber/EW, Aviation, Air Defense, Artillery: CSA Milley’s Priorities,” *Breaking Defense*, January 12, 2017, <http://breakingdefense.com/2017/01/cyberew-aviation-air-defense-artillery-csa-milleys-priorities/>.

15. Kyle Mizokami, “Russia’s Newest Cruise Missiles Make Combat Debut in Syria,” *Popular Mechanics*, November 20, 2015, <http://www.popularmechanics.com/military/weapons/news/a18262/russia-new-cruise-missiles-make-combat-debut-in-syria/>.

16. CSIS Missile Defense Project, “SS-26 (Iskander),” CSIS Missile Threat, last updated September 27, 2016, <https://missilethreat.csis.org/missile/ss-26/>.

17. CSIS Missile Defense Project, “SS-26 (Iskander);” CSIS Missile Defense Project, “SS-N-30A (Kalibr),” CSIS Missile Threat, last updated August 11, 2016, <https://missilethreat.csis.org/missile/ss-n-30a/>; CSIS Missile Defense Project, “Kh-55,” CSIS Missile Threat, last updated August 10, 2016, <https://missilethreat.csis.org/missile/kh-55/>.

**Figure 4.2. Russian Long-Range Strike Capabilities vs. NATO IAMD and PODs**



Source: Williams, "The Russia–NATO A2AD Environment."

Note: APOD = Aerial port of debarkation and embarkation; SPOD = Sea port of debarkation and embarkation.

## GROUND COMBAT

Lieutenant General H. R. McMaster has highlighted the erosion of the U.S. Army's advantages in ground combat operations by stating that the Army is "outranged and outgunned by many potential adversaries." While this deficiency is significantly moderated by continuing U.S. Army advantages in other areas, it presents both a significant current concern and a worrying potential trend line. While the Army continues to enjoy an overall qualitative advantage over Russian and similar near-peer forces, that gap has narrowed and there are certain areas where potential adversaries have already surpassed U.S. capabilities.<sup>18</sup>

The erosion of overwhelming U.S. combined arms qualitative superiority presents several operational challenges. First and foremost, the M1 Abrams' limited strategic mobility to and in the European theater of operations potentially dampens overall U.S. combat effectiveness. As compared to its Russian counterparts, the Abrams' heavy weight and heavy fuel demands make it difficult to

18. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe*, 39–40.



A round is fired from a U.S. Army M1A2 tank belonging to 1st Battalion, 68th Armor Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, during the first Live Fire Accuracy Screening Tests at Presidential Range in Swietozow, Poland, January 16, 2017. U.S. Army Europe photo by Staff Sergeant Elizabeth Tarr, [https://www.flickr.com/photos/usarmyurope\\_images/32198695972/](https://www.flickr.com/photos/usarmyurope_images/32198695972/).

amass firepower in the event of a sudden outbreak of hostilities. Second, in the realm of the long-range fires, the U.S. Army finds itself outranged and outgunned by Russian conventional and rocket artillery forces that have greater volume of fire. Finally, the American soldier provides the United States an asymmetric advantage over Russia. Compared to his or her Russian counterpart, the average American soldier is more experienced, highly trained, adaptable, and agile.

The following sections compare Russian and U.S. ground combined arms capabilities in tanks, indirect fires, and personnel.

### Russian vs. U.S. Tank Comparison

In abstract one-on-one combat, the United States' Abrams tank remains superior to any of the tanks Russian currently deploys (T-72B, T-80, T-90). However, there are certain design characteristics of both the M1 Abrams and the Russian tanks that could considerably shrink that gap in the event of war.

Originally developed in the 1970s as part of the "Big Five" and continuously upgraded since, the current version of the Abrams tank, the M1A2 System Enhancement Program (SEP) v2 Abrams, is a behemoth of a machine. Featuring steel-encased depleted uranium armor, the Abrams has been described as nearly indestructible. Despite weighing in at 71 tons, the M1A2 SEpv2 can drive at

speeds topping 40 miles per hour, thanks to its turbine engine. However, these features come with significant logistical drawbacks. Sustaining the turbofan engine requires substantial fuel supplies as the engine gets around 0.6 miles per gallon of fuel. Additionally, the Abrams' large weight makes simply moving the tank a logistical nightmare. At its current weight and given European road weight restrictions, the Abrams is too heavy for U.S. heavy equipment transports (HETs) in Europe and must instead be transported using German and British HETs.<sup>19</sup>

Unlike the behemoth that is the M1A2 SEPv2, the Russian tank inventory is comprised of a number of smaller, lighter tank models that include the T-72B, the T-80, and T-90, all modern variants based on the Soviets' T-72 tank, produced in the early 1970s. Rather than relying on heavy armor plating like the Abrams, the various Russian tanks instead rely more on a variety of countermeasures such as an active protection system (APS), infrared jammers, and explosive reactive armor. The Russian APS are mostly effective against most current-generation direct attack Anti-Tank Guided Missiles (ATGM), offsetting some of the differences in the lack of armor, but struggle against the FMG-148 Javelin in top-attack mode.<sup>20</sup> Finally, the various Russian tank models feature a 125-millimeter (mm) main gun, relatively similar in firepower to the Abrams main gun.

While the Abrams might be qualitatively superior to the Russians' tanks, that advantage matters little if they are not present for the actual fight. In the event of a crisis in Eastern Europe, the Army would have difficulties not only operating the Abrams in Europe, but also in rapidly deploying additional units to the AOR.<sup>21</sup> Meanwhile, Russia would be able to more freely move its armor formations throughout Europe, overwhelming American defenders.

### Russian vs. U.S. Indirect Fires Comparison

Russia's operations in the Ukraine have raised concerns about the gap between Russian and U.S. indirect fire capabilities. According to accounts from the ground, Russian indirect fire barrages are capable of "wiping out" Ukrainian mechanized battalions in a matter of minutes.<sup>22</sup> Furthermore, Potomac Foundation analysis concluded that approximately 80 percent of all casualties in the Russo-Ukrainian conflict resulted from artillery fire.<sup>23</sup> The advantages provided by Russian-developed indirect fire systems present challenges to the U.S. Army's tactical mobility as well as its ability to defeat equivalent force elements in direct high-intensity combat. For the purposes of this study, conventional artillery and rocket artillery merit more in-depth analysis.

---

19. Ibid., 29.

20. Dave Majumdar, "How Lethal and Dangerous Are Russian Tanks?," *National Interest*, July 16, 2016, <http://nationalinterest.org/blog/the-buzz/everything-you-need-know-about-russias-lethal-tank-force-17013>.

21. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe*.

22. Sydney J. Freedberg, "Russian Drone Threat: Army Seeks Ukraine Lessons," *Breaking Defense*, October 14, 2015, <http://breakingdefense.com/2015/10/russian-drone-threat-army-seeks-ukraine-lessons/>.

23. Phillip Karber and Joshua Thibeault, *Russia's New Generation Warfare* (Vienna, VA: Potomac Foundation, 2016), <http://www.thepotomacfoundation.org/russias-new-generation-warfare-2/>.



U.S. Army Rangers assigned to 2nd Battalion, 75th Ranger Regiment, fire a 120-mm mortar during a tactical training exercise on Camp Roberts, California, January 30, 2014. Rangers constantly train to maintain the highest level of tactical proficiency. U.S. Army photo by Private First Class Nathaniel Newkirk, <https://www.flickr.com/photos/soldiersmediacenter/12339938665/>.

## Conventional Artillery

The Russians have developed some advantages over the United States in regard to artillery capabilities. Not only can Russian artillery outrange the United States, they are also able to sustain a greater rate of fire. Whereas the U.S. Army's M109A6 PALADIN 155-mm 39-caliber main gun can fire at a maximum rate of fire of four rounds a minute, the Russians' 152-mm self-propelled artillery system 2S19 (MSTA-S) can fire seven to eight rounds per minute in optimal conditions.<sup>24</sup> Under the current PALADIN modernization plans, Paladin Integration Management (PIM), focuses on mobility and sustainment improvements, leaving the PALADIN's range and rate of fire unchanged. Though these improvements are important and worth doing, they fail to address the most critical shortfalls. Future iterative upgrades should address the PALADIN's range and rate of fire. The PALADIN can address some of the range issue when using the Global Positioning System (GPS) guided

---

24. Foss and O'Halloran, *IHS Jane's Land Warfare Platforms: Artillery and Air Defence*, 55; Gordon IV et al., *Comparing U.S. Army Systems*, 22.

M982 Excalibur round or other future guided rounds, but doing so brings the disadvantage of operational limitations and increased monetary costs.<sup>25</sup>

## Rocket Artillery

U.S. Army and Russian rocket artillery systems are roughly technologically equivalent today, though recent trends favor the Russians soon surpassing the United States. The United States currently fields two rocket artillery systems, the M270 Multiple Launch Rocket System (MLRS) and the H142 High Mobility Artillery Rocket System, which are capable of firing either the Army Tactical Missile System (ATACMS) or the M30 and M31 Guided Multiple Launch Rocket Systems (GMLRS). The Russians field a number of different rocket artillery systems to include the SPLAV 122-mm BM-21, SPLAV 300-mm BM 9A52 Smerch multiple rocket system, and SPLAV 220-mm BM 9P140 (16-round) Uragan multiple rocket system. While the American systems are more precise, the “larger” Russian systems outrange the American systems. This difference is indicative of the global trend in rocket artillery systems, where systems such as the Chinese WeiShi-2 (WS-2) are increasingly outranging U.S. MLRS systems. Furthermore, whereas the U.S. systems are limited to a singular warhead, the Russian rocket artillery systems feature multiple warhead variants.

## U.S. Asymmetric Advantages: The American Soldier and Situational Awareness

One area the United States possesses a second, though potentially more limited, asymmetric advantage is situational awareness. Since the launch of the Second Offset Strategy, the United States has made considerable investments in networking and other systems to increase battlefield situational awareness. In particular, the Army has made networking a major focus of its modernization strategy over the past 20 years through efforts like Blue Force Tracking. Recognizing this threat, the Russians have made targeting and countering U.S. situational awareness systems a high priority of its battlefield EW activities, necessitating co-joined U.S. investment to address and stay ahead of Russian counters. However, even in the event of Russia’s countering of these situational awareness investments, the United States retains one key considerable asymmetric advantage: the American soldier.

Unlike the United States’ professional All-Volunteer Force (AVF), the Russian army relies on a mix of conscripts and professional or “contract” soldiers to meet end-strength goals. Over half of the Russian soldiers are contracted soldiers, who are supplemented by mandatory one-year conscription from Russian men aged 18 to 27. For the Russian army, the use of conscripts presents several challenges. First, the professional soldiers are not distributed evenly across the Russian military services. Most professional soldiers are not placed in the general army but instead serve in SOF, “submarines and other complex equipment,” or rapid response airborne-assault troops.<sup>26</sup> Second, the use of conscripts makes it difficult to maintain heightened combat readiness in mixed-units due to conscription and mobilization timelines.<sup>27</sup> Third, the conscripts lag behind their

---

25. Gordon IV et al., *Comparing U.S. Army Systems*, 22.

26. International Institute for Strategic Studies (IISS), *The 2016 Military Balance* (London: IISS, 2016), 165; Keir Giles with Andrew Monaghan, *Russian Military Transformation-Goal in Sight?* (Carlisle, PA: Strategic Studies Institute, 2014), 38.

27. IISS, *The 2016 Military Balance*, 165.

professional counterparts and, in the case of the seizure of Crimea, “had to be left behind during the operation.”<sup>28</sup> Fourth, given the use of conscripts, Russia historically fails to sufficiently man a force large enough to meet stated end-strength goals. Though they have made progress in recent years, Russian forces remain manned somewhere between 80 and 92.5 percent of desired end strength. Finally, despite Russia’s attempts in recent years to create a professional noncommissioned officer (NCO) corps, the Russian army has fallen well short of its stated targets.<sup>29</sup> In the words of Vadim Kozyulin, senior research fellow at the PIR Center, “We still have a huge problem with NCO corps. In all professional armies, it’s NCOs that run the army, but we have this gap; we have soldiers and senior officers, but not NCOs.”<sup>30</sup>

Compared to his or her Russian counterpart, the average U.S. soldier is more experienced, highly trained, adaptable, and agile. Instead of a year-long conscription, the average U.S. enlisted service member has approximately 6.6 years of service (10.8 years for officers) in the Armed Forces.<sup>31</sup> Additionally, the average age of an American service member today is 27.21 years old (average 34.38 years for officers).<sup>32</sup> Finally, the Army today has significant combat deployment experience. At the height of Operation Iraqi Freedom and Operation Enduring Freedom in 2011, 73 percent of the active duty soldiers had deployed at least once to either Iraq or Afghanistan.<sup>33</sup> While the percentage of active duty soldiers with deployment experience has likely fallen since 2011, significant combat experience remains in the critical mid- to senior-grade NCO and officer corps.

## NONKINETIC CAPABILITIES

Nonkinetic capabilities—including EW, offensive cyber, and information operations (IO)—are a focal point for our near-peer adversaries and could introduce vulnerability in U.S. command, control, communication, computers, intelligence, surveillance, and reconnaissance (C4ISR) and satellites. Therefore, any potential Russo-American conflict would almost certainly extend to the cyber domain and include attacks on U.S. C4ISR systems and critical infrastructure. Moscow has “deployed radar-imagery jammers” and is developing other counter-space capabilities to disrupt American C4ISR during a conflict.<sup>34</sup> The effectiveness of Russia’s nonkinetic capabilities

---

28. Keir Giles, *Russia’s “New” Tools for Confronting the West: Continuity and Innovation in Moscow’s Exercise of Power* (London: Chatham House, 2016), 17, <https://www.chathamhouse.org/sites/files/chathamhouse/publications/2016-03-russia-new-tools-giles.pdf>.

29. Giles with Monaghan, *Russian Military Transformation—Goal in Sight?*, 35–36.

30. Quoted in Matt Bodner, “Russian Modernization Puts Focus on Land Force Protection,” *Defense News*, October 11, 2015, <http://www.defensenews.com/story/defense/land/vehicles/2015/10/11/russian-modernization-puts-focus-land-force-protection/73513960/>.

31. Office of the Undersecretary of Defense, Personnel and Readiness, *FY15 Population Representation in the Military Services: Appendix D—Historical Data Tables* (Washington, DC: Department of Defense), 16, 23, <https://www.cna.org/pop-rep/2015/appendixd/appendixd.pdf>.

32. Ibid.

33. Dave Baiocchi, *Measuring Army Deployments to Iraq and Afghanistan* (Santa Monica, CA: RAND, 2013), [http://www.rand.org/content/dam/rand/pubs/research\\_reports/RR100/RR145/RAND\\_RR145.pdf](http://www.rand.org/content/dam/rand/pubs/research_reports/RR100/RR145/RAND_RR145.pdf).

34. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe*.

is made plain by its incursion into Ukraine and the cyber surveillance and denial-of-service attacks levied against U.S. soldiers on NATO's eastern border.<sup>35</sup> Studying the ongoing Ukrainian conflict, the Potomac Foundation concluded that the Russians employ EW capabilities for four purposes:

- *Denying communications:* There are regions in Donbass where no electromagnetic communications—including radio, cell phone, and television—work.
- *Defeating unmanned aerial systems:* Electronic warfare is the single largest killer of Ukrainian systems by jamming either the controller or GPS signals.
- *Defeating artillery and mortars:* Russian electronic warfare pre-detonates or duds incoming artillery and mortar rounds that have electronic fusing.
- *Targeting command and control nodes:* Russian electronic warfare can detect all electromagnetic emissions, including those from radios, Blue Force Tracker, Wi-Fi, and cell phones, which can then be pinpointed with unmanned aerial systems and targeted with massed artillery.<sup>36</sup>

Russian forces have already been able to equip 45 percent of their EW units with new powerful jamming systems: the Murmansk-BN, Krasukha, and Borisoglebsk-2.<sup>37</sup> While the Murmansk and Krasukha systems primarily affect operational capabilities by jamming unmanned systems, satellite datalinks, and satellite-based navigation, the Borisoglebsk-2 is a mobile system capable of jamming mobile satellite communication and radio-navigational systems.<sup>38</sup> The R-330Zh system allows the Russian army to jam shortwave radio communications, and the Svet-KU mobile command and control (C2) system interferes with enemy communication systems and provides anti-jam capability to Russian C2 capability.<sup>39</sup>

Further, the Kremlin has disseminated to tactical-level units the authority to engage regularly in information operations—through social media and news broadcasts—along NATO's eastern border, an area that is particularly susceptible to Russian subversion and disinformation campaigns. Although the 2011 Russian cyber doctrine, "Conceptual Views on the Activity of the Russian Federation Armed Forces in Information Space," contains no reference to offensive cyber warfare, then Chief of the General Staff Nikolai Makarov noted three goals for Russian cyber forces: disrupt enemy information systems, defend native command-and-control capabilities, and actively shape the public opinion through misinformation campaigns.<sup>40</sup>

---

35. Ibid.

36. Karber and Thibeault, *Russia's New Generation Warfare*.

37. "Russian Electronic Warfare Equipment Surpasses Western Analogues—Commander," TASS, April 15, 2016, <http://tass.com/defense/869929>.

38. Timothy Thomas, *Russia Military Strategy Impacting 21st Century Reform and Geopolitics* (Fort Leavenworth, KS: Foreign Military Studies Office, 2015), [http://fmso.leavenworth.army.mil/E-Pubs/Epubs/Thomas\\_Russian%20Military%20Strategy\\_Final\\_\(2%20May%202016\).pdf](http://fmso.leavenworth.army.mil/E-Pubs/Epubs/Thomas_Russian%20Military%20Strategy_Final_(2%20May%202016).pdf).

39. Ibid.

40. IISS, *The 2016 Military Balance*.

Since the end of the Cold War, the U.S. Army has shifted its focus away from nonkinetic capabilities and let capability in EW technology “slip” as it focused on the counterinsurgency threat.<sup>41</sup> To make up the gap in nonkinetic capability against the counterinsurgency threat, the Army leaned on the EW capabilities of the Air Force and Navy, but they quickly realized those systems did not meet the needs of the Army mission profiles.<sup>42</sup> Spurred into developing EW technology to jam radio frequencies used to detonate improvised explosive devices (IEDs), the Army launched a larger EW study in 2006, which indicated that the last time the Army had electronic attack capabilities was during the Cold War in the 1980s.<sup>43</sup>

Although the Army currently has a low level of nonkinetic capability available through the Duke and Warlock vehicle-mounted jammers, the Thor III soldier-portable jammer, and the Ground Auto-Targeting Observation/Reactive Jammer (GATOR) system, they are limited to the mission profile of the Middle East.<sup>44</sup> The vehicle- and soldier-mounted jammers are purpose-built to have a short range and to prevent IEDs from detonating, not to disrupt enemy communication equipment or block satellite-based navigational systems. Even the Counter Radio-controlled Improvised Explosive Device—Electronic Warfare system (CREW) was only developed to counter radio frequency IED detonators.<sup>45</sup>

Compared with the Russian army, the U.S. Army’s nonkinetic capability is almost nonexistent. While the Russian army has a host of offensive jammers at its disposal, the United States is not set to field its next-generation jammer until 2023.<sup>46</sup> The Multi-Function Electronic Warfare System, another solution to fill this nonkinetic gap, is yet to be an official program and the timeline stretches full operational capability of the system out to 2027.<sup>47</sup>

In addition to the Army’s need for electronic attack capability, having full control of the electromagnetic spectrum in the Middle East diminished the need to develop anti-jammer technology or the means to operate in a GPS-denied environment. Furthermore, the U.S. Army was never able to test its IO capabilities in the communities of the Middle East because the Army never had the

---

41. Jen Judson, “U.S. Army Moves to Improve Electronic-Warfare Tactics,” *Defense News*, July 15, 2016, <http://www.defensenews.com/story/defense/land/army/2016/07/15/army-electronic-warfare-training-cyber/87124416/>.

42. Jet Bibler, “Rebuilding the U.S. Army’s Electronic Warfare Capability,” *Nexus 2*, no. 2 (February 26, 2009), [http://usacac.army.mil/cac2/cew/nexus/NEXUS\\_VOL\\_2-2\\_-\\_COL\\_Bibler.pdf](http://usacac.army.mil/cac2/cew/nexus/NEXUS_VOL_2-2_-_COL_Bibler.pdf).

43. *Ibid.*

44. Kris Osborn, “U.S. Army Is Making Some Sweeping Changes to Its Electronic Warfare Technology,” *National Interest*, September 9, 2016, <http://nationalinterest.org/blog/the-buzz/us-army-making-some-sweeping-changes-its-electronic-warfare-17657>.

45. Jen Judson, “Will Russian Aggression Ramp Up U.S. Army Focus on Electronic Warfare Needs?,” *Defense News*, March 7, 2016, <http://www.defensenews.com/story/defense/show-daily/ausa-global-force/2016/03/07/russian-aggression-ramp-up-us-army-focus-electronic-warfare-needs/81249312/>.

46. Bryan Bender, “The Secret U.S. Army Study That Targets Moscow,” *Politico*, April 14, 2016, <http://www.politico.com/magazine/story/2016/04/moscow-pentagon-us-secret-study-213811>.

47. Sydney J. Freedberg, “Army’s Electronic Warfare Cupboard Is Bare: No Jammer until 2023,” *Breaking Defense*, July 20, 2015, <http://breakingdefense.com/2015/07/armys-electronic-warfare-cupboard-is-bare-no-jammer-until-2023/>.

intention to stay.<sup>48</sup> The emphasis on the counterinsurgent threat led the U.S. Army to develop limited electronic attack capabilities, disregard defensive C4ISR technology, and leave untested its IO strategy. Meanwhile, Russia has been directly investing in nonkinetic capabilities that directly exploit these oversights.

## TODAY'S GEOSTRATEGIC ENVIRONMENT FINDINGS

1. *Today's geostrategic challenge is a kaleidoscope of challenges characterized not by a singular threat, but by a multitude of wide-ranging threats.* Challenges and threats include, but are certainly not limited to, ISIS and similar Islamic extremist groups, China, Russia, DPRK, and increasingly sophisticated nonstate actors.
2. *Russia is the greatest pacing threat for the U.S. Army, given operational challenges and proliferation of Russian arms sales.* For the Army, the Russian threat currently presents the most stressing combination of A2/AD-enabling systems, advanced ground combat capabilities, and nonkinetic effects. Additionally, the proclivity of Russian arms sales to regimes hostile to the United States means that likely future conflicts will involve some combination of Russian equipment and tactics, even if Russia itself is not directly involved.
3. *The Russians have either equaled or surpassed certain U.S. capabilities in A2/A2, ground combat, and nonkinetic operations necessitating additional Army investment.*
  - a. *The Russian A2/AD CONOPS is a sophisticated, layered, redundant, multi-domain network that hinders U.S. ability to project power in Europe and presents challenges to certain fundamental assumptions about the Army and its role in the joint force.* In a potential future conflict with Russia, the Army will not necessarily be able to rely on the joint force to provide certain capabilities such as SEAD/SHORAD, CAS, and logistics and sustainment that the Army is dependent on. Instead, the Army will need to develop its own indigenous capabilities for operating in A2/AD environments.
  - b. *Comparing ground combat capabilities, the United States retains a diminished lead in combat vehicles while the Russians have surpassed the United States in indirect fire capabilities.* However, the American soldier remains the Army's asymmetric advantage over the Russians.
    - i. Comparing the Abrams and its Russian counterparts, the Abrams remains the better tank on paper, but logistical challenges make it difficult to realize the Abrams' full combat effectiveness in the European AOR.
    - ii. Russian indirect fire capabilities today are superior to those of the United States. Comparing conventional artillery systems, the Russians not only outrange the United States, but can also fire at a greater rate. The capability gap between American and

---

48. Bender, "The Secret U.S. Army Study That Targets Moscow."

Russian rocket artillery is smaller than between conventional artillery, but Russia's advantages in range and types of munitions outweigh the U.S. precision advantage.

- c. *Russian nonkinetic capabilities, particularly in EW and cyber operations, significantly outpace the limited capabilities the U.S. Army could currently bring to a future conflict.* Whereas the Russian army has made these capabilities a top priority, the U.S. Army largely neglected these capabilities after the end of the Cold War, instead choosing to rely on the joint force.

# Setting Priorities for the Future Army: Recommendations for Developing a New Army Modernization Strategy

CSIS analysis demonstrates that a mismatch exists between U.S. Army threats, budgets, and its modernization strategy. Addressing the future security environment requires that the Army reevaluate its current approach and devise a new modernization strategy and commit to funding it. The FY17 POM projects Army modernization funding that is approximately \$7 billion below its historical average and about \$9 billion below the average modernization funding level during periods of increasing budgets. It is hard to escape the conclusion that the Army will need substantially increased levels of modernization funding if it hopes to field significant new capabilities in the coming years. Increased funding alone, however, is insufficient. There is a significant near- to mid-term need to field new Army capabilities. As a result, even assuming significant new funding is added to the Army's modernization budget, the Army will have to be extremely disciplined in ensuring that this funding is focused on the key capabilities required to address emerging threats. Given the likelihood that the Army's force structure will be expanded beyond what is envisioned in the FY17 POM, a certain level of modernization funding increase will be required just to equip new force structure with today's capabilities. Unless the Army grows force structure smartly and equips its forces to address its shortfalls, even increased modernization funding may not necessarily result in increased capability.

The goal of delivering the key capabilities the U.S. Army needs is best accomplished by adopting an Army modernization strategy that focuses on adding capabilities to the Army's large force of fielded systems across five major capability areas including: electronic warfare, air and missile defense, cross-domain fires, advanced protection, and logistics. These capabilities will require, and can further leverage, the Army's substantial investment made in the last two decades in networking and situational awareness. The Army can obtain the fastest, most pervasive

improvement in its force by progressively fielding these improvements in regular, sizable increments. In addition, the Army's modernization strategy should explicitly set aside room in the POM for quickly developing, prototyping, and deploying capabilities in response to emerging threats and opportunities. Because the Army's technology pipeline currently has serious gaps, some of these capabilities may need to leverage developments undertaken outside of the Army's technology development process by adapting mature designs to meet the Army's needs. Although this modernization strategy would not rule out some limited investment in efforts to develop new platforms, as many of the Army's platforms will eventually need to be replaced, such investments should be undertaken only to the extent that they do not undermine the strategy's central approach.

The CSIS study team has identified six overarching recommendations to help guide the development of a new Army Modernization Strategy. Within each overarching recommendation, this report proposes several additional specific recommendations.

1. Develop a clearly articulated, focused modernization strategy.
2. Make Army modernization a higher priority.
3. Focus on capability gaps, not platforms.
4. Make Army acquisition more agile by focusing on continuous innovation.
5. Ensure room for newly emerging opportunities and challenges.
6. Align human capital with updated modernization strategy.

## 1. DEVELOP A CLEARLY ARTICULATED, FOCUSED MODERNIZATION STRATEGY

The current shortfall in Army modernization funding compared to historical standards demonstrates that without increased funding, particularly in the design and development of deployable technologies, the Army will likely be unable to sustain or recover its overmatch capabilities. Calling for increased funding alone, however, is insufficient to solve the Army's modernization challenge; plans for increased funding must be paired with a newly articulated modernization strategy that demonstrates the utility of any new funding. This strategy must clearly articulate a focused modernization approach that outlines and prioritizes among competing capabilities. The Army needs to develop a new, clearly articulated, and focused modernization strategy and use the ongoing Strategic Portfolio Analysis and Review (SPAR) to make priorities explicit.

### Recommendation: Senior Army Leadership Must Develop an Updated, Clearly Articulated, and Focused Modernization Strategy

Senior Army leadership must develop an updated, clearly articulated, and focused modernization strategy that demonstrates and prioritizes development of the most important capabilities. This report found that there is a lack of consensus among priorities for Army modernization, among the various stakeholders, but also within the Army itself. The Army's modernization strategy does

not need to be inclusive of every capability, nor should it be. While an expansive articulated modernization strategy inclusive of everyone's priorities might be internally desirable for keeping the Army's competing communities happy, such an approach makes it difficult to present a compelling case for modernization to senior leaders and to Congress, and to make the trade-offs necessary to sufficiently fund the most critical investments. A focused modernization strategy does not preclude investments in other areas—it just ensures critical capabilities receive the necessary funds in an era of limited resources. The Army's FY 1976 Budget Request provides an example of this kind of prioritization of capabilities: "The Army's research and development effort covers projects that range from tanks and helicopters to radios and military medicine. Of highest priority, however, is a group known as the "Big 5." These five programs offer the promise of satisfying the Army's most pressing current materiel needs."<sup>1</sup>

### Recommendation: Use Ongoing Strategic Portfolio Analysis and Review to Prioritize and Rebalance the Army Modernization Portfolio

The Army should use the ongoing SPAR to prioritize and rebalance the Army modernization portfolio to reflect the newly developed modernization strategy. As discussed previously, CSIS analysis of the Army POM shows that planned future Army modernization investment is largely flat, with no major shifts across capability portfolios. Making the investments necessary to meet future security challenges requires making trade-offs within the budget.

## 2. MAKE ARMY MODERNIZATION A HIGHER PRIORITY

### Recommendation: Congress and the New Administration Should Increase Army Modernization Funding to Address Gaps in Army Capabilities

Addressing the future security environment's challenges requires increased funding for Army modernization to make the necessary investments in critical capabilities. Simply attempting to shift the current level of funding around the entire Army modernization portfolio, discounting any increased funds for procurement associated with growing the size of the force, insufficiently addresses the current geostrategic threats. Today's Army modernization portfolio is stretched nearly as thin as possible. While there may still be a few smaller opportunities to make trade-offs by cutting "low-hanging fruit," those opportunities are extremely limited.<sup>2</sup> As shown by the study team's historical and POM analyses, remedying the Army's capability shortfalls is likely to require significantly increased funding. This is particularly true in the area of research and development, which must be increased if the Army is to field new capabilities to maintain or recover combat overmatch.

Furthermore, while the overall Army modernization topline might increase under the Trump administration, such an increase may not directly address these key capability gaps. A significant

---

1. David Trybula, "Big Five" Lessons for Today and Tomorrow (Alexandria, VA: Institute for Defense Analyses, 2012), 92, <http://www.benning.army.mil/Library/content/NS%20P-4889.pdf>.

2. Courtney McBride, "Army G-8: Extensive Reviews Set for Services Portfolios This Fall," *Inside Defense*, August 31, 2016, <http://insidedefense.com/daily-news/army-g-8-extensive-reviews-set-service-portfolios-fall>.

portion of any topline changes is likely to be required to field and equip units that result from increases in Army force structure (compared to current plans) that the new administration has indicated it supports and that Congress has supported. While increases in Army force structure can provide benefits in terms of global posture and the resiliency of the force, they will not significantly address the issues resulting from the erosion of combat overmatch identified in this report. As such, Army modernization requires not just an increase in the overall topline, but an increase in spending that results in increased capabilities.

### Recommendation: Make the New Big Five “Capabilities” and Not Specific Platforms

Even under the new Trump administration, the Army is not likely to have sufficient funds to invest for the development, testing, and wide-scale procurement of new platforms for the whole force. Given these limitations, the CSIS study team recommends that rather than focus on specific platforms, the Army focus on developing the capabilities it needs to fight tomorrow’s fight. At this time, it is less important for the Army to procure specific new platforms than it is to address the significant capability gaps the Army faces.

### Recommendation: As Army Force Structure Increases, Grow “Smartly”

It is likely that the Army force structure will grow in the current administration given the mutual interest between Congress and the president. As force structure grows, the Army should equip this force structure with fully modernized capabilities, rather than just piecing together older, on-hand equipment to fill out the force. This approach may result in a smaller increase in force structure. Growing the force structure under the first approach risks consuming a significant portion of the Army’s modernization accounts without actually modernizing and addressing critical capability shortfalls.

Under this recommended “smart growth” approach, the Army should procure new block upgrades of existing platforms featuring crucial technological upgrades that increase Army capabilities in critical areas such as EW. For example, the Army recently reached out to industry to solicit feedback on potential future upgrades to the Stryker Combat Vehicle beyond adding Javelin and a 30-mm cannon.<sup>3</sup> Instead of procuring a last-generation model, the Army should procure a Stryker block-model featuring mature technologies identified from this solicitation process. This approach will not solve the Army’s critical capability shortfalls overnight, but it is an important immediate and intermediate step in shrinking the gap. Given that the Army faces near-term shortfalls and a range of competing priorities for resources, it is important that investments in equipment accelerate the deployment of capability gains.

---

3. Jen Judson, “U.S. Army Seeks New Stryker Capability beyond Bigger Gun,” *Defense News*, March 1, 2016, <http://www.defensenews.com/story/defense/land/vehicles/2016/03/01/army-seeks-new-stryker-capability-beyond-bigger-gun/81144946/>.



A U.S. Army tank crew, 1st Battalion, 68th Armor Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, fires a round from an M1A2 Main Battle Tank during a Live Fire Accuracy Screening Test at Presidential Range in Swietozow, Poland, January 16, 2017. U.S. Army Europe photo by Staff Sergeant Timothy D. Hughes, [https://www.flickr.com/photos/usarmyeurope\\_images/32267005501/](https://www.flickr.com/photos/usarmyeurope_images/32267005501/).

### 3. FOCUS ON CAPABILITY GAPS, NOT PLATFORMS

The Army should articulate its modernization priorities for the immediate future in terms of the key increased “capabilities” necessary for the future fight, rather than on the development of platforms. Given potential adversary technological advances, the Army faces a number of capability gaps on the battlefield of the future. It is less important that the Army develop specific platforms to address these gaps and more important that it is able to broadly deploy new capabilities to address the gaps themselves across the force. Given limited resource funding, prioritizing specific platforms focuses too much on point solutions, which may or may not be correct, rather than the underlying problem. It also presents solutions that often arrive late to need and for this reason lose the institutional and political support required to survive the sometimes decades-long development and fielding process.

**Recommendation: Prioritize New Big Five Capabilities: Electronic Warfare, Air and Missile Defense, Cross-Domain Fires, Advanced Protection, and Logistics**

Based on assessments of the international security environment and current Army capabilities, this report recommends that an updated Army modernization strategy prioritize the following five capabilities:

- Electronic Warfare
- Air and Missile Defense

- Cross-Domain Fires
- Advanced Protection
- Logistics

These five capabilities will require, and can further leverage, the Army's substantial investment made in the last two decades in networking and situational awareness.

### *Electronic Warfare*

On the battlefields of today and the future, the Army needs to be capable of operating both offensively and defensively across the electromagnetic spectrum. Army units need to be capable of disrupting adversaries while simultaneously defending themselves against enemy EW and cyber effects. Whereas other countries, such as China and Russia, have made significant investments in EW, U.S. Army capabilities are significantly behind after two decades of noninvestment.<sup>4</sup> Rather than meet its own EW requirements following the end of the Cold War, the Army chose to disband its Combat Electronic Warfare Intelligence (CEWI) unit and instead rely on U.S. Navy and Air Force assets.<sup>5</sup> However, recent events in Ukraine and technological advances have raised questions about relying on access to Navy and Air Force EW assets.

The Army is aware of this significant shortfall and has begun taking steps to reduce the gap, but recovering from a portfolio that is "empty," in the words of Colonel Jeffery Church, chief of electronic warfare on the Army Staff, will require more investment than the Army has made.<sup>6</sup> Under current investments and acquisition plans, the gap between the EW capabilities of the Army and its potential adversaries will remain for the foreseeable future. The first significant problem facing the Army is that it does not presently plan on procuring a new offensive jammer until 2023.<sup>7</sup> Second, while the Army has increased investments in recent years, the total Army EW investment is still insufficient. In PB17, the Army EW requests totaled \$142 million for procurement and \$118 million for RDT&E. As a percentage of the Army's procurement and RDT&E budgets, EW investments totaled just 0.8 percent and 1.6 percent, respectively.<sup>8</sup>

This report recommends that the Army significantly increase EW funding in the coming years to accelerate the production of new capabilities, but also to fund production of critical capacity indigenous to the Army. The Army needs to invest in both defensive and offensive EW systems to

---

4. General Paul J. Selva, "FY2017 Defense Programs" (speech at 2016 McAleese/Credit Suisse defense conference, Washington, DC, March 10, 2016), <http://www.mcaleese.com/events/mcaleese-2017-defense-programs-conference-march-10-2016>; found originally at <http://breakingdefense.com/2016/03/army-electronic-warfare-investment-lags-rhetoric-russians/>.

5. Jen Judson, "Will Russian Aggression Ramp Up U.S. Army Focus on Electronic Warfare Needs?," *Defense News*, March 7, 2016, <http://www.defensenews.com/story/defense/show-daily/ausa-global-force/2016/03/07/russian-aggression-ramp-up-us-army-focus-electronic-warfare-needs/81249312/>.

6. Sydney J. Freedberg, "Army's Electronic Warfare Cupboard Is Bare: No Jammer until 2023," *Breaking Defense*, July 20, 2015, <http://breakingdefense.com/2015/07/armys-electronic-warfare-cupboard-is-bare-no-jammer-until-2023/>.

7. *Ibid.*

8. Sydney J. Freedberg, "Army Electronic Warfare Investment Lags Russian Threat," *Breaking Defense*, March 21, 2016, <http://breakingdefense.com/2016/03/army-electronic-warfare-investment-lags-rhetoric-russians/>.

defend against a potential near-peer adversary's attacks and make attacks themselves across the electromagnetic spectrum. Additionally, the Army should avoid making a singular system the primary focus of its EW modernization strategy. This type of approach leaves the Army vulnerable to acquisition failure and enemy counters, and slows down deployment across the force. Finally, to facilitate quicker fielding to forward-deployed forces, the Army should heavily leverage the Rapid Capabilities Office (ROC) to accelerate the performance of the acquisition system. As the ROC finalizes development of new capabilities, the Army should procure critical EW systems first for forward-deployed forces, keeping the most modern equipment deployed to the highest threat areas. As units rotate to forward-deployed locations, they can be equipped with the most modern EW equipment available.

### *Air and Missile Defense*

Since the Korean War, U.S. forces have operated largely free from fear of aerial and missile attacks. This fact resulted in current U.S. doctrine reflecting assumptions about the presence of U.S. air superiority, or even air supremacy, in future operating environments. However, near-peer competitors' technological advances and Army post-Cold War divestments challenge these assumptions, leaving the future force vulnerable to these threats. Given these challenges, air and missile defense needs to be a top Army modernization priority if the United States is to succeed in potential future conflict.

Up until the end of the First Gulf War, even though the U.S. Army relied on U.S. Air Force and U.S. Navy forces to create and sustain air superiority/dominance, the Army invested in SHORAD to protect ground forces from aerial attack. Following the end of the Gulf War and the collapse of the Soviet Union, the Army suddenly found itself in an operating environment in which no credible potential air threat existed. In the absence of a credible air threat, the Army began divesting SHORAD capabilities by deactivating these battalions.<sup>9</sup> While SHORAD divestment proved inconsequential for the wars in Iraq and Afghanistan, this is not true for potential conflicts with near-peer adversaries. As countries such as China and Russia have invested in A2/AD capabilities, the ability for Air Force and Navy forces to provide sustained air-superiority is in doubt. Additionally, the ongoing conflict in the Ukraine demonstrates the potential for small unmanned aerial systems to present challenges to ground forces. Given the previous divestments in SHORAD capabilities, the U.S. Army is currently ill-structured to address either challenge.

While the Army has continued investing in missile defense capabilities unlike with SHORAD, potential near-peer missile advances present similar challenges for the Army and for the joint force more broadly. As discussed in Chapter 4, Russian missile forces can threaten critical U.S. and NATO positions throughout Europe. The challenge in countering Russian ballistic and cruise missiles is more one of capacity than capabilities. Current U.S. and NATO IAMD systems are largely effective

---

9. Gary Sheftick, "Short-Range Air Defense Back in Demand," Army News Service, February 12, 2016, [https://www.army.mil/article/162389/Short\\_range\\_air\\_defense\\_back\\_in\\_demand](https://www.army.mil/article/162389/Short_range_air_defense_back_in_demand).



U.S. Forces Korea continued its progress in fulfilling the Republic of Korea–U.S. Alliance decision to install a Terminal High Altitude Area Defense (THAAD) on the Korean peninsula as the first elements of the THAAD system arrived in the ROK. U.S. Department of Defense photo, <https://www.flickr.com/photos/39955793@N07/32600040984/>.

at defeating Russian ballistic missiles fired in small quantities, but become overwhelmed when facing large missile barrages.<sup>10</sup>

To address some of these challenges, the report authors recommend the following potential IAMD investments over the near term. First, the Army can accelerate development of the Integrated Air and Missile Defense Battle Command System (IBCS) to better integrate existing PATRIOT systems. Without IBCS, the PATRIOT system can only fire using tracks on its own radar. IBCS links existing PATRIOT radars together to form a network in which any shooter can use any sensor. Second, the Army can invest in more efficient interceptor loading systems. Currently, the Army uses a crane, which unsurprisingly is very slow. Rather than developing such a system from scratch, the Army can look into harvesting this capability from the Medium Extended Air Defense System's (MEAD) palletized loading system. Third, as the size of the active Army grows under the

---

10. Kathleen H. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe: Phase II Report* (Washington, DC: CSIS, 2016), 39–42, <https://www.csis.org/analysis/evaluating-future-us-army-force-posture-europe-phase-ii-report>.

new administration, the Army should consider adding an additional PATRIOT battalion. This would relieve strain on the PATRIOT force and better position the Army to integrate new and upgraded IAMD equipment by freeing up a battalion for testing. Fourth, the Army should invest in cruise missile detection capabilities, whether that be the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) or something else. Fifth, the Army should accelerate development of the Indirect Fire Protection Capability (IFPC) Increment 2 to address the aerial challenges and free up PATRIOT systems to focus on missile defense.<sup>11</sup> Finally, long term, the Army should leverage work conducted by the Strategic Capabilities Office (SCO) and the Navy in hypervelocity projectiles and directed energy for IAMD purposes. The Army currently lacks the funds to develop these capabilities independently, but as work elsewhere advances such that they prove available, relevant, effective, and mature, they have the potential to redefine the future cost calculus.<sup>12</sup>

### Cross-Domain Fires

Advances in enemy A2/AD capabilities demonstrate the need for the Army to be able to execute cross-domain fires, or fires across the land, air, sea, cyber, and space domains.<sup>13</sup> As demonstrated by the Russian A2/AD “thicket,” the proliferation of A2/AD capabilities means that the Army cannot necessarily rely on the Joint Force to provide certain assumed critical offensive and defensive capabilities, such as air defense through the establishment of air superiority or attacks on enemy rear echelon forces. Instead, in the future, the Army will play a critical role in certain missions, such as SEAD and long-range attacks, that it largely relied on the broader joint force to perform. To accomplish these types of missions, the Army needs to invest in cross-domain fires, “lethal and nonlethal effects against targets in all domains (air, land, sea, cyber, and space) at increased range, with greater effect, and in spite of attempts to disrupt cyber, electromagnetic spectrum, or space systems.”<sup>14</sup>

At the most basic level, the Army can enable cross-domain fires by making existing systems capable of striking targets across multiple domains, similar to what the SCO did with the ATACMS. SCO’s work on the ATACMS permitted the Army to now hit land- and sea-based moving targets with existing munitions systems.<sup>15</sup> By making these types of innovations, the Army can better leverage the existing inventory without the need for new development programs. Beyond

---

11. Jen Judson, “U.S. Army Grapples with Short-Range Air Defense Gap in Europe,” *Defense News*, June 14, 2016, <http://www.defensenews.com/story/defense/show-daily/eurosatory/2016/06/14/us-army-grapples-short-range-air-defense-gap-europe/85860378/>.

12. Sydney J. Freedberg, “Army Missile Defense Must Step Up Its Game: Heidi Shyu,” *Breaking Defense*, August 12, 2015, <http://breakingdefense.com/2015/08/army-missile-defense-must-step-up-its-game-heidi-shyu/>.

13. DoD defines fire as “the use of weapon systems or other actions to create specific lethal or nonlethal effects on a target (JP 3-09).” *Department of Defense Dictionary of Military and Associated Terms* (Washington, DC: DoD, 2017), [http://www.dtic.mil/doctrine/new\\_pubs/jp1\\_02.pdf](http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf).

14. Army Capabilities Integration Center, *The Urgency of Modernization (draft)* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2016), 9; Department of the Army, *Unified Quest 2016: Future Force Design I, Final Report* (Washington, DC: DoD, 2016), 9, [http://www.arcic.army.mil/app\\_Documents/UQ/UQ16\\_Future\\_Force\\_Design\\_I-Report.pdf](http://www.arcic.army.mil/app_Documents/UQ/UQ16_Future_Force_Design_I-Report.pdf).

15. Sydney J. Freedberg, “Carter, Roper Unveil Army’s New Ship-Killer Missile: ATACMS Upgrade,” *Breaking Defense*, October 28, 2016, <http://breakingdefense.com/2016/10/army-atacms-missile-will-kill-ships-secdef-carter/>.

SCO-esque improvements, the Army should immediately prioritize addressing capability gaps by making investments in new ATGM, MLRS warhead variants, and methods of extending the PALADIN system's range. Finally, long term, the Army should prioritize investments that enable existing platforms to operate in the cyber and space domains. Eventually, the Abrams and other platforms should be capable of delivering lethal and nonlethal fires by operating not just in the land domain, but also the cyber and space domain. This will likely encompass not a singular system but a number of systems. For example, a future platform might feature both an EW jammer system and "munitions-delivered non-kinetic effects," potentially include "electromagnetic pulse rounds."<sup>16</sup>

### *Advanced Protection Systems*

The rapid proliferation of advanced munitions globally has left U.S. ground forces vulnerable in an unprecedented manner. Both state and nonstate actors are increasingly fielding advanced rocket-propelled grenades (RPG) and ATGM that outpace U.S. defense capabilities.<sup>17</sup> Ensuring continued survivability of U.S. ground forces requires investing in and rapidly fielding advanced protection systems—in particular, APS that destroy or disrupt enemy threats before they reach U.S. forces. While the Army has sought to field APS since the 1950s, and rejected APS as "too high risk" in 2013, today's threats and foreign APS technological advances justify overriding those concerns.<sup>18</sup> Whereas the Army previously addressed similar risks by adding additional armor to combat vehicles, today's vehicles are at their near-maximum weight given operational and logistical performance. For example, the M1A2 today is too heavy for the United States to transport across Europe itself, instead having to rely on the German and British heavy equipment transports.<sup>19</sup> If the Army is to increase survivability of its ground forces, it will need to invest in APS.

The Army itself has recognized this capability shortfall and has a dual-track plan that looks to address both the short-term need and develop a long-term solution. In the short term, the Army plans to experiment with competing foreign APS across its ground combat vehicle fleet in 2017 and 2018.<sup>20</sup> Based on the results of these tests, in 2018 the Army will only then decide how to proceed. Over the long term, the Army plans to develop Modular Active Protection (MAPS), a modular open-system that allows for quicker APS upgrades. However, questions exist about the need for the Army to develop its own APS system.<sup>21</sup>

The Army should first prioritize procuring operationally usable APS in small quantities for purposes of doing integration testing and analysis of these systems on current U.S. platforms. The concerns

---

16. Department of Defense, "DoD 2017.1 SIBR Solicitation: Munition-Delivered Non-Kinetic Effects (NKE)," Small Business Innovation Research, November 30, 2016, <https://www.sbir.gov/sbirsearch/detail/1207771>.

17. Andrew Feickert, "Army and Marine Corps: Active Protection System (APS) Efforts," Congressional Research Service, August 23, 2016, 1–5.

18. Ibid.

19. Hicks et al., *Evaluating Future U.S. Army Force Posture in Europe*, 28.

20. Jen Judson, "Army Testing Foreign Active Protection Systems for U.S. Combat Vehicles," *Defense News*, June 29, 2016, <http://www.defensenews.com/story/defense/land/vehicles/2016/06/29/army-testing-foreign-active-protection-systems-us-combat-vehicles/86529894/>.

21. Ibid.; Sydney J. Freedberg, "Military Defense for Tanks: Raytheon Quick Kill vs. Israeli Trophy," *Breaking Defense*, March 9, 2016, <http://breakingdefense.com/2016/03/missile-defense-for-tanks-raytheon-quick-kill-vs-israeli-trophy/>.

that existed in 2013 cannot and should not be dismissed out of hand, but the Army should weigh whether those concerns are still justified given changes in the security environment. This report recommends that in the long term, should Army modernization receive additional funding, the Army invest in MAPS. Each of today's operational advanced protection systems present certain disadvantages, but the necessity of this capability offsets those disadvantages.<sup>22</sup> In the long term, it is in the Army's interests to develop an open-system APS such as MAPS. Given the challenges of current APS systems, however, a period of integration testing and technical refinement is in order in the near years to help reach this objective.

### *Logistics*

Logistics, while not glamorous, offers the Army some of the largest potential to improve on capability and lower operational costs in return for its investment. In recent years, the commercial sector has made substantial advances in areas that include, but are not limited to, autonomous and semi-autonomous driving assist, 3-D printing, unmanned vehicles, nanotechnology,<sup>23</sup> and robotics.<sup>24,25</sup> Given limited modernization budgets, rather than attempt to develop these capabilities indigenously from scratch, the Army should heavily leverage innovation already developed in the commercial sector. While the Army will likely still need to modify commercial-sector products to meet military operational requirements, doing so is cheaper and quicker than starting wholly new development acquisition programs.

Investing in logistics is a fundamental necessity given the likely future operational environment. In a precision-guided munitions proliferated world, the rear echelon areas from which logistics operations flow today are no longer safe from enemy attack. Near-peer adversaries, and potentially asymmetric adversaries eventually, will be capable of targeting rear echelon logistics forces, preventing forces deployed forward from being reinforced or resupplied, essentially crippling those forces. Instead of the massive centralized logistics operations of previous wars, this future operational environment is likely to require logistics operations to be smaller, more dispersed operations. Furthermore, in the wars in Iraq and Afghanistan, the United States heavily relied on contractor forces to provide essential logistics functions for U.S. and allied forces. In a future conflict with a potential, near-peer adversary, there are serious questions to be raised about the likely use of battlefield contractors.<sup>26</sup>

---

22. Sydney J. Freedberg, "Army Pushed Missile Defense for Tanks: MAPS," *Breaking Defense*, April 25, 2016, <http://breakingdefense.com/2016/04/army-pushes-missile-defense-for-tanks-maps/>.

23. National Commission on the Future of the Army, "National Commission on the Future of the Army: Report to the President and Congress of the United States," January 28, 2016, 33, [http://www.ncfa.ncr.gov/sites/default/files/NCFA\\_Full%20Final%20Report\\_0.pdf](http://www.ncfa.ncr.gov/sites/default/files/NCFA_Full%20Final%20Report_0.pdf).

24. John Gordon IV et al., *Comparing U.S. Army Systems with Foreign Counterparts: Identifying Possible Capability Gaps and Insights from Other Armies* (Santa Monica, CA: RAND, 2015), 60.

25. Graham Grose, "New Ecosystem Emerging in Military Logistics," *National Defense*, April 2016, <http://www.nationaldefensemagazine.org/archive/2016/April/Pages/NewEcosystemEmerginginMilitaryLogistics.aspx>.

26. Undersecretary of Defense (AT&L) Frank Kendall to Chairman, Defense Science Board, December 15, 2016, "Terms of Reference—Survivable Logistics," [https://insidedefense.com/sites/insidedefense.com/files/documents/jan2017/01112017\\_log.pdf](https://insidedefense.com/sites/insidedefense.com/files/documents/jan2017/01112017_log.pdf).



On board this train, waiting to be offloaded, are two M88 Recovery Vehicles and 15 M1A2 Abrams Tanks that arrived February 13, 2017, at Mihail Kogalniceanu Airbase, Romania. The 3-4 armored brigade combat team's arrival marks the start of back-to-back rotations of armored brigades in Europe as part of Atlantic Resolve. U.S. Army Europe photo, [https://www.flickr.com/photos/usarmyurope\\_images/32671983910/](https://www.flickr.com/photos/usarmyurope_images/32671983910/).

Beyond the necessity of investing in the future operating environment, investment in logistics provides the Army the opportunity to both reduce risk and rebalance the Total Army. From a risk-reduction perspective, investments in logistics capabilities such as autonomous/semi-autonomous driving assist and unmanned vehicles reduce some of the risk to the soldier. In the wars in Iraq and Afghanistan, ground convoy operations were some of the most dangerous operations. For example, there were "more than 1,100 attacks on ground convoy operations in 2010" in just Afghanistan.<sup>27</sup> Across the two theaters, the U.S. Marine Corps (USMC) and Army estimated that 10 percent and 18 percent of casualties, respectively, occurred during ground convoy operations.<sup>28</sup> For the foreseeable future, the Army will never completely reduce the risk associated with ground convoy operations, but by making investment in logistics capabilities, it can reduce some of that risk by decreasing convoy personnel requirements.

---

27. Moshe Schwartz, Katherine Blakeley, and Ronald O'Rourke, "Department of Defense Energy Initiatives: Background and Issues for Congress," Congressional Research Service, June 2016, 12, [https://www.wired.com/images\\_blogs/dangerroom/2012/07/R42558.pdf](https://www.wired.com/images_blogs/dangerroom/2012/07/R42558.pdf).

28. Ibid.

As increased investments permit reducing the number of required logistics personnel, the Army has a chance to rebalance the composition of the Total Army.<sup>29</sup> Particularly in the active component, reductions in logistics personnel permit increases to the size of combat forces (“tooth”). Beyond rebalancing the tooth-to-tail ratio, reductions in logistical personnel allow for increases across the Total Army in other critical forces—cyber, electronic warfare, civil affairs, C4ISR, etc.—that enable U.S. military success.

For these reasons—operational necessity, reduced operational risks, and rebalancing composition of the Total Army—investments in logistics represent not just increased fuel-efficiencies but actual increases in military effectiveness. Given the centrality of assured logistics to U.S. combat operations abroad, failure to invest in logistical capabilities today leaves the U.S. Army ill-prepared and perhaps critically crippled in future operations.

The Army should focus immediate investments on improving and increasing logistic capabilities in Europe in order to meet U.S. Army Europe requirements. These investments should focus on better enabling rapid deployment into the theater<sup>30</sup> and reducing the time between deployment and combat readiness in order to meet future potential operational challenges.<sup>31</sup> Second, the Army should leverage commercial-sector developments that enable upgrades to the existing inventory without the need for massive redesigns. For example, a 2015 RAND study concluded that semi-autonomous appliqué kits could be integrated into “existing platforms at one-tenth of the cost of integrating technology into a new platform.”<sup>32</sup> By embracing these types of opportunities, the Army can see significant increases to the operational effectiveness of its current inventory with more limited investment. Finally, long term, the Army should leverage work ongoing elsewhere in DoD to identify the most opportune areas for investment and ensure interoperability across the joint force. Shortly before leaving office, Undersecretary of Defense for Acquisition, Technology, and Logistics (AT&L) Frank Kendall sponsored a Defense Science Board Study looking at “Survivable Logistics.”<sup>33</sup> This work can provide an important jumping board for long-term Army logistics investments.

## Why Not Combat Vehicles?

In recent months, Lieutenant General McMaster and ARCIC’s forthcoming Future Force Development Strategy have called for the Army to begin work on the Next-Generation Combat Vehicle (NGCV). Pointing out that the Army does not have a ground combat vehicle in development for the first time since the end of World War I, McMaster and ARCIC are pushing for the Army to begin

---

29. A majority of the Army’s logistics and engineer force resides in the Reserve component. See Jen Judson, “Interview: U.S. Army Europe’s Lt. Gen. Ben Hodges,” *Defense News*, March 7, 2016, <http://www.defensenews.com/story/defense/show-daily/ausa-global-force/2016/03/07/interview-us-army-europes-lt-gen-ben-hodges/81284300/>.

30. Sydney J. Freedberg, “Over Where? Army Struggles to Relearn Rapid Deployment,” *Breaking Defense*, March 16, 2016, <http://breakingdefense.com/2016/03/over-where-army-struggles-to-relearn-rapid-deployment/>.

31. Robert Wall, “U.S. Army Deployment to Europe Encounters Logistical Challenges,” *Wall Street Journal*, January 24, 2017, <http://www.wsj.com/articles/u-s-army-deployment-to-europe-encounters-logistical-challenges-1485203221>.

32. Gordon IV et al., *Comparing U.S. Army Systems*, 60.

33. Undersecretary of Defense (AT&L) Frank Kendall to Chairman, Defense Science Board.

work on NGCV shortly with a planned initial fielding date of 2035.<sup>34</sup> It is the opinion of the authors that while the Army should begin very early work on NGCV in the coming years, it should not be part of the Army's "New Big Five" capabilities. First, highly prioritizing the NGCV at this point risks the Army modernization strategy becoming NGCV. In the case of Future Combat System (FCS), the Army modernization strategy eventually became FCS. When the program failed, so too did the Army modernization strategy. While the Army has made significant reforms to its acquisition process since FCS, the technological development is not guaranteed. Given the status of the inventory, the Army cannot afford a similar failure as FCS. Finally, the Army must focus its limited resources on addressing its immediate challenges to the warfighter, such as EW. Current-generation ground combat vehicles may face physics limitations in the future, but that day has not yet come; the U.S. soldier on the battlefield today is already at risk of losing qualitative tactical overmatch. For these reasons, the CSIS study team supports very early work on NGCV, but recommends against making it a top Army modernization priority at this time. Only after the technologies mature, prove effective and reliable, and the initial fielding date gets closer should the Army make NGCV a top priority. Many of these technologies would also likely be fielded faster if inserted into the Army's existing force, suggesting that an NGCV technologies effort may be a more useful near-term effort than a new vehicle design program.

### Recommendation: Refine and Develop New Big Five Capabilities in Conjunction with Emerging Operational Concepts Such as Multi-Domain Battle

The Army should further refine and procure "New Big Five" capabilities in conjunction with emerging concepts such as Multi-Domain Battle, just as the original "Big Five" developed concurrently with Air-Land Battle.<sup>35</sup> This related, but not interdependent, concurrent refinement and development process is mutually reinforcing for Multi-Domain Battle and the "New Big Five." Work on new operational concepts can highlight critical capability gaps. For example, early work on Multi-Domain Battle already makes clear the need for the Army to develop and better integrate and project cyber and space capabilities into its platforms and tactical operations. Furthermore, as new operational concepts evolve, work on the concept can change the importance of certain capabilities. Capability shortfalls that were perhaps previously critical shortfalls may no longer be so as new concepts minimize that risk, whereas new capability shortfalls may emerge. Meanwhile, the "New Big Five" can provide a lens through which to evaluate the technical feasibility of new concepts and their foundational assumptions. FCS is a good example of what can happen when concept and capability developments occur separately. In the absence of critical analytical capabilities, the Army failed to identify the technical limitations of the key assumptions underpinning their concept of operations, which ultimately resulted in technologically infeasible requirements that undermined both FCS and the operational concept development effort.<sup>36</sup>

---

34. Courtney McBride, "McMaster Makes Case for Combat Vehicle Modernization," *Inside Defense*, November 2, 2016, <https://insidedefense.com/daily-news/mcmaster-makes-case-combat-vehicle-modernization>.

35. Courtney McBride, "Senior Leaders Weigh Funding Picture for New Doctrine," *Inside Defense*, November 16, 2016, <http://insidedefense.com/daily-news/senior-leaders-weigh-funding-picture-new-doctrine>.

36. Christopher G. Pernin et al., *Lessons from the Army's Future Combat Systems Program* (Santa Monica, CA: RAND, 2012), 17–20, [http://www.rand.org/content/dam/rand/pubs/monographs/2012/RAND\\_MG1206.pdf](http://www.rand.org/content/dam/rand/pubs/monographs/2012/RAND_MG1206.pdf).

## Recommendation: Use Experimentation to Demonstrate the Utility of “Capabilities”

The concurrent refinement and development process for the “New Big Five” and Multi-Domain Battle outlined above should not be static, but constantly evolving through war-gaming and experimentation to test and reevaluate key assumptions. At the most basic level, war-gaming and experimentation are a necessary step in evaluating the potential effectiveness of new operational concepts such as Multi-Domain Battle. As such, the U.S. Army Training and Doctrine Command (TRADOC) will soon begin testing the Multi-Domain Battle doctrine, starting with U.S. Pacific Command (PACOM) in 2017 and EUCOM in 2018.<sup>37</sup> These two war games are important, but the Army cannot rest on its laurels once development of the Multi-Domain Battle concept is “finalized.” The Army must constantly find itself testing and reevaluating key assumptions. Did capability developments occur as planned? Have new technological advances nullified certain fundamental planning assumptions? Failure to ask these types of questions about key assumptions risks repeating the lessons of the 1990s and the “Revolution in Military Affairs.”

## 4. MAKE ARMY ACQUISITION MORE AGILE BY FOCUSING ON CONTINUOUS INNOVATION

The history of military innovation demonstrates that most successful innovations are not the result of a singular, revolutionary scientific advance, but rather a continuous, evolutionary process. Instead, these evolutionary technologies, such as the tank and Blitzkrieg concept during the Interwar period, went from a concept or nascent technology to a revolutionary form of warfare.<sup>38</sup> However, recent Army acquisition efforts since the 1990s have focused on developing “leap ahead” technologies such as FCS that ended in failure.<sup>39</sup> Given these realities, the Army should instead focus efforts on progressively fielding capability improvements in regular, sizable increments. Combining mature technologies and iteratively upgrading these “evolutionary” technologies can potentially become revolutionary. Stryker is a good example of how technologies can be iteratively upgraded from a mature design to a next-generation design. Originally procured as an interim solution to fill a gap until FCS finished development, the Stryker has since received several upgrades that have allowed it to become a benchmark of U.S. deterrence against Russian aggression in Europe.<sup>40</sup>

---

37. Sydney J. Freedberg, “Army’s Multi-Domain Battle to Be Tested in PACOM, EUCOM Wargames,” *Breaking Defense*, November 9, 2016, <http://breakingdefense.com/2016/11/armys-multi-domain-battle-tested-in-pacom-eucom-wargames/><http://breakingdefense.com/2016/11/armys-multi-domain-battle-tested-in-pacom-eucom-wargames/>.

38. Williamson Murray, “Innovation: Past and Future,” *Joint Force Quarterly* (Summer 1996), <http://www.dtic.mil/dtic/tr/fulltext/u2/a423155.pdf>.

39. Pernin et al., *Lessons from the Army’s Future Combat Systems Program*.

40. Daniel Goure, “The Stryker Infantry Combat Vehicle: A Model for Future Acquisition Programs?,” Lexington Institute, February 24, 2012, <http://lexingtoninstitute.org/the-stryker-infantry-combat-vehicle-a-model-for-future-acquisition-programs/>; Sydney J. Freedberg, “The 30 Millimeter Solution: Army Upgunning Strykers vs. Russia,” *Breaking Defense*, April 23, 2015, <http://breakingdefense.com/2015/04/the-30-millimeter-solution-army-upgunning-strykers-vs-russia/>.



A Stryker vehicle crew belonging to the 4th Brigade, 2nd Infantry Division, fires a TOW (tube-launched, optically tracked, wire-guided) antitank missile during the brigade's rotation through Fort Polk's Joint Readiness Training Center. U.S. Army photo, <https://www.flickr.com/photos/soldiersmediacenter/3698437102/>.

### Recommendation: Continue Reforming the Army Requirements Process

If the evolutionary, iterative upgrade modernization strategy proposed here is to succeed, the Army must reform its requirements generation process. Historically, the Army's requirements generation process has either been too risk averse or unconstrained by technological maturity or cost.<sup>41</sup> In recent years, the Army has made a series of important reforms to its requirements generation process, but further reforms are a necessary step in addressing the Army's modernization problem.<sup>42</sup> Even after reforms, the requirements generation process remains too slow, taking

---

41. U.S. Army, *Army Strong: Equipped, Trained, and Ready: Final Report of the 2010 Army Acquisition Review* (Washington, DC: Secretary of the Army, 2011), 31, <http://breakingdefense.sites.breakingmedia.com/wp-content/uploads/sites/3/2011/07/213465.pdf>.

42. Recent reforms include tying requirements to specific operational problems, placing commanders and the Army Chief of Staff at the center of the Army Requirements Council, and discussing trade-offs with industry much earlier in the requirements generation process. Sydney J. Freedberg, "Army Changing How It Does Requirements: McMaster," *Breaking Defense*, February 19, 2015, <http://breakingdefense.com/2015/02/army-changing-how-it-does-requirements-mcmaster/>; Courtney McBride, "Army Vice Chief: AROC Changes Make Progress toward Acquisition Reform," *Inside Defense*, May 10, 2016, <http://insidedefense.com/daily-news/army-vice-chief-aroc-changes-mark-progress-toward-acquisition-reform>; Sydney J. Freedberg, "Big Guns for Light Infantry: Mobile Protected Firepower," *Breaking Defense*, August 11, 2016, <http://breakingdefense.com/2016/08/big-guns-for-light-infantry-mobile-protected-firepower/>.

upwards of two years to simply approve a requirement.<sup>43</sup> Additionally, given the Army's multiple competing communities, requirements can end up demanding the pristine, highly lethal, invincible, ultra-lightweight solution that coincidentally fits the needs of all stakeholders. These two factors, combined with the Army acquisition community's inclination to wait to procure a system until it meets 99.9 percent of the Army's requirements, means that, by the time a system is finally approved and procured, the program is either technologically out of date or has been canceled because it no longer meets the warfighters' requirements.<sup>44</sup>

This report recommends that the Army continue reforming the requirements generation process in order to enable quicker acquisition of new capabilities in an era of rapid technological development. First and foremost, the Army's requirement process needs to deemphasize the need for pristine, 99.9 percent solutions that are everything for everyone. This emphasis has resulted in a system that either waits forever to procure new items or attempts technically infeasible development programs such as FCS. The Army should instead focus on developing requirements that permit and encourage procuring the 80 percent solutions with the understanding that upgrades can still be made to the program after it has entered production. However, the remaining 20 percent should not consist of the technologies and capabilities necessary to make a platform meet basic operationally survivable and capability requirements, as in the case of FCS. This emphasis has two significant benefits. First, it forces the Army to make trade-offs between survivability, lethality, and weight up-front, instead of trying to develop systems that meet all three requirements, a near-impossible task within the bounds of current materiel sciences. Second, by deemphasizing pristine solutions, the requirements generation process can be sped up by the CSA and the Army Requirements Council (AROC).

The strengths of this approach have already been demonstrated by the successful fielding of Stryker and the "Big Five" acquisition programs, and the failures of the Army acquisition system in the late-1990s through the 2000s. In the case of Stryker, given that it was only supposed to be an interim solution, the Army focused on procuring a system that could be rapidly provided to the warfighter, and less on a pristine solution. Numerous subsequent upgrades demonstrate how improvements added after production and fielding can increase the effectiveness of systems. Second, in the case of the "Big Five," even while these programs represented significant steps above the existing inventory, they were not optimal solutions upon initial fielding.<sup>45</sup> Instead of waiting to procure a more optimal solution, the Army chose to begin procuring and fielding these systems with concrete plans to upgrade them further just a few years later. For example,

---

43. Heidi Shyu, former assistant secretary of the Army for acquisition, logistics, and technology, "Defense Market Outlook: Challenges for the Next Administration" (remarks at the CSIS 2016 Global Security Forum, Washington, DC, December 1, 2016), <https://www.csis.org/events/global-security-forum-2016-defense-market-outlook-challenges-next-administration>; Jordana Mishory, "Shyu: DoD's Procurement Process Too Slow, Industry Partnership Needed," *Inside Defense*, December 2, 2016, <http://insidedefense.com/daily-news/shyu-dods-procurement-process-too-slow-industry-partnership-needed>.

44. Jen Judson, "Army Looks for Ways to Make Contracting More Agile," *Defense News*, October 3, 2016, <http://www.defensenews.com/army%20looks%20for%20ways%20to%20make%20contracting%20more%20agile>.

45. Trybula, "Big Five" Lessons for Today and Tomorrow, 70.

the initial M-1 Abrams models were first fielded in 1980, with the M1A1 models, featuring a 120-mm cannon among other upgrades, entering production just five years later.<sup>46</sup>

An early test for a reformed requirements process is the Army's light tank requirement, MPF. Designed to accompany infantry units in environments the M1 Abrams cannot operate in, the Army is currently working on developing, and finalizing the MPF requirements. While the Army has indicated the MPF has certain definite high-level requirements, "32-ton maximum weight, at least a 50-millimeter cannon and certain levels [more than a heavy machinegun<sup>47</sup>] of protection," the other desired capabilities are unknown at this time.<sup>48</sup> For example, a prominent debate about the MPF requirements moving forward is whether the platform needs to be air-droppable. This decision will have a significant impact on the final requirements, as meeting the weight requirements to be air-droppable will entail making trade-offs for lethality and survivability. Given the Army's desired timeline for MPF procurement, the requirements cannot be set up in a way that meets everyone's desires.

### Recommendation: Embrace Adaptable Systems (Open Systems Architectures)

The Army should embrace and increasingly move toward adaptable systems, also known as modular open systems. The adaptable system allows for upgrades to a platform or systems components without replacing or upgrading the base platform. Given the Army's equipment inventory, this adaptable systems approach is particularly appealing. While improvements in material sciences might only permit the development of a new tank chassis every 20 to 40 years, the components within the ground vehicles develop much more quickly. Rather than wait for the material science developments to upgrade the ground vehicles external components, such as the tank chassis, the Army could upgrade only the internal components. For fast-moving technologies, such as cyber and command and control, this approach allows for the Army to better keep pace with technological developments compared to seriously lagging, which occurs currently.

Starting January 1, 2019, any Army Major Defense Acquisition Program is required by law to be designed and developed using this approach, but the Army should begin to embrace this approach sooner and more broadly than required by law.<sup>49</sup> By embracing this approach sooner rather than later, Army officials can become more familiar and experienced with this approach. There is nothing in the Federal Acquisition Regulation (FAR) stopping the Army from embracing this adaptable

---

46. Ibid., 13–14.

47. Sydney Freedberg, "Army Seeks Early Industry Input on Mobile Protected Firepower," *Breaking Defense*, August 12, 2016, <http://breakingdefense.com/2016/08/army-seeks-early-industry-input-on-mobile-protected-firepower/>.

48. Jon Harper, "Army Light Tank Requirements Still up in the Air," *National Defense Magazine*, October 5, 2016, <http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=2321>.

49. U.S. Congress, House Armed Services Committee, National Defense Authorization Act for Fiscal Year 2017, Sec., H.R. 4909, Accompanying S. 2943, 114th Cong., 2nd sess., Sec. 805 (2016), [https://insidedefense.com/sites/inside-defense.com/files/documents/nov2016/11302016\\_conf1.pdf](https://insidedefense.com/sites/inside-defense.com/files/documents/nov2016/11302016_conf1.pdf).

systems approach sooner than required by 2017 National Defense Authorization Act (NDAA). The necessary acquisition mechanisms already exist, but acquisition officials have chosen not to use them due to disincentives. With those disincentives disappearing, however, the opportunity to embrace adaptable systems sooner rather than later exists.

### Recommendation: Focus on “Harvesting Technology” through Large-Scale Prototyping

In an era of limited budgets, the Army modernization strategy should not prioritize new-start, low-rate production of new platforms designed from the bottom-up, but instead heavily rely on prototyping and experimentation to test and evaluate emerging capabilities. As technologies prove available, relevant, effective, and mature the Army should then procure these new capabilities, but only in smaller quantities for forward-deployed units. Should Army modernization budget fortunes change, the Army can then procure these capabilities in larger quantities. However, unlike the current approach, the Army should focus less on predefined upgrades, instead focusing more on upgrading platforms in response to emerging operational requirements or technological advances. Given the pace of technology development, predefined upgrades might not address current operational requirements or might be near-obsolete by the time they are finally procured. If the upgrade decision process is instead more organic, the Army will be better positioned to leverage technological advances or address emerging operational requirements.

This “technology harvest” approach does have the negative downside of likely increased sustainment costs as a result of less standardized platforms across the Army, but the benefits significantly outweigh the costs.<sup>50</sup> The problem with the current approach of low-rate mass production modernization partially locks the Army into current or, in some cases, last-generation technologies in an era of rapid global technological development. For example, in PB17 the Army requested decreased funding for the Warfighter Information Network–Tactical (WIN-T) program, a critical mission command system. At the decreased funding, the Army could only provide two division sets of WIN-T increment per year instead of the Army’s own stated ideal of six to ten units per year.<sup>51</sup> Under this more minimal production schedule, it could take two to three decades to field WIN-T across the force.<sup>52</sup> When WIN-T Increment 2 is finally finished fielding, it will be woefully out of date. Furthermore, while WIN-T Increment 3 (a planned software upgrade for WIN-T Increment 2) is already in development, it presents a problem with the current approach of preplanned upgrades for low-rate mass production systems. By the time WIN-T Increment 3 is finally fielded it is likely that the pace of technological development will have already outpaced the system.

---

50. Courtney McBride, “Stryker Lethality Upgrade Adds New Challenge for 21st TSC,” *Inside Defense*, March 22, 2016, <http://insidedefense.com/daily-news/stryker-lethality-upgrade-adds-new-challenge-21st-tsc>.

51. Courtney McBride, “Lawmakers Decry Funding Cuts for Major Army Communications Program,” *Inside Defense*, April 13, 2016, <http://insidedefense.com/daily-news/lawmakers-decry-funding-cuts-major-army-communications-program>.

52. Sebastian Sprenger, “Lawmaker Seeks to Undo Cuts Slated for Major Army Network Program,” *Inside Defense*, March 23, 2016, <http://insidedefense.com/daily-news/lawmaker-seeks-undo-cuts-slated-major-army-network-program>.

## 5. ENSURE ROOM FOR NEWLY EMERGING CHALLENGES AND OPPORTUNITIES

Changes in the pace of technological advancement and the rapidly changing global security environment necessitate the Army ensure room for the budget and acquisition processes for newly emerging challenges and opportunities. By leaving room in the budget and continuing efforts like the Army Rapid Capabilities Office (RCO), the Army can respond to emerging geopolitical and technological changes more rapidly than the traditional acquisition process permits.

### Recommendation: Continue the Army Rapid Capabilities Office in the Current Presidential Administration

The new presidential administration should continue the newly created RCO in order to better position the Army to respond to rapidly emerging geopolitical and technological changes. Sitting outside of the traditional acquisition system and regulations, the RCO is best situated to respond to newly emerging challenges presented by adversaries, but also fully leverage opportunities presented by new technological advances. With a lean chain of command and a directive to focus on experimentation and prototyping of new capabilities, the RCO amplifies the advantages of these recommendations to make the Army acquisition system more agile.<sup>53</sup> As the RCO-developed capabilities prove available, relevant, effective, and mature, the traditional Army acquisition system can harvest these technologies.

Since the RCO's creation, the office has already made an immediate impact in the form of a war game for evaluating a number cyber/electronic warfare, robotics, and other "future warfare" concepts and capabilities either being employed or in development today by countries such as China and Russia. Simulating a potential conflict in the Pacific theater, the multinational coalition of Australian, Canadian, Italian, and U.S. forces faced a red cell "intent on disrupting communications and navigation."<sup>54</sup> War-game results confirmed that the United States faces capability gaps in a number of those areas (particularly if GPS is blocked), which if left unresolved leave U.S. forces vulnerable on the future battlefield.

### Recommendation: Congress Should Fund the Army Rapid Capabilities Office

Initially created using money from the Army's prototyping fund, the RCO has sufficient funding to survive until 2018 even without any additional funds. Beyond 2018, if the RCO is to continue, some congressional funding is required. Katrina McFarland, then-acting assistant secretary of the Army for acquisition, logistics, and technology (ASA/ALT), indicated in October 2016 that any future RCO

---

53. Jen Judson, "Army Launches Rapid Capabilities Office," *Defense News*, August 31, 2016, <http://www.defensenews.com/articles/army-launches-rapid-capabilities-office>.

54. Anthony Capaccio, "War Game Confirms Major Gaps in U.S. Army's Cyber Capabilities," *Bloomberg*, November 29, 2016, <https://www.bloomberg.com/news/articles/2016-11-29/war-game-confirms-major-gaps-in-u-s-army-s-cyber-capabilities>.



In below freezing temperatures, the Strike Soldiers of Battery A, 1st Battalion, 320th Field Artillery Regiment, 2nd Brigade Combat Team "STRIKE," 101st Airborne Division, conduct artillery air assault gun-raid training with the 101st's 4th Battalion, 101st Aviation Regiment, at multiple Fort Campbell training areas, March 20, 2013. U.S. Army photo by Sergeant Joe Padula, 2nd BCT Public Affairs Office, 101st Airborne Division, <https://www.flickr.com/photos/soldiersmediacenter/8599251791/in/photolist-RSHd8g-fWh-hoQ-fCgfRU-e6TpXV-FD5ebC-fCgfQf-FV22rN-nptiBP-9BbrDj-fz5icL-fZ6sSr-8inqq8-gYj9nx-F8VGuk-gbDdrT-gtxiZM-dMvV1R-4NtnYw-4CBBi9-pJkZ68-fLdSyY-fWcqn4-fPYrXH-gtw1JC-gqmhf4-4NtorS-fZ6sDv-fPYs32-fv1GRu-6MR2ji-fPYs8R-6rf5gj-fzctaj-gqmfMp-5YxaX3-fQg1fq-gqkj6w-gtAxPC-gqkEpi-8inuUa-dQFzid-eGQh7s-4NtoyE-fZsuZy-gqkn2S-fUXiS3-dALzQj-9w1ubS-fPYsex-64rUvS>.

funding requests would not exceed \$100 million.<sup>55</sup> Given the low-cost, immediate impact, high return-on-investment potential, the RCO is an effort worth funding.

### Recommendation: Dedicate a Portion of the Army Modernization Budget to Addressing Immediate Challenges and Opportunities

The Army and Congress should ensure a portion of the Army's modernization budget is not tied to any specific program, but is instead available to respond to immediate challenges and opportunities. In the absence of a walled-off portion of the budget, responding to immediate challenges and opportunities normally requires getting new programs into the POM. Given the

---

55. Scott Maucione, "Army's Rapid Capabilities Office Takes First Steps," Federal News Radio, October 4, 2016, <http://federalnewsradio.com/army/2016/10/armys-rapid-capabilities-office-takes-first-steps/>.

POM cycle, it can take two to three years before a new program gets into the POM once the requirements have been decided. Congress has historically provided emergency funding for late-breaking urgent modernization requirements, such as in the case of MRAP and upgunned Stryker, but this is not guaranteed for future challenges and opportunities.<sup>56</sup>

Such a walled-off budgetary fund does not require large amounts of money; nor would such an approach be wise. If made too large, this fund might encourage the Army to treat it as a second modernization account instead of for its intended purpose—addressing immediate challenges and opportunities. The purpose of this type of fund is to ensure stopgap funding exists to begin immediate work on rapidly emerging requirements until such time that additional funds can be authorized and appropriated.

### Recommendation: Revitalize Industry-Army Partnerships and Reward Industry Innovation

With future modernization funding likely limited, the Army needs to better leverage and reward innovation originating in the defense industrial base. When companies can bring capabilities to the Army that address urgent capability gaps funded by IRAD, the Army should use the RCO and other rapid acquisition authorities to procure these capabilities. The Stryker 30-mm cannon upgrade is a good example of how industry can provide solutions to urgent capabilities gaps. Using internal R&D funds, General Dynamics developed and demonstrated the possibility of an upgunned Stryker for Army officials in 2011. At that time, Army officials concluded that the Stryker current turret was suitable given the counterinsurgency environments experienced in Iraq and Afghanistan. However, when Russian activities in Ukraine demonstrated the Stryker's turret presented an urgent capability gap to U.S. Army Europe in 2015, the U.S. Army was able to quickly turn to the General Dynamics solution presented four years earlier.<sup>57</sup> To incentivize more companies to make these types of investments, the Army should reward companies willing to expend internal funds to address these types of situations, as there is still a general reluctance in industry to invest IRAD funding for projects without clear requirements.<sup>58</sup>

Additionally, for the few new design procurement programs in the pipeline, the Army should structure the source-selection criteria in a way that rewards and encourages company innovation. The Joint Light Tactical Vehicle (JLTV) program is an example of a competition that encouraged companies to innovate. All three competitors—Oshkosh, Lockheed Martin, and AM General—each brought proposals featuring significant truck technological breakthroughs.<sup>59</sup> Eventually, Oshkosh

---

56. Andrew Feickert, "Mine-Resistant, Ambush Protected (MRAP) Vehicles: Background and Issues for Congress," Congressional Research Service, January 18, 2011, <https://fas.org/sgp/crs/weapons/RS22707.pdf>; Freedberg, "The 30 Millimeter Solution."

57. Joe Gould, "U.S. Army: Strykers Need Bigger Gun to Fight Russia," *Defense News*, July 23, 2016, <http://www.defense-news.com/story/defense/international/europe/2015/07/23/us-army-strykers—europe-need-30mm—russia/30551987/>.

58. Sandra Erwin, "Defense R&D: Is the Reward Worth the Risk?," *National Defense Magazine*, February 21, 2016, <http://www.nationaldefensemagazine.org/blog/lists/posts/post.aspx?ID=1753>.

59. Yasmin Tadjdeh, "Joint Light Tactical Vehicle Pushed Truck Technology Forward," *National Defense Magazine*, July 2015, <http://www.nationaldefensemagazine.org/archive/2015/July/Pages/JointLightTacticalVehiclePushesTruckTechnologyForward.aspx>.

won the JLTV contract after its prototype outperformed the nearest competitor's mean miles between operational mission failure by a factor of 5.5. Whereas the Oshkosh JLTV traveled 7,000 miles between breakdown, which is 4,600 miles more than the reliability requirement, the Lockheed Martin and AM General options lasted just 1,271 and 526 miles, respectively.<sup>60</sup>

Finally, while the Army cannot afford to fund clean-sheet design of new platforms for mass production, it can begin making low-cost investments in prototypes and experimentations for companies that bring them initial technology demonstrators. For relatively limited amounts of money, the Army and industry can use these prototypes to begin testing and evaluating the feasibility of new platforms and concepts well in advance of a more formalized procurement decision.

## 6. ALIGN HUMAN CAPITAL WITH UPDATED MODERNIZATION STRATEGY

Implementing an updated Army modernization strategy requires ensuring the Army's human capital aligns with the updated strategy. More so than perhaps any service other than the Marines, the individual soldier is the Army's asymmetric advantage over potential adversaries. In the words of Lieutenant General McMaster, "We [the Army] don't man equipment, we equip the man or woman."<sup>61</sup> Without properly aligned human capital, an updated modernization strategy provides little value to the warfighter. The Army needs to ensure that it retains not only the acquisition officials and "thought leaders" who will help implement these recommendations, but also ensure the force writ large possesses the knowledge, skills, and experience necessary to operate future technological advances.

### Recommendation: Find and Retain Future Innovation Leaders in Emerging Technologies

The Army should reform its personnel system in order to better find and retain future innovation leaders in emerging technologies such as EW/cyber, robotics and autonomy, and biotechnology. Historically, realizing the potential of emerging technologies has depended on innovative individuals translating promise into actual tactics, techniques, and procedures (TTP). For example, USMC helicopter TTPs can be traced back to a small group of individuals who recognized the potential for new technology to fundamentally change Marine Corps amphibious assault doctrine.<sup>62</sup> However, the structure of the Army's up-or-out personnel system is set

---

60. Sydney J. Freedberg, "Lockheed Drops JLTV Suit; DOT&E Knocks Reliability," *Breaking Defense*, February 18, 2016, <http://breakingdefense.com/2016/02/lockheed-drops-jltv-suit-dote-knocks-reliability/>.

61. Lieutenant General H. R. McMaster, "Strategy, Policy, and History" (speech, Foreign Policy Initiative, Washington, DC, November 30, 2016), <https://www.c-span.org/video/?419276-8/foreign-policy-national-security-conference-lieutenant-general-mcmaster>.

62. B. J. Armstrong, "The Answer to the Amphibious Prayer: Helicopters, the Marine Corps, and Defense Innovation," *War on the Rocks*, December 17, 2014, <http://warontherocks.com/2014/12/answer-to-amphibious-prayer-helicopters-marine-corps-and-defense-innovation/>.



173rd Airborne Brigade paratroopers conduct a security halt during a foot patrol at the 7th Army Training Command's Grafenwoehr Training Area, Germany, January 28, 2017. U.S. Army photo by Visual Information Specialist Markus Rauchenberger, <https://www.flickr.com/photos/soldiersmediacenter/32406524880/>.

up in such a way that not only fails to find and retain these potential future leaders, but actively encumbers any effort to retain these individuals. Because many of individuals most familiar with these emerging technologies fall outside of the "command track," they often miss out on the necessary opportunities, schools, and positions required for promotion and to stay in the Army.<sup>63</sup> In addition to making basic reforms, such as revising the up-or-out system, the Army will need to create opportunities and incentives in order to compete with the private sector for these individuals.

### Recommendation: Commit to Talent Management across the Force

Beyond retention of the future innovation leaders, the Army needs to ensure that it is recruiting and retaining a force possessing the knowledge, skills, and experience required on the future battlefield. Since the end of the Vietnam War and the transition to the All-Volunteer Force, Army equipment has increasingly required smart, well-trained individuals to realize its full combat

---

63. David Barno and Nora Bensahel, "Can the U.S. Military Halt Its Brain Drain?," *Atlantic*, November 5, 2015, <http://www.theatlantic.com/politics/archive/2015/11/us-military-tries-halt-brain-drain/413965/>.

potential.<sup>64</sup> This trend will only continue going forward as emerging capabilities such as cyber, robotics, and autonomy capabilities, which only existed in science fiction at the start of the careers of today's senior leaders, rapidly proliferate onto the battlefield. Efforts like the Force of the Future are an important step in ensuring the Army can continue to recruit and retain a force with the knowledge, skills, and experiences required to operate future Army platforms and systems, and such efforts should be continued and expanded in the new administration.

### Recommendation: Strengthen the Army Acquisition Workforce

The final step in aligning human capital with an updated modernization strategy entails strengthening the competencies of the Army acquisition workforce. Cuts to the Army acquisition workforce in the immediate post–Cold War era left the Army with an acquisition community overworked and lacking in core competencies.<sup>65</sup> With the Army's struggling acquisition workforce, it is of little surprise that it lacked the analytical capabilities and sufficient number of talented personnel to ensure the success of the Army's recent complex acquisition programs.<sup>66</sup> While the Army made increasing the size and skills of its acquisition workforce a top priority in recent years, budget cuts have hampered that effort.<sup>67</sup> According to Government Accountability Office (GAO) analysis, since 2008, the number of Army acquisition personnel decreased by 3,400 personnel, with another probable 1,800 personnel losses likely by 2020.<sup>68</sup> Successfully implementing a more agile acquisition process requires an experienced, skilled acquisition workforce. Therefore, the Army should make halting and reversing the recent cuts to the size of the Army acquisition workforce a top human capital priority.

---

64. Trybula, "Big Five" Lessons for Today and Tomorrow, 70.

65. U.S. Army, *Army Strong: Equipped, Trained, and Ready*.

66. Pernin et al., *Lessons from the Army's Future Combat Systems Program*.

67. Department of the Army, "The State of the U.S. Army Acquisition Corps," *Army AL&T*, January–March 2011, [http://asc.army.mil/docs/pubs/alt/archives/2011/Jan-Mar\\_2011.pdf](http://asc.army.mil/docs/pubs/alt/archives/2011/Jan-Mar_2011.pdf).

68. Government Accountability Office, "Defense Acquisition Workforce: Actions Needed to Guide Planning Efforts and Improve Workforce Capability," GAO-16-80, December 2015, 10, 22, <http://www.gao.gov/assets/680/674152.pdf>.

# Conclusion

The combination of increasingly sophisticated potential adversaries and budgetary declines has left the Army's modernization strategy in a precarious position. Russian advances in A2/AD, ground combat, and nonkinetic capabilities have reduced U.S. tactical overmatch and threatened our ability to project power into and across Europe. These Russian capability advances demonstrate a clear message: there is a need for significant efforts to modernize U.S. ground force capabilities in the near and medium term.<sup>1</sup> Simultaneously, the Army's modernization triple whammy has left the U.S. Army's modernization program particularly ill-equipped to deal with the security challenges on NATO's eastern flank, as the severity of the drawdown led to a process where every portfolio in the Army's modernization program was cut back to, or below, minimum sustainment rates. Though these trends present significant challenges, the time is ripe for Army senior leaders to seize the initiative and reorient the Army's modernization strategy.

Now that the drawdown is over and the defense budget is poised to begin to grow, the Army's modernization strategy must be reoriented to address the challenges posed by Russia and other potential adversaries. The FY17 POM projects Army modernization funding that is approximately \$7 billion below its historical average and about \$9 billion below the average modernization funding level during periods of increasing budgets. It is hard to escape the conclusion that the Army will need substantially increased levels of modernization funding if it hopes to field significant new capabilities in the coming years. However, increased modernization funding alone is insufficient and should be accompanied by an Army modernization strategy that focuses on addressing the near- to mid-term need to field new ground force capabilities.

---

1. This section is adapted from the author's testimony before the House Armed Services Tactical Air and Land Force subcommittee: Andrew Hunter, "U.S. Ground Force Capability and Modernization Challenges in Eastern Europe" (statement before the House Armed Services Subcommittee on Tactical Air and Land Forces, March 1, 2017), [https://csis-prod.s3.amazonaws.com/s3fs-public/congressional\\_testimony/170301\\_ground\\_force\\_capability\\_hunter.pdf?Gr2sEfWA.yNedFESWBAciLhwBf0H.X1K](https://csis-prod.s3.amazonaws.com/s3fs-public/congressional_testimony/170301_ground_force_capability_hunter.pdf?Gr2sEfWA.yNedFESWBAciLhwBf0H.X1K).

The goal of delivering the Army the key capabilities it needs is best accomplished by adopting an Army modernization strategy that focuses on adding capabilities to the Army's large force of fielded systems across five major capability areas: electronic warfare, air and missile defense, cross-domain fires, advanced protection, and logistics. These capabilities will require, and can further leverage, the Army's substantial investment made in the last two decades in networking and situational awareness. The Army can obtain the fastest, most pervasive improvement in its force by progressively fielding these improvements in regular, sizable increments. In addition, the Army's modernization strategy should explicitly set aside room in the POM for quickly developing, prototyping, and deploying capabilities in response to emerging threats and opportunities, as the Army has previously done with the upgunned Stryker. Although this modernization strategy would not rule out some limited investment in efforts to develop new platforms, as many of the Army's platforms will eventually need to be replaced, such investments should be undertaken only to the extent that they do not undermine the strategy's central approach.

By adopting this new modernization approach, the Army can seize the modernization initiative and work to ensure continued U.S. tactical overmatch against potential adversaries. The following sections summarize this report's recommendations for developing a new Army modernization strategy.

1. *Develop a clearly articulated, focused modernization strategy.*
  - Senior Army leadership must develop an updated, clearly articulated, and focused modernization strategy.
  - Use ongoing Strategic Portfolio Analysis and Review to rebalance the Army modernization portfolio.
2. *Make Army modernization a higher priority.*
  - Congress and the new administration should increase Army modernization funding to address gaps in Army capabilities
  - Make the "New Big Five" capabilities and not specific platforms.
  - As Army force structure increases, grow "smartly."
3. *Focus on capability gaps, not platforms.*
  - Prioritize "New Big Five" capabilities: electronic warfare, air and missile defense, cross-domain fires, advanced protection, and logistics.
  - Refine and develop "New Big Five" capabilities in conjunction with new emerging operational concepts such as Multi-Domain Battle.
  - Use experimentation to demonstrate utility of "capabilities."
4. *Make Army acquisition more agile by focusing on continuous innovation.*
  - Continue reforming the Army requirements process.
  - Embrace adaptable systems (open systems architectures).
  - Focus on "harvesting technology" through large-scale prototyping.

5. *Ensure room for newly emerging challenges and opportunities.*

- Continue the Army Rapid Capabilities Office in the current presidential administration.
- Request that Congress fund the Army RCO.
- Dedicate a portion of the Army modernization budget to addressing immediate challenges and opportunities.
- Revitalize Industry-Army Partnerships and reward industry innovation.

6. *Align human capital with the updated modernization strategy.*

- Find and retain future innovation leaders in emerging technologies.
- Commit to talent management across the force.
- Strengthen the Army acquisition workforce.

# About the Authors

**Andrew Hunter** is a senior fellow in the International Security Program and director of the Defense-Industrial Initiatives Group (DIIG) at CSIS. From 2011 to 2014, he served as a senior executive in the Department of Defense, serving first as chief of staff to undersecretaries of defense for acquisition, technology, and logistics (AT&L) Ashton B. Carter and Frank Kendall, before directing the Joint Rapid Acquisition Cell. From 2005 to 2011, he served as a professional staff member of the House Armed Services Committee. Hunter holds an MA in applied economics from the Johns Hopkins University and a BA in social studies from Harvard University.

**Rhys McCormick** is a research associate with the Defense-Industrial Initiatives Group at CSIS. His work focuses on unmanned systems, global defense industrial base issues, and U.S. federal and defense contracting trends. Prior to working at DIIG, he interned at the Abshire-Inamori Leadership Academy at CSIS and the Peacekeeping and Stability Operations Institute at the U.S. Army War College. He holds a BS in security and risk analysis from the Pennsylvania State University and an MA in security studies from Georgetown University.



---

COVER PHOTO PVT. RANDY WREN | U.S. ARMY

**CSIS** | CENTER FOR STRATEGIC &  
INTERNATIONAL STUDIES

1616 Rhode Island Avenue NW  
Washington, DC 20036  
202 887 0200 | [www.csis.org](http://www.csis.org)

**ROWMAN &  
LITTLEFIELD**

Lanham • Boulder • New York • London

4501 Forbes Boulevard  
Lanham, MD 20706  
301 459 3366 | [www.rowman.com](http://www.rowman.com)

