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The GAO's 11th Annual Assessment of Selected Weapon Programs

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Preface & Acknowledgements

Welcome to our Tenth Annual Acquisition Research Symposium! We regret that this year it will be a "paper only" event. The double whammy of sequestration and a continuing resolution, with the attendant restrictions on travel and conferences, created too much uncertainty to properly stage the event. We will miss the dialogue with our acquisition colleagues and the opportunity for all our researchers to present their work. However, we intend to simulate the symposium as best we can, and these *Proceedings* present an opportunity for the papers to be published just as if they had been delivered. In any case, we will have a rich store of papers to draw from for next year's event scheduled for May 14–15, 2014!

Despite these temporary setbacks, our Acquisition Research Program (ARP) here at the Naval Postgraduate School (NPS) continues at a normal pace. Since the ARP's founding in 2003, over 1,200 original research reports have been added to the acquisition body of knowledge. We continue to add to that library, located online at www.acquisitionresearch.net, at a rate of roughly 140 reports per year. This activity has engaged researchers at over 70 universities and other institutions, greatly enhancing the diversity of thought brought to bear on the business activities of the DoD.

We generate this level of activity in three ways. First, we solicit research topics from academia and other institutions through an annual Broad Agency Announcement, sponsored by the USD(AT&L). Second, we issue an annual internal call for proposals to seek NPS faculty research supporting the interests of our program sponsors. Finally, we serve as a "broker" to market specific research topics identified by our sponsors to NPS graduate students. This three-pronged approach provides for a rich and broad diversity of scholarly rigor mixed with a good blend of practitioner experience in the field of acquisition. We are grateful to those of you who have contributed to our research program in the past and encourage your future participation.

Unfortunately, what will be missing this year is the active participation and networking that has been the hallmark of previous symposia. By purposely limiting attendance to 350 people, we encourage just that. This forum remains unique in its effort to bring scholars and practitioners together around acquisition research that is both relevant in application and rigorous in method. It provides the opportunity to interact with many top DoD acquisition officials and acquisition researchers. We encourage dialogue both in the formal panel sessions and in the many opportunities we make available at meals, breaks, and the day-ending socials. Many of our researchers use these occasions to establish new teaming arrangements for future research work. Despite the fact that we will not be gathered together to reap the above-listed benefits, the ARP will endeavor to stimulate this dialogue through various means throughout the year as we interact with our researchers and DoD officials.

Affordability remains a major focus in the DoD acquisition world and will no doubt get even more attention as the sequestration outcomes unfold. It is a central tenet of the DoD's Better Buying Power initiatives, which continue to evolve as the DoD finds which of them work and which do not. This suggests that research with a focus on affordability will be of great interest to the DoD leadership in the year to come. Whether you're a practitioner or scholar, we invite you to participate in that research.

We gratefully acknowledge the ongoing support and leadership of our sponsors, whose foresight and vision have assured the continuing success of the ARP:

- Office of the Under Secretary of Defense (Acquisition, Technology, & Logistics)
- Director, Acquisition Career Management, ASN (RD&A)
- Program Executive Officer, SHIPS
- Commander, Naval Sea Systems Command
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Acquisition Portfolio Trends

Weapons Acquisition Reform: Reform Act Is Helping DoD Acquisition Programs Reduce Risk, but Implementation Challenges Remain

Michael J. Sullivan
Government Accountability Office

Service-Oriented Architecture Afloat: A Capabilities-Based Prioritization Scheme

Matthew C. Horton, *United States Navy*
Diana I. Angelis, *Naval Postgraduate School*

The Impact of Computer-Based Training on Operating and Support Costs for the AN/SQQ-89(v) Sonar System

Diana I. Angelis, *Naval Postgraduate School*
William A. Gibson, *United States Navy*

The GAO's 11th Annual Assessment of Selected Weapon Programs

Michael J. Sullivan
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The GAO's 11th Annual Assessment of Selected Weapon Programs

Michael J. Sullivan—Sullivan is the director, Acquisition and Sourcing Management, U.S. Government Accountability Office. This group has responsibility for examining the effectiveness of the DoD's acquisition and procurement practices in meeting its mission performance objectives and requirements. In addition to directing reviews of major weapon system acquisitions such as the Joint Strike Fighter, F-22, Global Hawk, and various other major weapon acquisition programs, Sullivan has developed and directs a body of work examining how the DoD can apply best practices to the nation's largest and most technically advanced weapon systems acquisition system. This work has spanned a broad range of issues critical to the successful delivery of systems, including technology development, product development, transition to production, software development, program management, requirement-setting, cost estimating, and strategic portfolio management. The findings and recommendations from this work have played a major role in the department's recent acquisition policy revisions. Most recently, he has directed the GAO's annual assessment of major weapon systems programs for the Congress and GAO's work with Congress in establishing acquisition policy reforms. His team also provides the Congress with early warning on technical and management challenges facing these investments. Sullivan has been with the GAO for 24 years. He received a bachelor's degree in political science from Indiana University and a master's degree in public administration from the School of Public and Environmental Affairs, Indiana University. [sullivanm@gao.gov]

Abstract

This paper reflects the GAO's observations on how well the DoD is planning and executing its $1.602 trillion portfolio of major weapon programs. Although the total projected cost of the portfolio remains significant, that cost has declined since peaking at $1.75 trillion in 2010 and is currently at its lowest point in over five years. In addition, the number of programs in the portfolio has decreased from 98 programs in 2010 to 86 programs in 2012. DoD weapon system acquisition represents one of the largest areas of the government's discretionary spending. With the likelihood of decreased defense budgets looming in the near future, it is imperative that the DoD continue to find ways to reduce cost and improve efficiency.

Introduction

This paper reflects the GAO's observations on how well the DoD is planning and executing its $1.602 trillion portfolio of major weapon programs. Although the total projected cost of the portfolio remains significant, that cost has declined since peaking at $1.75 trillion in 2010 and is currently at its lowest point in over five years. In addition, the number of programs in the portfolio has decreased from 98 programs in 2010 to 86 programs in 2012. DoD weapon system acquisition—an area that has been on the GAO's high-risk list for more than 20 years—still represents one of the largest areas of the government's discretionary spending. Over the past decade, Congress and the DoD have made meaningful improvements in the statutory and policy frameworks that govern weapon system acquisitions by mandating and encouraging a more knowledge-based approach to the development and production of major systems. The GAO has noted in the past that practice has lagged behind policy in certain areas, and commensurate improvements in program outcomes have not been evident. However, the changes in the DoD's portfolio over the past few years indicate that some improvements are being realized. With the likelihood of decreased defense budgets looming in the near future, it is imperative that the DoD continue to find ways to reduce cost and improve efficiency.

The following are observations on (1) the cost and schedule performance of the DoD's 2012 portfolio of 86 major defense acquisition programs, including the Missile

Defense Agency's (MDA's) Ballistic Missile Defense System (BMDS); (2) the knowledge attained at key junctures in the acquisition process for 40 weapon programs in development or early production; and (3) key acquisition reform initiatives and program concurrency.[1] For a more detailed discussion of each of the observations, see GAO-13-294SP (GAO, 2013).

Data from three sets of programs provided the basis for the observations:

- We assessed all 86 major defense acquisition programs in the DoD's 2012 portfolio for our analysis of cost and schedule performance. To develop our observations, we obtained cost, schedule, and quantity data from the DoD's December 2011 Selected Acquisition Reports (SARs) and from the Defense Acquisition Management Information Retrieval Purview system. In order to fully reflect the total size and cost of the DoD's portfolio, we included the cost of BMDS—as of DoD's fiscal year 2013 budget submission—in this year's assessment of the changes in the overall cost and size of the portfolio over the past year. However, the program was excluded from the remainder of our analyses because no acquisition program baseline exists.
- We assessed 40 MDAPs that were mostly between the start of development and full-rate production for our analysis of knowledge attained at key junctures and the implementation of acquisition reforms. To develop our observations, we obtained information on the extent to which the programs follow knowledge-based practices for technology maturity, design stability, and production maturity using a data-collection instrument. We also submitted a survey to program offices to collect information on systems engineering reviews, design stability, manufacturing planning and execution, and the implementation of specific acquisition reforms. We received survey responses from all of the programs from August to November 2012.
- In addition, we assessed 17 future major defense acquisition programs in order to gain additional insights into the implementation of key acquisition reform initiatives. To develop our observations, we submitted a survey to program offices to collect information on program schedule events, costs, and numerous acquisition reforms, and received responses from all 17 future programs from August to October 2012.

Observations on the Performance of the DoD's 2012 Major Defense Acquisition Program Portfolio

The overall size and estimated cost of the DoD's portfolio of MDAPs decreased over the past year, while the average time to deliver initial capability to the warfighter increased by one month. Our analysis of the DoD's 2012 portfolio allows us to make the following nine observations.

1. The DoD's 2012 portfolio of major defense acquisition programs contains 86 programs with a combined total estimated cost of $1.602 trillion, which is a

[1] Major defense acquisition programs are those identified by the DoD that require eventual total research, development, test, and evaluation (RDT&E) expenditures, including all planned increments, of more than $365 million, or procurement expenditures, including all planned increments, of more than $2.19 billion, in fiscal year 2000 constant dollars. The DoD has a list of programs designated as pre–major defense acquisition programs (pre-MDAP). These programs have not formally been designated as MDAPs; however, the DoD plans for these programs to enter system development, or bypass development and begin production, at which point they will likely be designated as MDAPs. We refer to these programs as future major defense acquisition programs throughout this report.

reduction of 10 programs and more than $152 billion from 2011 levels. This represents the smallest portfolio in more than five years.[2]

2. The total estimated acquisition cost of the 86 programs in the 2012 portfolio decreased by $44 billion over the past year while the delivery of initial operating capability slipped by one month on average.[3] When assessed against first full estimates, the total cost of the portfolio has increased by over $400 billion, including more than $90 billion in development cost growth and nearly $290 billion in procurement cost growth, with an average delay of 27 months in the delivery of initial operating capability.[4]
3. Program cancelations and restructurings account for nearly all of the cost reduction over the past year.
4. Long-term progress of the Missile Defense Agency's $133 billion BMDS cannot be assessed because insight into future program costs is limited to the five years covered by the budget, and the program was not required to establish an acquisition program baseline when it began.
5. More than 60% of the programs in the 2012 portfolio increased buying power over the past year—as measured by a decrease in program acquisition unit cost—a notable improvement when compared to last year, when more than 60% of the programs in the portfolio lost buying power.
6. When measured against cost growth targets discussed by the DoD, the Office of Management and Budget (OMB), and the GAO, the portfolio's performance has improved. Only 15% of programs exceeded the one-year target—down from 40% last year—and smaller percentages of programs exceeded targets for growth both in the past five years and since first full estimates.
7. Eight of the 10 costliest programs in the DoD's portfolio, excluding BMDS, reported cost reductions over the past year totaling nearly $5 billion—about 10% of the portfolio's total cost reduction.
8. The DoD has invested more than $805 billion in its 2012 portfolio, leaving over $660 billion remaining to be funded, excluding BMDS. More than 90% of the remaining funding is for procurement, with more than 60% of that amount associated with the 10 costliest programs in the portfolio, most prominently the Joint Strike Fighter.
9. Around 40% of the funding needed to complete the programs in the portfolio represents cost growth since first full estimates.

Observations on Knowledge Attained by Programs at Key Acquisition Junctures

Our 2013 assessment continues to demonstrate both progress and a significant need for programs to better follow a knowledge-based approach, reducing gaps in technology, design, and production knowledge. Knowledge in these three areas builds over

[2] All dollar figures are in fiscal year 2013 constant dollars, unless otherwise noted.
[3] In addition to research and development and procurement costs, total acquisition cost includes acquisition-related operation and maintenance and system-specific military construction costs.
[4] Our discussion of cost growth since first full estimates does not include the BMDS, as the program was not required to establish an acquisition program baseline when it began (see GAO, 2012a, for an assessment of the Missile Defense Agency's cost, testing, and performance progress in developing the system).

time—a knowledge deficit early in a program can cascade through design and production, leaving decision-makers with less knowledge to support decisions about when and how best to move into subsequent acquisition phases that commit more budgetary resources. A knowledge-based acquisition approach is a cumulative process in which certain knowledge is acquired by key decision points before proceeding. Demonstrating technology maturity is a prerequisite for moving forward into system development, during which the focus should be on design and integration. A stable and mature design is likewise a prerequisite for moving forward into production where the focus should be on efficient manufacturing. We assessed the knowledge attained at key junctures in the acquisition process for 40 individual weapon programs, which are mostly in development or early production.[5] Not all programs included in our assessment of knowledge-based practices provided information for every knowledge point or had reached all of the knowledge points—development start, design review, and production start—at the time of our review. Our analysis allows us to make the following three observations:

1. Many of the programs that began in the last five years had mature technologies and held a preliminary design review prior to the start of development (knowledge point 1), providing a better foundation to avoid future cost and schedule problems.
2. Less than one third of the programs that provided data on design drawings released actually reported having a stable design at their critical design review (knowledge point 2), and the use of other knowledge-based practices to ensure design stability at this critical juncture varied.
3. Many of the programs we assessed have taken or plan to take steps to capture critical manufacturing knowledge prior to the start of production (knowledge point 3), although the methods used varied.

Observations on Implementation of Acquisition Reform Initiatives and Program Concurrency

Over the past several years, Congress and the DoD have instituted multiple initiatives aimed at improving the way the department does business by driving down acquisition costs and ensuring that programs are more affordable: specifically the Weapon Systems Acquisition Reform Act of 2009, the reissuance of DoD Instruction 5000.02 (OUSD[AT&L], 2008), and multiple "Better Buying Power" memorandums issued by the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD[AT&L], 2010a, 2010b, 2010c, 2012). We analyzed survey data collected from 40 current major defense acquisition programs—the same programs reflected in our knowledge point analysis—and 17 programs identified by the DoD as future major defense acquisition programs, regarding the implementation of key aspects of these reform initiatives. We focused our analysis on the aspects of the DoD's "Better Buying Power" initiatives and the Weapon Systems Acquisition Reform Act of 2009 aimed at ensuring program and portfolio affordability, controlling cost growth, and promoting competition throughout the acquisition life-cycle.[6] In addition, we assessed the amount of concurrency between developmental

[5] Because knowledge points and best practices differ for shipbuilding programs, we exclude the six shipbuilding programs from some of our analysis related to knowledge point 2 and knowledge point 3.
[6] In December 2012, we reported on the DoD's implementation of the Weapon System Acquisition Reform Act of 2009 and noted that the DoD had taken steps to implement fundamental provisions of the Act, and that the DoD was taking additional steps to further strengthen its policies and acquisition capabilities. We also reported, however, that the DoD still faced organizational, policy, and cultural challenges to implementing acquisition reform (GAO, 2012b).

testing and production for those current programs beyond knowledge point 3.[7] We have consistently emphasized the importance of completing developmental testing before entering production and have pointed out the increased risks associated with concurrent testing and production. Our analysis allows us to make the following five observations:

1. The implementation of several key initiatives in the Weapon System Acquisition Reform Act of 2009 aimed at increasing program knowledge at development start varied among the future major defense acquisition programs we surveyed.
2. Around half of the current and future programs we assessed have established affordability requirements, and many are meeting those requirements.
3. Almost 90% of the current MDAPs we assessed have conducted "should cost" analysis, and most of those programs noted that they had realized or expected to realize cost savings as a result.
4. Although the DoD recognizes the need for and benefits of competition in weapon system acquisitions, and the Weapon Systems Acquisition Reform Act of 2009 requires programs to have competitive acquisition strategies, many of the programs we assessed did not have such strategies in place.
5. Nearly 80% of the programs we surveyed that were in production reported that 30% or more of their developmental testing had been or was going to be done during production, despite the increased risk that design changes and costly retrofits will need to be made.

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Weapon Systems Acquisition Reform Act of 2009, Pub. L. No. 111-23 (2009).

[7] This analysis reflects 18 non-ship programs, of the 40 total, for which we have a knowledge point 3 date identified. Ships are excluded from this analysis because we do not assess knowledge point 3 for ships.

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