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U.S. LAUNCH ENTERPRISE

Acquisition Best Practices Can Benefit Future Efforts

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Chairmen Rockefeller and Udall, Ranking Members Thune and Sessions, and members of the Committee and Subcommittee:

Thank you for inviting me to testify on the current and future state of the U.S. launch enterprise. As you know, the EELV program is the primary provider of launch vehicles for U.S. military and intelligence satellites. Today I will discuss (1) highlights of GAO's past work on EELV, and (2) how acquisition best practices would benefit future engine development efforts. In general, our past work has highlighted a need for stronger management and oversight for EELV as well as more knowledge about pricing, costs and the industrial base for the block buy. DOD and Congress have implemented many positive actions to address our recommendations. For future efforts, adopting best practices early could help stem cost and schedule growth and other problems.

My testimony is based on the body of work we have performed on the EELV program and acquisition best practices in recent years and related reports issued from September 2008 to March 2014. In this body of work we interviewed DOD and industry officials, conducted contract reviews, assessed knowledge of the industrial base, and analyzed program acquisition strategies, among other things. Our prior reports each include a detailed description of our scope and methodology. All work on which this testimony is based was performed in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The Department of Defense (DOD) expects to spend about $9.5 billion over the next five years acquiring launch hardware and services through the program, during which time it will also be working to certify new launch providers. This investment represents a significant amount of what the entire U.S. Government expects to spend on launch activities—including new development, acquisition of launch hardware and services, and operations and maintenance of launch ranges—for the same period. The United Launch Alliance (ULA) is currently the sole provider of launch services through the EELV program. However, DOD, the National Aeronautics and Space Administration (NASA), and the National Reconnaissance Office (NRO) are working to certify new launch providers who can compete with ULA for launch contracts.

Highlights of GAO's Work on EELV

Because of the importance of the national security space launch enterprise, we have been asked to look at many aspects of the EELV program over the last 10 years. Our work has examined management and oversight for EELV, as well as the "block buy" acquisition approach. The block buy approach, finalized in December 2013, commits the department to an acquisition that spans 5 years, in contrast with the prior practice of acquiring launch vehicles one or two at a time, with the aim of stabilizing the launch industrial base and enabling the government to achieve savings. Additionally, we have assessed the status of the launch vehicle certification process for new entrants. DOD and Congress have taken numerous actions to address our prior recommendations which have resulted in financial and oversight benefits. Highlights of our work over the years follow.

2008

We reported that when DOD moved the EELV program from the research and development phase to the sustainment phase in the previous year, DOD eliminated various reporting requirements that would have provided useful oversight to program officials and Congress.[1] For example, the EELV program was no longer required to produce data that could have shed light on the effects the joint venture between Lockheed Martin and Boeing companies (later known as ULA) was having on the program, programmatic cost increases and causes, and other technical vulnerabilities that existed within the program. Furthermore, because the program was now in the sustainment phase, a new independent life-cycle cost estimate was not required for the program; as a result, DOD would not be able to rely on its estimate for making long-term investment planning decisions. According to DOD officials, the life-cycle cost estimate for the program at the time was not realistic. Our recommendations to strengthen oversight reporting gained attention in 2011 following concerns about rising program cost estimates and at that time, Congress required the Secretary of Defense to redesignate the EELV program as a major defense acquisition program, thereby removing it from the sustainment phase and reinstating previous reporting requirements. DOD also developed a new program cost estimate, which allows for greater oversight of the program for both Congress and DOD.

[1] GAO, *Space Acquisitions: Uncertainties in the Evolved Expendable Launch Vehicle Program Pose Management and Oversight Challenges,* GAO-08-1039 (Washington, DC: Sept. 26, 2008).

2011

We reported that the block buy acquisition approach may be based on incomplete information and although DOD was still gathering data as it finalized the new acquisition strategy, some critical knowledge gaps remained.[2] Specifically, DOD analysis on the health of the U.S. launch industrial base was minimal, and officials continued to rely on contractor data and analyses in lieu of conducting independent analyses. Additionally, some subcontractor data needed to negotiate fair and reasonable prices were lacking, according to Defense Contract Audit Agency reports, and some data requirements were waived in 2007 in exchange for lower prices. DOD also had little insight into the sufficiency or excess of mission assurance activities, which comprise the many steps taken by the government and contractors to ensure launch success. Though the level and cost of mission and quality assurance employed today is sometimes criticized as excessive, it has also resulted in more than 80 consecutive successful launches. We also reported that the expected block buy may commit the government to buy more booster cores than it needs, and could result in a surplus of hardware requiring storage and potentially rework if stored for extended periods.[3] Further, while DOD was gaining insight into the rise in some engine prices, expected at that time to increase dramatically, it was unclear how the knowledge DOD was gaining would inform the expected acquisition approach or subsequent negotiations.

We reported that broader issues existed as well, regarding the U.S. Government's acquisition of, and future planning for, launch services—issues which we recommended be addressed, given that they could reduce launch costs and assure future launch requirements are met. For example, we recommended that federal agencies—like the Air Force, NRO, and NASA—more closely coordinate their acquisitions of launch services. Planning was also needed for technology development focused on the next generation of launch technologies, particularly with respect to engines, for which the United States remains partially reliant on foreign suppliers. Congress responded to our work by legislating that DOD explain how it would address the deficiencies we found.

[2] GAO, *Evolved Expendable Launch Vehicle: DOD Needs to Ensure New Acquisition Strategy Is Based on Sufficient Information*, GAO-11-641 (Washington, D.C.: Sept. 15, 2011).

[3] The booster core is the main body of a launch vehicle.

2012

We reported that DOD had numerous efforts underway to address the knowledge gaps and data deficiencies identified in our 2011 report.[4] Of the seven recommendations we made to the Secretary of Defense, two had been completely addressed, four were partially addressed and one had no action taken. That recommendation was aimed at bolstering planning for the next generation of launch technologies. Since GAO's 2011 report, DOD had completed or obtained independent cost estimates for two EELV engines and completed a study of the liquid rocket engine industrial base. Officials from DOD, NASA, and the NRO initiated several assessments to obtain needed information, and worked closely to finalize new launch provider certification criteria for national security space launches. Conversely, we reported that more action was needed to ensure that launch mission assurance activities were not excessive, to identify opportunities to leverage the government's buying power through increased efficiencies in launch acquisitions, and to strategically address longer-term technology investments.

2013

We reported on the status of DOD's efforts to certify new entrants for EELV acquisitions.[5] While potential new entrants stated that they were generally satisfied with the Air Force's efforts to implement the process, they identified several challenges to certification, as well as perceived advantages afforded to the incumbent launch provider, ULA. For example, new entrants stated that they faced difficulty in securing enough launch opportunities to become certified. During our review, the Under Secretary of Defense for Acquisition, Technology, and Logistics directed the Air Force to make available up to 14 launches for competition to new entrants, provided they demonstrate the required number of successful launches and provide the associated data in time to compete. Additionally, new entrants considered some Air Force requirements to be overly restrictive; for example, new entrants must be able to launch a minimum of 20,000 pounds to low earth orbit from specific Air Force launch sites (versus facilities the new entrants currently use.) The Air Force stated that 20,000 pounds represents the low end of current EELV lift requirements, and that alternate launch sites are not equipped to

[4] GAO, *Evolved Expendable Launch Vehicle: DOD Is Addressing Knowledge Gaps in Its New Acquisition Strategy,* GAO-12-822 (Washington, DC: July 26, 2012).

[5] GAO, *Launch Services New Entrant Certification Guide*, GAO-13-317R (Washington, DC: Feb. 7, 2013).

	support DOD's national security space launches. Further, new entrants noted that the incumbent provider receives ongoing infrastructure and development funding from the government, an advantage not afforded to the new entrants, and that historical criteria for competition in the EELV program were more lenient. The Air Force acknowledged that criteria for competition are different, and reflective of the differences in the current acquisition environment.
2014	We reported and testified that DOD's new contract with ULA (sometimes referred to as the "block buy") represented a significant effort on the part of DOD to negotiate better launch prices through its improved knowledge of contractor costs, and that DOD officials expected the new contract to realize significant savings, primarily through stable unit pricing for all launch vehicles.[6] At the time of our review, DOD was leading the broader competition for up to 14 launches, expected to begin in fiscal year 2015. In advance of the upcoming competition, DOD was considering several approaches to how it would require competitive proposals to be structured. Our report did not recommend an approach. However, we identified the pros and cons of two different ends of the spectrum of choices, one being a commercial-like approach and the other being similar to the current approach (a combination of cost-plus and fixed price contracts). If DOD required offers be structured similar to the way DOD currently contracts with ULA, there could be benefits to DOD and ULA as both are familiar with this approach, but potential burdens to new entrants, which would have to change current business practices. Alternatively, if DOD implemented a commercial approach to the proposals, new entrants would potentially benefit from being able to maintain their current efficient business practices, but DOD could lose insight into contractor cost or pricing, as this type of data is not typically required by the Federal Acquisition Regulation under a commercial item acquisition. DOD could also require a combination of elements from each of these approaches, or develop new contract requirements for this competition.

[6] GAO, *The Air Force's Evolved Expendable Launch Vehicle Competitive Procurement,* GAO-14-377R (Washington, D.C.: Mar, 4, 2014) and GAO, *Evolved Expendable Launch Vehicle: Introducing Competition into National Security Space Launch Acquisitions*, GAO-14-259T (Washington, D.C.: Mar. 5, 2014).

Best Practices Would Benefit Future Engine Development Efforts

ULA's Atlas 5 launch vehicle uses the RD-180 engine produced by the Russian company NPO Energomash. DOD and Congress are currently weighing the need to reduce U.S. reliance on rocket engines produced in Russia and the costs and benefits to produce a similar engine domestically. The RD-180 engine has performed extremely well for some of the nation's most sensitive national security satellites, such as those used for missile warning and protected communications. Moreover, the manufacture process of the RD-180 is one that cannot be easily replicated. In addition, the most effective way to design a launch capability is to design all components in coordination to optimize capabilities needed to meet mission requirements. In other words, replacing the RD-180 could require the development of a new launch vehicle and potentially new launch infrastructure.

Space launch vehicle development efforts are high risk from technical, programmatic, and oversight perspectives. The technical risk is inherent. For a variety of reasons, including the environment in which they must operate, a vehicle's technologies and design are complex and there is little to no room for error in the fabrication and integration process. Managing the development process is complex for reasons that go well beyond technology and design. For instance, at the strategic level, because launch vehicle programs can span many years and be very costly, programs often face difficulties securing and sustaining funding commitments and support. At the program level, if the lines of communication between engineers, managers, and senior leaders are not clear, risks that pose significant threats could go unrecognized and unmitigated. If there are pressures to deliver a capability within a short period of time, programs may be incentivized to overlap development and production activities or delete tests, which could result in late discovery of significant technical problems that require more money and ultimately much more time to address. For these reasons, it is imperative that any future development effort adopt disciplined practices and lessons learned from past programs. I would like to highlight a few practices that would especially benefit a launch vehicle development effort.

First, decisions on what type of new program to pursue should be made with a government-wide and long-term perspective. Our prior work has shown that defense and civilian government agencies together expect to require significant funding, nearly $44 billion in then-year dollars (that factor in anticipated future inflation), for launch-related activities from

fiscal years 2014 through 2018.[7] At the same time, our past work has found that launch acquisitions and activities have not been well coordinated, though DOD and NASA have since made improvements.[8] Concerns have also been raised in various studies about the lack of strategic planning and investment for future launch technologies. Further, the industry is at a crossroads. For example, the government has a decreased requirement for solid rocket motors, yet for strategic reasons some amount of capability needs to be sustained and exercised. The emergence of Space Exploration Technologies, Corp. (SpaceX) and other vendors that can potentially compete for launch acquisitions is another trend that benefits from coordination and planning that takes a government-wide perspective. The bottom line is that any new launch vehicle effort is likely to have effects that reach beyond DOD and the EELV program and should be carefully considered in a long-term, government-wide context.

Second, requirements and resources (for example, time, money, and people) need to be matched at program start. This is the first of three key knowledge points we have identified as best practices. In the past, we have found that recent launch programs, such as NASA's Constellation program and Commercial Crew Program, have not had sufficient funding to match demanding requirements.[9] Funding gaps can cause programs to delay or delete important activities and thereby increase risks and can limit the extent to which competition can be sustained. Realistic cost estimates and assessments of technical risk are particularly important at program start. Space programs have historically been optimistic in estimating costs (although recently DOD and NASA have been making strides to produce more realistic estimates). The commitment to more realistic, higher confidence cost estimates would be a great benefit to any new launch vehicle development program and enable Congress to ensure

[7] GAO, *Defense and Civilian Agencies Request Significant Funding for Launch-Related Activities*, GAO-13-802R (Washington, D.C.: Sept. 9, 2013).

[8] GAO, *2012 Annual Report: Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue*, GAO-12-342SP (Washington, D.C.: Feb. 28, 2012).

[9] GAO, *NASA: Constellation Program Cost and Schedule Will Remain Uncertain Until a Sound Business Case Is Established,* GAO-09-844 (Washington, D.C.: Aug., 26, 2009) and GAO, *NASA: Actions Needed to Improve Transparency and Assess Long-Term Affordability of Human Exploration Programs,* GAO-14-385 (Washington, D.C.: May 8, 2014).

its commitment is based on sound knowledge. We have also found that imposing overly ambitious deadlines can cause an array of problems. For instance, they may force programs to overlap design activities with testing and production.[10] The many setbacks experienced by the Missile Defense Agency's ground-based midcourse defense system, for example, are rooted in schedule pressures that drove concurrent development.[11] Even if the need for a new engine is determined to be compelling, the government is better off allowing adequate time for disciplined engineering processes to be followed.

Third, the program itself should adopt knowledge-based practices during execution. The program should also use quantifiable data and demonstrable knowledge to make go/no-go decisions, covering critical facets of the program such as cost, schedule, technology readiness, design readiness, production readiness, and relationships with suppliers. Our work on the second and third knowledge points during execution (design stability and production process maturity) has tied the use of such metrics to improved outcomes. In addition, the program should place a high priority on quality, for example, holding suppliers accountable to deliver high-quality parts for their products through such activities as regular supplier audits and performance evaluations of quality and delivery, among other things. Prior to EELV, DOD experienced a string of launch failures in the 1990s due in large part to quality problems.

This concludes my statement. I am happy to answer questions related to our work on EELV and acquisition best practices.

[10] GAO, *Missile Defense: Mixed Progress in Achieving Acquisition Goals and Improving Accountability,* GAO-14-351 (Washington, D.C.: Apr. 1, 2014).

[11] GAO-14-351. In 2004 we found that the Missile Defense Agency (MDA) committed to a highly concurrent development, production, and fielding ground-based midcourse (GMD) interceptors. Because MDA moved forward with interceptor production before completing its flight testing program, test failures have exacerbated disruptions to the program. For example, because the program has delivered approximately three-fourths of the interceptors for fielding, the program faced difficult and costly decisions on how it will implement corrections from prior test failures. Also, the program has had to add tests that were previously not planned and delay tests that are necessary to understand the system's capabilities and limitations. As a result of these development challenges, the GMD program will likely continue to experience delays, disruptions, and cost growth.

GAO Contact and Staff Acknowledgments

For questions about this statement, please contact Cristina Chaplain at (202) 512-4841, or at chaplainc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Individuals making key contributions to this testimony were Art Gallegos, Assistant Director; Pete Anderson, Claire Buck, Erin Cohen, Laura Hook, and John Krump.

Related GAO Products

NASA: Actions Needed to Improve Transparency and Assess Long-Term Affordability of Human Exploration Programs. GAO-14-385. Washington, D.C.: May 8, 2014.

Missile Defense: Mixed Progress in Achieving Acquisition Goals and Improving Accountability. GAO-14-351. Washington, D.C.: April 1, 2014.

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