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STATEMENT OF

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BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

ON

CASE STUDIES IN DOD ACQUISITION: FINDING WHAT WORKS

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Chairman McKeon, Ranking Member Smith, distinguished members of the committee, thank you for the opportunity to appear before you today to discuss case studies in Department of Defense (DOD) acquisition.

As part of my work as a naval issues analyst at CRS, I have been tracking issues related to Navy acquisition, and DOD acquisition more generally, since 1984. In addition to reports on individual Navy shipbuilding programs and other individual Navy acquisition programs, I have authored or co-authored reports on alternative funding approaches for Navy ship procurement,[1] options for lower-cost Navy ships,[2] factors affecting efficiency in Navy shipbuilding,[3] shipyard mergers and their effect on Navy ship acquisition,[4] the DOD full funding provision,[5] and multiyear procurement (MYP) and block buy contracting in DOD acquisition.[6]

As requested, my statement will focus on three topics:

- some examples of Navy acquisition programs that are generally regarded as success stories;
- some potential acquisition lessons that emerge from a review of Navy acquisition in recent decades; and
- some additional observations relating to DOD acquisition and potential options for improving it.

Some Examples of Navy Acquisition Programs That Are Generally Regarded As Success Stories

Focusing on Successful (Not Just Less-Than-Successful) Programs Has Value

Discussions of DOD acquisition often focus on programs that have experienced problems with cost growth, schedule slippage, performance shortfalls, system design problems, and construction quality. While focusing on such programs is consistent with Congress' role in overseeing DOD activities, focusing on programs that are generally regarded as success stories is also consistent with Congress' oversight role, and can identify options for improving DOD acquisition that might not be easy to identify solely by focusing on programs that have experienced problems.

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[1] CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches—Background and Options for Congress*, by Ronald O'Rourke.

[2] CRS Report RL32914, *Navy Ship Acquisition: Options for Lower-Cost Ship Designs—Issues for Congress*, by Ronald O'Rourke.

[3] CRS Report 96-785 F, *Navy Major Shipbuilding Programs and Shipbuilders: Issues and Options for Congress*, by Ronald O'Rourke, particularly Appendix B (on spreading of shipyard fixed costs) and Appendix C (on shipyard learning effects).

[4] CRS Report RL31400, *Navy Shipbuilding: Recent Shipyard Mergers -- Background and Issues for Congress*, by Ronald O'Rourke.

[55] CRS Report RL31404, *Defense Procurement: Full Funding Policy—Background, Issues, and Options for Congress*, by Ronald O'Rourke and Stephen Daggett.

[6] CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz.

Some Navy Programs That Are Well Regarded Today Might Not Have Been Well Regarded Years Ago

It is worth mentioning, prior to listing some examples of Navy acquisition programs that are generally regarded as success stories, that acquisition programs and the platforms they produce that are generally well regarded today were, in some cases, not very well regarded in earlier years.

For example, in the early 1980s the Navy was procuring a new class of ships that one article referred to as "an obese, $1 billion walrus of the high seas with potentially dangerous stability problems."[7] The ship class in question was the Ticonderoga (CG-47) class Aegis cruiser—a ship class that today is a valued component of the Navy's surface fleet. Indeed, the Navy in its FY2015 budget submission is proposing a strategy for continuing to operate some of its CG-47s into the 2040s.

As another example, in the late 1980s a different Navy ship acquisition program was criticized as a "procurement nightmare,"[8] and the class of ship being acquired through the program was described by its critics as "the Navy's billion-dollar hole in the water" and "another example of the Navy driving itself to the poor house in a Cadillac."[9] The ship in question was the Arleigh Burke (DDG-51) class Aegis destroyer—a class that, with a total of 70 ships procured through FY2014 and additional units scheduled for procurement in FY2015 and beyond, has become one of the largest classes of major Navy combatants in recent decades. The DDG-51 acquisition program today is generally not controversial. The program office received a David Packard Excellence in Acquisition Award from DOD in 2012, and the bidding method used in the program in recent years is cited below as an example of an acquisition success story.

Indeed, as I discussed in more detail in my testimony to the Seapower and Projection Forces subcommittee last October 23, several classes of surface combatants that the Navy has acquired since the 1970s were criticized on one or more grounds in their early years, but went on to become well-regarded (or at least less controversial) in later years.[10] This is not to argue that those early criticisms were necessarily invalid; it is only to point out that problems can be overcome, and that the reputations of acquisition programs and the platforms that they produce can change over time.

With this cautionary note in mind, below are some examples of Navy acquisition programs that are generally regarded as success stories. These are by no means the only examples that might be cited, and lists compiled by other observers would likely include different examples.

Nuclear Propulsion

The Navy's success in developing, procuring, and safely operating nuclear propulsion systems on Navy surface ships and submarines is so longstanding that it can be easy to overlook in a list of successful Navy acquisition efforts, particularly since the office in charge of this effort, Naval Reactors, generally does not

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[7] Richard Barnard, "CG-47: Overweight and 'Ineffectual,'" *Defense Week*, August 16, 1982: 1, 15.

[8] George C. Wilson, "$1 Billion Navy Destroyer's Cost Is Making Waves," *Washington Post*, September 15, 1989: A13; Timothy McCune, "Bath Iron Works Begs Off Meeting With GAO," *Defense Week*, September 25, 2989: 14; William V. Kennedy, "New Navy Ship Faces Its First Battle," *Christian Science Monitor*, September 28, 1989: 8.

[9] George C. Wilson, "The Wrong Destroyer?" *Washington Post*, August 10, 1986: B5.

[10] See Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, Before the House Armed Services Committee, Subcommittee on Seapower and Projection Forces, on the Navy's FY2014 30-Year Shipbuilding Plan, October 23, 2013, pp. 9-13.

go out of its way to draw attention to itself. When one considers the various things that conceivably might go wrong with integrating a nuclear propulsion system into a warship and operating that ship at sea over a period of decades, as well as the potential consequences of something going wrong with a nuclear propulsion plant, the Navy's success since the 1950s in procuring and safely operating scores of nuclear powered ships, and in developing a succession of reactor designs and using reactor fuel cores with increasingly long lives (reducing the need for mid-life refueling operations), can be considered a major success story.[11] Comparisons with the Soviet Union's naval nuclear propulsion program, which was frequently dangerous to its own people, are instructive.

To be sure, not everyone has always been satisfied with Naval Reactors' work. For a few years in the 1990s, for example, there was some tension between members of this committee and the Navy (including Naval Reactors) regarding submarine design and technology development. On the whole, however, Naval Reactors has usually enjoyed a strong degree of support from Congress.

Naval Reactors' success can be attributed in part to its administrative setup, which provides Naval Reactors with a clear and focused mission, clear and total (i.e., cradle-to-grave) responsibility and accountability for implementing that mission, a director with a high rank (four-star admiral/Deputy Administrator in NNSA) and a long term of office (eight years), centralized control of the program's industrial base and suppliers, and a fairly flat organizational structure with an in-house staff that is fully knowledgeable in the technology that it acquires from its contractors.[12] Naval Reactors' success can also be attributed to its operational philosophy, which is characterized by, among other things, a focus on technical excellence, rigorous quality control, comprehensive procedures and procedural compliance, careful selection of personnel, and rigorous and continuous training of those personnel. A 1998 journal article states:

> A principle of transcending importance [at Naval Reactors] is that every organizational unit and each individual has responsibilities that are defined clearly and understood thoroughly. Careful attention is given to seeing that these responsibilities are internalized, that the name of an individual is identified unambiguously with each required function, and that these responsibilities are put in writing. Naval Reactors policy and practice gives emphasis to this principle to a degree matched by few organizations....
>
> The cardinal principle applied by Naval Reactors is that the government itself is the customer—and an exacting one at that—for each and every activity and function that contractors are engaged to perform. The contractor is required to meet the requirements of the contract in all respects. Naval Reactors built up an outstanding technical staff... to ensure that it could perform as a "demanding customer."[13]

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[11] Naval Reactors reported in March 2013 that the Naval Nuclear Propulsion Program had accumulated more than 6,500 reactor-years of operation, that nuclear-powered Navy ships had safely steamed more than 151 million miles, and that Navy nuclear-powered ships were accepted for port calls in more than 150 ports in more than 50 foreign countries and dependencies around the world. See U.S. Department of Energy and U.S. Department of the Navy, *The United States Naval Nuclear Propulsion Program*, March 2013, p. 1.

[12] Naval Reactors' administrative setup was formalized by Executive Order 12344 of February 1, 1982. 50 U.S.C. 2511, where this executive order is codified as a note, states that the provisions of this executive order shall remain in force until changed by law.

[13] John W. Crawford and Steven L. Krahn, "The Naval Nuclear Propulsion Program: A Brief Case Study In Institutional Constancy," *Public Administration Review*, vol. 58, no. 2, March/April 1998: 160.

Virginia Class Attack Submarine Program

The Virginia (SSN-774) class attack program has been held up frequently in recent years as an example of a successful acquisition program. The program received a David Packard Excellence in Acquisition Award from DOD in 2008. Although the program experienced cost growth in its early years that was due in part to annual procurement rates that were lower than initially envisaged and challenges in restarting submarine production at Newport News Shipbuilding,[14] the lead ship in the program was delivered within four months of the target date that had been established about a decade earlier, and ships in recent years have been delivered on cost and ahead of schedule.

As a requirement for the program to increase its procurement rate from one boat per year to two boats per year starting in FY2012, the program was challenged with reducing the procurement cost of each boat by about 17%, from $2.4 billion to $2.0 billion in FY2005 dollars. The goal was referred to as "2 for 4 in 12," meaning two boats for $4.0 billion in FY2005 dollars in FY2012. The program met this challenge without having to reduce the capability of the Virginia-class design. (Capability, in fact, was increased.) About half of the cost reduction was accomplished simply by shifting to two-per-year construction, which offers better production economies of scale. About a quarter was accomplished through changes to the boat's design that make it less expensive to build, and about a quarter was accomplished through changes to the shipyard processes for building the boats.[15] With congressional support, the program was increased to two boats per year in FY2011, a year ahead of the Navy's schedule. The Navy is now working to further increase the cost effectiveness of the Virginia-class design by reducing its total ownership cost and increasing the number of deployments that each boat will make during its 33-year life.

The success of the Virginia-class program can be attributed to, among other things, achieving a higher degree of design completion prior to the start of construction than was true for previous submarine acquisition programs, establishing operational requirements for the program that were not overly ambitious, using technologies developed for previous Navy submarine classes where appropriate, sharing production best practices between the two submarine shipbuilders (General Dynamics/Electric Boat and Huntington Ingalls Industries/Newport News Shipbuilding) that jointly build each boat, and achieving production efficiencies through the use, with congressional approval, of a block buy contract (for the first four boats in the program) and a subsequent series of MYP contracts.

Acoustic Rapid COTS Insertion (ARCI) Program

The ARCI (pronounced AR-key) program is an open architecture program for continuously upgrading the acoustic signal-processing capabilities of existing Navy submarines. Under the ARCI program, the sensors on a submarine are not changed, but its signal-processing computers are changed out every four years (using commercial, off-the-shelf [COTS] hardware), and the signal-processing software that runs on those computers is improved every two years. The first ARCI installation was completed in 1998; the program improves 10 to 12 boats each year.

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[14] See Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, before the House Armed Services Committee Subcommittee on Seapower and Expeditionary Forces Hearing on Submarine Force Structure and Acquisition Policy, March 8, 2007, Table 10 on pp. 14-15.

[15] For further discussion, see the section entitled "Cost-Reduction Effort" in CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke. See also David C. Johnson et al., "Managing Change on Complex Programs: VIRGINIA Class Cost Reduction," *Naval Engineers Journal*, No. 4, 2009: 79-94; and John D. Butler, "The Sweet Smell of Acquisition Success," *U.S. Naval Institute Proceedings*, June 2011: 22-28.

The ARCI program can be viewed as an early example of "walking the walk" on open architecture. Under the program's open-architecture approach, firms and other organizations are invited to submit improved signal-processing solutions for incorporation into the next available insertion cycle. Lockheed, a lead contractor for the program, states that the program "harvests 'best of breed' solutions from all possible sources—big business, small business, University Affiliated Research Centers (UARCs), and labs," and that to date six larger firms and 14 smaller ones have been brought into the program because of the open architecture approach.[16]

The ARCI program was instituted to reverse a deterioration in the submarine force's acoustic edge over improving foreign submarines that had occurred by the mid-1990s—and do so within a submarine research and development budget that was much lower than it had been during the Cold War years of the 1980s. The program can be viewed as an example of a service responding to a reduction in funding by finding a new and less-expensive approach to accomplishing its objective. The continuous improvement in capability among existing submarines achieved through the ARCI program might be considered equivalent to adding some number of boats to the force—but at a very small fraction of what it would cost to actually build those additional boats, and at much less cost for each boat's acoustic upgrade than had previously been achieved through the closed-architecture approach. The Navy stated in 2008 that

> The old [closed-architecture] way of doing business was expensive. It guaranteed recurring revenue to manufacturers for the purchase of sonar and combat control systems. Any significant upgrade in capability resulted in a large sale for them since everything from the sensors, the beam forming hardware, the computers, the detection and tracking software, and even the cabling were in need of replacement in order to use new system's capabilities. Previously on the order of $150 million per ship set we have achieved a near ten-fold reduction for current cost of about $15 million for today's shipsets.
>
> In [ARCI's] open architecture/open business model system, the software is developed independently from the hardware (through the use of middleware), allowing us to choose the best software application from any company interested in doing business with us. Costs lie in changing lines of code. By continuously updating the small number of lines of code in the middleware, updates to large amounts of hardware-based code and application code are avoided.[17]

Aegis Ballistic Missile Defense (BMD) System

Since 2002, the Aegis BMD program has achieved what is generally regarded as a largely successful test flight record of 28 successful exo- and endo-atmospheric intercepts in 34 attempts against increasingly challenging short- and medium-range ballistic missile targets. The program builds on the baseline air-defense capability of the Aegis combat system, which entered service on the Aegis cruiser Ticonderoga (CG-47) in 1983, and the Standard Missile (SM) family of interceptors. The Aegis BMD program's

[16] Source: Lockheed information paper on ARCI program provided to CRS on June 13, 2014.

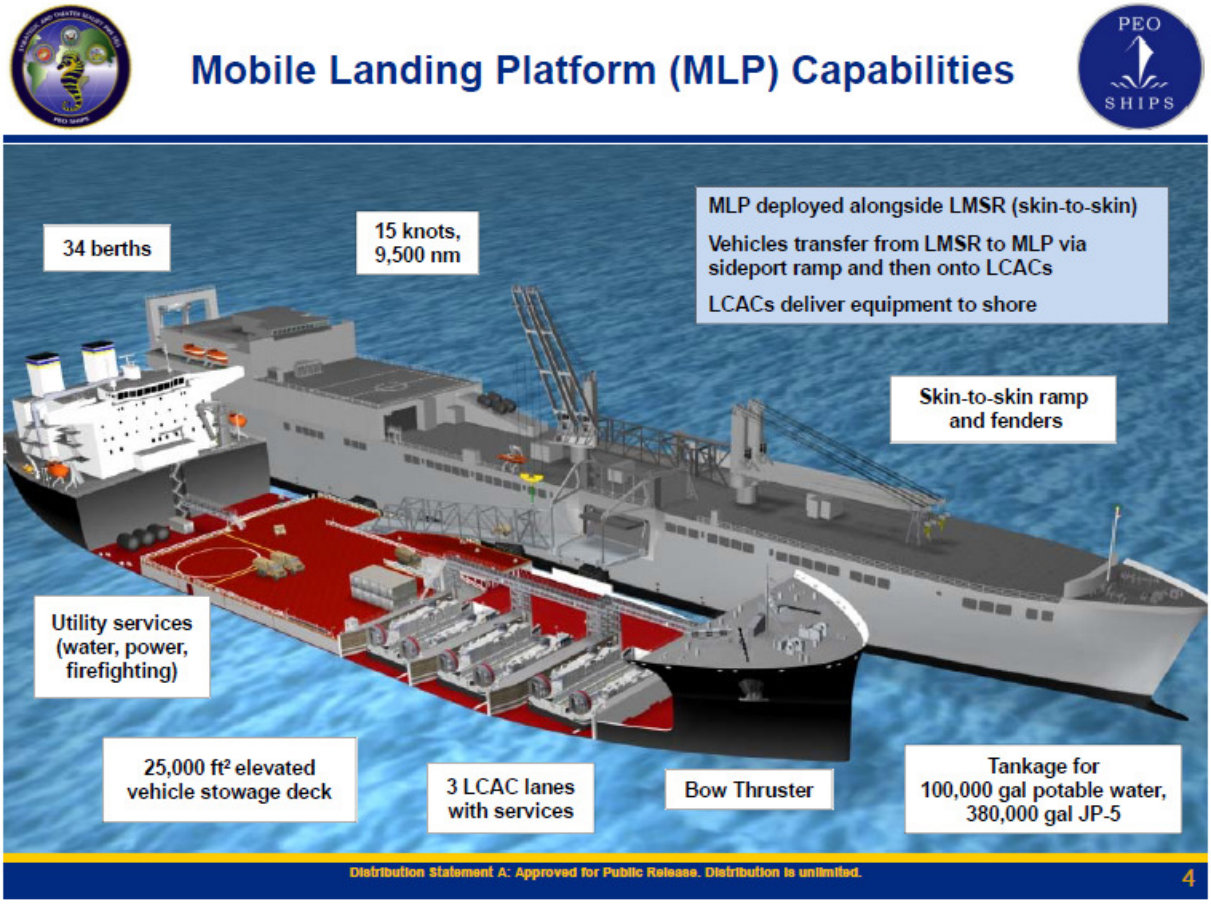
[17] Jim Stevens, "The How and Why of Open Architecture," *Undersea Warfare*, Spring 2008, accessed June 17, 2014, at: http://www.navy.mil/navydata/cno/n87/usw/spring08/HowAndWhy.html, See also "Acoustic Rapid COTS Insertion (ARCI)," accessed June 17, 2014, at: http://www.navy.mil/navydata/cno/n87/future/arci.html; John Keller, "Lockheed Martin to Make COTS Upgrades to Submarine Sonars in $29.4 Million Contract," *Military & Aerospace Electronics (www.militaryaerospace.com)*, June 10, 2013, accessed June 17, 2014, at: http://www.militaryaerospace.com/articles/2013/06/lockmart-arci-contract.html; and Michael Boudreau, "Acoustic Rapid COTS Insertion: A Case Study in Spiral Development," Naval Postgraduate School, October 30, 2006, 63 pp., accessed June 17, 2014, at: www.dtic.mil/get-tr-doc/pdf?AD=ADA458431.

success can be attributed in part to its use of the Aegis community's longstanding incremental development philosophy, known as "build a little, test a little, learn a lot [then repeat]."[18]

Mobile Landing Platform (MLP) Ship Program

The Mobile Landing Platform (MLP) ship provides a "pier at sea" that permits maritime prepositioning ships such as Large, Medium-Speed, Roll-on/Roll-Off ships (LMSRs) to offload their equipment and supplies to the MLP for transshipment to shore via air-cushioned landing craft (LCACs). Without an MLP, these prepositioning ships would need to find a secure port to disembark their cargo. In effect, the MLP acts something like a well deck (the floodable space in the back end of an amphibious ship that landing craft go in and out of) for prepositioning ships that do not have well decks. Adding MLPs to the fleet increases the ability of the Navy/Marine Corps team to launch and support ship-to-shore operations directly from the sea, without need for access to secure ports. **Figure 1** shows an MLP (with three LCACs on board) ready to receive equipment and supplies from a prepositioning ship.

Figure 1. Mobile Landing Platform Ship



Source: Briefing slides from PMS 385, Program Office for Strategic and Theater Sealift, undated, posted at InsideDefense.com (subscription required), January 17, 2014.

[18] For more on the Aegis BMD program, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

The Navy's original, all-new design for the MLP had an estimated procurement cost in the FY2009 budget submission of about $1,236 million for the lead ship and $964 million for the second ship. This design was subsequently deemed unaffordable. As a more-affordable alternative, the Navy selected a proposal by General Dynamics/National Steel and Shipbuilding Company (GD/NASSCO) to instead modify the design of an existing oil tanker built by NASSCO into a less-capable but less-expensive version of the MLP. The resulting design permitted the two MLPs to be procured for a total of about $930 million, or an average of $465 million per ship—less than half the cost of the originally contemplated design.

The MLP program can be viewed as a successful example of what is sometimes referred to in DOD acquisition as a 70% (or 80%) solution, meaning a solution that provides something like 70% or 80% of the desired capability, at something less than 70% or 80% of the cost of a system that would have provided all the desired capability. (In the case of the MLP, the capability provided by the new design might be less than 70% of the capability that would have been provided by the originally contemplated design, but the cost of the new design is less than 50% of the originally contemplated design.) The baseline MLP design is now being used as the basis for a modified MLP known as the Afloat Forward Staging Base (AFSB), which the Navy is currently procuring. Current Navy plans call for procuring a total of three AFSBs.

Profit Related to Offers (PRO) Bidding for DDG-51 Destroyer Program

When the end of the Cold War led to a reduction in the annual procurement rate of Arleigh Burke (DDG-51) class Aegis destroyers, the Navy judged that the new, lower rate was insufficient to sustain a meaningful competition between the two DDG-51 builders (General Dynamics/Bath Iron Works and Huntington Ingalls Industries/Ingalls Shipbuilding) for the right to build each year's DDG-51s.[19] The Navy, however, found a way to maintain competition in the DDG-51 program by using Profit Related to Offers (PRO) bidding, and has used PRO bidding in the DDG-51 almost every year since FY1996. Under PRO bidding, the Navy allocates individual DDG-51s to the two yards (over time, each yard receives roughly half of the ships), and the yard that submits the lower bid for the ships that it has been allocated receives a higher profit margin. The approach is referred to as competition for profit rather than for quantity, and can be considered a successful example of how to continue employing competition in a procurement program when the program's annual procurement rate is not deemed sufficient to sustain a meaningful competition for quantity.[20]

Use of Multiyear Procurement (MYP) and Block Buy Contracting

The Navy, with congressional approval, has made significant use in recent years of MYP and block buy contracting in its ship and aircraft acquisition programs. Among other things, the Navy currently is using MYP or block buy contracting for all three of its year-to-year shipbuilding programs—the Virginia-class attack submarine program, the DDG-51 destroyer program, and the Littoral Combat Ship. Use of MYP and block buy contracting reduces flexibility for making changes in programs in future years in response to changing strategic and budgetary circumstances, but can reduce procurement costs. Savings from the use of MYP recently have, among other things, helped Congress and the Navy to convert a nine-ship buy

[19] A meaningful competition can be defined here as one that generates bargaining leverage for the government.

[20] For an article discussing PRO bidding in the DDG-51 program, see Sydney J. Freedberg Jr., "Can Navy Afford Next-Gen DDG-51 Destroyer, Packard Award Or Not?" *Breaking Defense (BreakingDefense.com)*, November 12, 2012.

of Virginia-class attack submarines into a 10-ship buy, and a nine-ship buy of DDG-51 class destroyers into a 10-ship buy.

The Navy's increasing use of MYP and block buy contracting in recent years amounts to a significant change—some might say a quiet revolution—in Navy ship and aircraft acquisition. In an interview published on January 13, 2014, Sean Stackley, the Assistant Secretary of the Navy for Research, Development, and Acquisition (i.e., the Navy's acquisition executive), stated:

> What the industrial base clamors for is stability, so they can plan, invest, train their work force. It [multiyear contracting] gives them the ability in working with say, the Street [Wall Street], to better predict their own performance, then meet expectations in the same fashion we try to meet our expectations with the Hill.
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> It's emblematic of stability that we've got more multiyear programs in the Department of the Navy than the rest of the Department of Defense combined. We've been able to harvest from that significant savings, and that has been key to solving some of our budget problems. It's allowed us in certain cases to put the savings right back into other programs tied to requirements.[21]

Some Potential Acquisition Lessons That Emerge From a Review of Navy Acquisition in Recent Decades

A Summary of Some Shipbuilding Lessons Learned

A summary of lessons learned for Navy shipbuilding, reflecting comments made repeatedly by various sources over the years, includes the following:

- **Get the operational requirements for the program right up front.** Manage risk by not trying to do too much in the program, and perhaps seek a 70%-to-80% solution. Achieve a realistic balance up front between requirements and estimated costs.
- **Impose cost discipline up front.** Use realistic price estimates, and consider not only development and procurement costs, but life-cycle operation and support (O&S) costs.
- **Minimize design/construction concurrency** by developing the design to a high level of completion before starting construction and by resisting changes in requirements (and consequent design changes) during construction.
- **Use a contract type that is appropriate for the amount of risk involved**, and structure its terms to align incentives with desired outcomes.
- **Properly supervise construction work.** Maintain an adequate number of properly trained Supervisor of Shipbuilding (SUPSHIP) personnel.
- **Provide stability for industry**, in part by using, where possible, MYP or block buy contracting.
- **Maintain a capable government acquisition workforce** that understands what it is buying, as well as the above points.

[21] "Interview: Sean Stackley, US Navy's Acquisition Chief," *Defense News*, January 13, 2014: 22. For more on MP and block buy contracting, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz.

Identifying these lessons is not the hard part—most if not all these points have been cited for years. The hard part is living up to them without letting circumstances lead program-execution efforts away from these guidelines.

Regarding contract type and the setting of requirements, a June 3, 2014, press report stated:

> Despite a growing Pentagon movement toward fixed-price contracts to keep a lid on costs, U.S. Navy contracting officers should look to cost-plus contracts if there is a greater element of risk, says Sean Stackley, assistant Navy secretary for research, development and acquisition.
>
> "You had better not be using fixed-price contracts for something that is high risk," Stackley said June 2 during a question-and-answer session following his lunch keynote address during the 2014 Navy Opportunity Forum. In those cases, he says, "Use a cost-plus contract. It's OK. What we don't want to be is kidding ourselves."
>
> Generally, he says, contractors have not balked at the greater use of fixed-price contracts. "I didn't sense any fear of taking on fixed-price contacts, as long as the risk is understood," he said.
>
> What has to be better understood across the board for contracts now, he says, are the requirements.
>
> "The most important thing is getting the requirements right," he says. "When things break down, 90% of the time it's because we failed to get the requirements right. We're spending more time in that phase."[22]

Littoral Combat Ship (LCS) Program Lessons Learned

Given criticisms of the LCS program in recent years for cost growth, design issues, and construction-quality issues, one issue for Congress concerns what defense-acquisition policy lessons, if any, the LCS program may offer to policy makers, particularly in terms of the rapid acquisition strategy that the Navy pursued for the LCS program, which aimed at reducing acquisition cycle time (i.e., the amount of time between starting the program and getting the first ship into service). I address this issue in my report on the LCS program; the paragraphs below are adapted from that report.[23]

One possible perspective on this issue is that the LCS program demonstrated that reducing acquisition cycle time can be done. Supporters of this perspective might argue that under a traditional Navy ship acquisition approach, the Navy might have spent five or six years developing a design for a new frigate or corvette (i.e., a ship about the size of an LCS), and perhaps another five years building the lead ship, for a total acquisition cycle time of perhaps 10 to 11 years. For a program announced in November 2001 (the announced start of the LCS program), this would have resulted in the first ship entering service in between late 2011 and late 2012. In contrast, supporters of this perspective might argue, LCS-1 entered service on November 8, 2008, about seven years after the program was announced, and LCS-2 entered service on January 16, 2010, a little more than eight years after the program announced. Supporters of this perspective might argue that this reduction in acquisition cycle time was accomplished even though the LCS incorporates major innovations compared to previous larger Navy surface combatants in terms of reduced crew size, "plug-and fight" mission package modularity, high-speed propulsion, and (in the case of LCS-2) a new type of hull form (trimaran) and a new hull material (all-aluminum).

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[22] Michael Fabey, "U.S. Navy Acquisition Chief: Stick With Cost-Plus If Risk Is High," *Aerospace Daily & Defense Report*, June 3, 2014: 1.

[23] CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress*, by Ronald O'Rourke.

Another possible perspective is that the LCS program demonstrated the risks or consequences of attempting to reduce acquisition cycle time. Supporters of this perspective might argue that the program's rapid acquisition strategy resulted in design-construction concurrency, a practice long known to increase risks in shipbuilding and other defense acquisition programs. Supporters of this perspective might argue that the cost growth, design issues, and construction-quality issues experienced by the first LCSs were due in substantial part to design-construction concurrency, and that these problems embarrassed the Navy and reduced the Navy's credibility in defending other acquisition programs. They might argue that the challenges the Navy faces today in terms of developing an LCS concept of operations (CONOPS),[24] LCS manning and training policies, and LCS maintenance and logistics plans were increased by the rapid acquisition strategy, because these matters were partly deferred to later years (i.e., to today) while the Navy moved to put LCSs into production. Supporters of this perspective might argue that the costs of the rapid acquisition strategy are not offset by very much in terms of a true reduction in acquisition cycle time, because the first LCS to be equipped with a mission package that has reached IOC (initial operational capability) will not occur until the fourth quarter of FY2014—almost 13 years after the LCS program was announced. Supporters of this perspective could argue that the Navy could have avoided many of the program's early problems and current challenges—and could have had a fully equipped first ship enter service in 2011 or 2012—if it had instead pursued a traditional acquisition approach for a new frigate or corvette. They could argue that the LCS program validated, for defense acquisition, the guideline from the world of business management that if an effort aims at obtaining something fast, cheap, and good, it will succeed in getting no more than two of these things,[25] or, more simply, that the LCS program validated the general saying that haste makes waste.

A third possible perspective is that the LCS program offers few if any defense-acquisition policy lessons because the LCS differs so much from other Navy ships and the Navy (and DOD generally) consequently is unlikely to attempt a program like the LCS in the future. Supporters of this perspective might argue that the risks of design-construction concurrency have long been known, and that the experience of the LCS program did not provide a new lesson in this regard so much as a reminder of an old one. They might argue that the cost growth and construction delays experienced by LCS-1 were caused not simply by the program's rapid acquisition strategy, but by a variety of factors, including an incorrectly made reduction gear[26] from a supplier firm that forced the shipbuilder to build the lead ship in a significantly revised and sub-optimal construction sequence.

Some Additional Observations Relating to DOD Acquisition and Potential Options For Improving It

This final section presents some additional observations relating to DOD acquisition and potential options for improving it. My focus here is to attempt to add value to the discussion of defense acquisition and options for improving it by making some points that I do not see frequently made by others.

[24] A CONOPS is a detailed understanding of how to use the ship to accomplish various missions.

[25] The guideline is sometimes referred to in the business world as "Fast, cheap, good—pick two."

[26] A ship's reduction gear is a large, heavy gear that reduces the high-speed revolutions of the ship's turbine engines to the lower-speed revolutions of its propulsors.

The Challenge of Assessing What Works and What Does Not In A System That Is Changed Frequently

An initial observation is that in recent years there have been, through legislation and internal DOD initiatives, numerous changes and adjustments to DOD's acquisition system. These changes and adjustments have all been well-intentioned, and many of them no doubt have helped improve acquisition outcomes. But they have also had the effect of not leaving DOD's acquisition system in any one configuration for very long.

The continuously evolving features of DOD's acquisition system can complicate the task of identifying what works and what does not work in DOD acquisition, because no one configuration of the system is tested for very long, an individual program can be implemented across several versions of DOD's acquisition system, and a service's collection of programs at any given moment can include programs initiated under various versions. This situation might suggest a need for careful consideration in determining the reasons for acquisition outcomes.

Program Ambitions vs. Engineering and Design Capability

Today's defense engineers and designers are every bit as smart as their predecessors. They are at least as well-educated as their predecessors, and they have much better design and modeling tools at their disposal than their predecessors did.

At the same time, due to the reduction in the overall scale of DOD acquisition efforts following the end of Cold War, there may be fewer engineers and designers today in some defense sectors than there were in the past. Moreover, due to the general decline over the last few decades in the frequency of DOD program starts, today's designers and engineers may have, on average, fewer prior projects under their belt than their predecessors, which can reduce the store of prior project experience on which they can draw, particularly regarding lessons that might not be easy to capture in written form. In addition, today's designers and engineers are being asked to implement programs that are often more complex than those that were undertaken by their predecessors, particularly in terms of their software and networking dimensions.

The question this raises is how to factor this situation regarding the engineering and design base into assessments of the likelihood of being able to successfully execute large and complex acquisition programs, and whether it might make sense to divide larger and more-complex programs into smaller and individually less-complex efforts. Dividing larger and more-complex programs into smaller and individually less-complex ones might be thought of as a shift to a more modular form of acquisition, or as a more comprehensive application of the Aegis community's "build a little, test a little, learn a lot" approach.

Regulation and the Political Economy of Acquisition

Consider an acquisition program that has most or all of the following features:

- The item being acquired is considered a must-have item for the customer.
- The program for acquiring it is largely sheltered from international competition, and perhaps also sheltered, to some degree at least, from domestic competition.
- The program proposes to procure the end item in question at a relatively low annual production rate, reducing the potential room for making further reductions in that rate.

- The industrial base producing the item is considered critical and will not be allowed to go out of business.

If one were to describe such a program to an economist, the economist might reply that the program would be inherently vulnerable to problems in areas such as cost control, schedule adherence, and production quality, because these going-in conditions can send a message to industry that less-than-stellar performance in executing the program would not create much risk of losing the work or going out of business. Much of the regulation of DOD acquisition can be viewed as an attempt to direct DOD acquisition toward better outcomes without fundamentally changing going-in conditions such as these, which together might be thought of as forming the underlying political economy of some (perhaps many) DOD acquisition programs. Whether regulation can succeed fully in overcoming the challenges created by going-in conditions like these is a key question, because if the answer is no, it suggests certain limits to what might be accomplished through any form of acquisition reform. The existence of such limits does not mean reform should not be pursued, but it might temper expectations as to resulting outcomes (or direct attention back toward looking for possible ways to change the going-in conditions).

Programs as Sole-Source Solutions to Their Associated Mission Needs

The potential challenges of achieving good outcomes in defense acquisition efforts where there is a sole-source producer are well recognized. Less recognized is that DOD acquisition programs themselves are often set up to be, in effect, sole-source solutions for filling their associated mission needs. That is the practical meaning of the first of the above-listed going-in conditions—that the item being produced is considered a must-have item for the customer (DOD). It is a must-have item because there is no alternative program for meeting the mission need.

In contrast to the situation with producers, where much effort is frequently put into finding ways to achieve and sustain competition among multiple sources, the DOD acquisition system, through the requirements and program-definition process, frequently works in the opposite direction, to identify and define programs that are intended, in effect, to become monopoly solutions to their associated mission needs.

It appears that programs are set up as monopoly solutions to their associated mission needs for at least two reasons. First, the early stages of the acquisition process are aimed at identifying the best possible solution for filling a mission need. A competition among competing approaches can be held at this point, and if the aim is to find the best possible solution, then by definition only one solution can emerge as the best. The analyses leading to the selection of a best possible solution, however, incorporate many variables, assumptions, and uncertainties, which can result in a selection process with less precision and certainty than might be admitted.

Second, the idea of maintaining multiple programs for meeting a single mission need appears on its face to be wasteful and unaffordable, because of the resulting duplication of development costs, reduction in production economies of scale, and added life-cycle costs of supporting multiple systems. Monopolies, however, can exact their own costs. In the case of a program that is a sole-source solution to its mission need, it might mean that some of the people involved in the program, either in government or industry, though capable and honest, might nevertheless not sharpen their pencils quite as much as they would have if they faced ongoing competition from another solution to the mission need.

Setting up multiple programs for a given mission need would indeed be very expensive. The question, then, is whether there is a way to subject programs to competition for longer periods of time while avoiding the costs associated with supporting multiple programs.

One possibility would be to make greater use of overlap between programs across time. Under this approach, the existing system for filling a mission need (call it System A) would remain in production (with spiral development improvements as needed) until the new system that is being developed (System B) is fully ready to enter production. At that point, production would be cut over from System A to System B, and System B would remain in production until it appears that a still-newer design (System C) might be more cost effective in performing the mission. System B, however, would continue in production until System C is fully ready to enter production. And so on.

Under this approach, the system currently in development (System B) would face greater competition in its earlier years from the predecessor system (System A), as well as competitive pressures in its later years from a downstream successor (System C). At any one point, only one system is being developed, and only one is being produced. But as System B is being developed, it needs to perform well to earn the right to enter production, and during the years it is being produced, it needs to perform well to dissuade DOD officials for as long as possible from initiating a System C effort. The point at which System B is to enter production, and the total number of System B units produced over time, are not set in stone, but rather determined by the success of the System B program.

Under this approach, there would be less emphasis on identifying precise dates for starting and stopping production of platforms and systems, and less emphasis on planned total production quantities (which often prove illusory). There would be more emphasis on readiness for production, and more flexibility regarding production cutover dates. There would also be more emphasis on annual production rates and their relationship to supporting planned force structure over the long run, and on the ability of programs to achieve necessary annual production rates within budget constraints. The idea that a program can be helped by clearing the decks of all possible competition (i.e., shutting down production of the existing system so as to clear the path for the new program) would be deemphasized, and an alternative idea—that a program is best helped (i.e., kept strong) by keeping it in competition longer against competing solutions for meeting the mission need—would instead be employed.

Some of the Navy's quantitatively larger shipbuilding programs are in effect treated this way, which is why, in discussing these programs, there tends to be less focus on total planned production quantities and more focus on annual production rates.

This proposed approach for addressing the challenges that result from the current situation of programs often being sole-source solutions to their mission needs might not make sense for certain defense acquisition efforts, depending on the circumstances of those efforts. And this approach is by no means perfect—it has its own drawbacks, and ways could likely be found to attempt to game such a system. Among many other things, there would continue to be, for example, a question as to who determines when a program is fully ready to enter production, and how that determination is made. But it is an option that might be considered for some defense acquisition efforts. If this option is not pursued, some other approach for addressing the challenges that result from the current situation of programs often being sole-source solutions to their mission needs might be sought. The point, at least initially, is to recognize that the DOD acquisition system often creates sole-source program solutions, and that this can lead to challenges in achieving successful acquisition outcomes.

Fixed-Price Contracts

This section and the following section present, with minor changes, discussions of fixed-price contracts and minimizing procurement cost that were originally included in testimony I provided to the Seapower and Projection Forces subcommittee on October 23, 2013.[27]

In response to instances of cost growth on DOD acquisition programs, including programs in the 30-year shipbuilding plan, there is now a strong focus on encouraging DOD to use fixed-price contracts as much as possible. Fixed-price contracts help shift the risk of cost growth from the government to the contractor, and are an important tool for constraining procurement costs. At the same time, there are some cautionary notes regarding fixed-price contracts that are worth bearing in mind:

- In writing the terms of a fixed-price contract, the devil can be in the details. A fixed-price contract could include provisions for adjusting costs that could, in the aggregate, make the contract operate more like a cost-type contract. Such a contract might be termed a Fixed-Price In Name Only (FPINO) contract.

- The contractor, in fulfilling the terms of a fixed-price contract, may choose to do the work exactly as described in the contract, and not a single thing more—even if doing that single thing more would have made sense in terms of value delivered to the government. In writing fixed-price contracts, DOD needs to understand its requirements well, so as to avoid instances in which it would have benefited from having the contractor perform work items that were not included in the terms of the contract.

- Depending on the bargaining leverage available to DOD in its negotiation with the contractor, the contractor, in return for agreeing to the use of a fixed-price contract (particularly a Firm Fixed Price contract), might demand a high price for the item to be built (a price close to what I refer to in the next section as Point D), which would mean that the contract, while avoiding cost growth, could create an increased risk for DOD of paying more for the item than was necessary.

- When the government is in a largely closed relationship with the contractor—that is, when the contractor is largely dependent on the government for its business, and the government in turn must rely on that contractor as the source for at least some of what that contractor provides to the government—then it is not clear what fixed-price contracts are accomplishing in the long run in terms of insulating the government from the risk of cost growth. Use of fixed-price contracts can translate cost growth into losses for the contractor. In a largely closed relationship between the government and the contractor, the contractor could seek to recover those losses by charging higher prices for future work it does for the government. Alternatively, the contractor could simply absorb the losses, which could weaken the contractor financially, reducing its ability invest in its work force and modernize its capital plant, which in turn could increase the cost of work that the contractor performs for the government in the future.[28] Either way, the cost growth

[27] Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, Before the House Armed Services Committee, Subcommittee on Seapower and Projection Forces, on the Navy's FY2014 30-Year Shipbuilding Plan, October 23, 2013, pp. 4-7.

[28] Another option for the contractor, at least in theory, would be to stop (or threaten to stop) work on the contract unless the government agrees to renegotiate the terms of the contract or agrees to provide a payment to cover the contractor's losses (i.e., a "bailout"), as the government, for example, has done in the past under the terms of P.L. 85-804 of August 28, 1958 (72 Stat. 972).

> on the earlier contract could, in the long run, be effectively shifted back to the government. The potential implications of a largely closed relationship between the government and a contractor are potentially important to bear in mind for shipbuilding, because one of the government's principal shipbuilders, Huntington Ingalls Industries (HII), can be viewed as being in a largely closed relationship with the government: HII currently derives substantially all its revenues from work it does for the U.S. government (primarily the Navy),[29] and HII in turn is the Navy's sole source for building aircraft carriers and the only builder of certain parts of each Virginia-class submarine.

The points above are made not to argue against using fixed-price contracts—as mentioned above, fixed-price contracts are an important tool for constraining procurement costs. Even in a situation where the government is in a largely closed relationship with the contractor, fixed-price contracts can, at a minimum, help make cost developments in a program more immediately visible to policymakers, which can be of value in maintaining oversight of the program. The point, rather, is to provide some perspective on what can be accomplished through the use of fixed-price contracts.

Avoiding Procurement Cost Growth vs. Minimizing Procurement Costs

The affordability challenge posed by the Navy's 30-year shipbuilding plan has tended to reinforce the strong oversight focus on preventing or minimizing procurement cost growth in Navy shipbuilding programs, which is one expression of a strong oversight focus on preventing or minimizing cost growth in DOD acquisition programs in general. This oversight focus may reflect in part an assumption that avoiding or minimizing procurement cost growth is always synonymous with minimizing procurement cost. It is important to note, however, that as paradoxical as it may seem, avoiding or minimizing procurement cost growth is *not* always synonymous with minimizing procurement cost, and that a sustained, singular focus on avoiding or minimizing procurement cost growth might sometimes lead to *higher* procurement costs for the government.

How could this be? Consider the example of a design for the lead ship of a new class of Navy ships. The construction cost of this new design is uncertain, but is estimated to be likely somewhere between Point A (a minimum possible figure) and Point D (a maximum possible figure). (Point D, in other words, would represent a cost estimate with a 100% confidence factor, meaning there is a 100% chance that the cost would come in at or below that level.) If the Navy wanted to avoid cost growth on this ship, it could simply set the ship's procurement cost at Point D. Industry would likely be happy with this arrangement, and there likely would be no cost growth on the ship.

The alternative strategy open to the Navy is to set the ship's target procurement cost at some figure between Points A and D—call it Point B—and then use that more challenging target cost to place pressure on industry to sharpen its pencils so as to find ways to produce the ship at that lower cost. (Navy officials sometimes refer to this as "pressurizing" industry.) In this example, it might turn out that industry efforts to reduce production costs are not successful enough to build the ship at the Point B cost. As a result, the ship experiences one or more rounds of procurement cost growth, and the ship's procurement cost rises over time from Point B to some higher figure—call it Point C.

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[29] HII states in its annual report for 2013 that "Revenues from the U.S. Government accounted for substantially all of our revenues in 2013, 2012 and 2011. In 2013, 2012 and 2011, approximately 94%, 96% and 97%, respectively, of our revenues were generated from the U.S. Navy and approximately 6%, 4% and 3%, respectively, were generated from the U.S. Coast Guard." (Huntington Ingalls Industries, *2013 Annual Report*, p. 5. [pdf page 16 of 135])

Now, here is the rub: Point C, in spite of incorporating one or more rounds of cost growth, *might nevertheless turn out to be lower than Point D*, because Point C reflected efforts by the shipbuilder to find ways to reduce production costs that the shipbuilder might have put less energy into pursuing if the Navy had simply set the ship's procurement cost initially at Point D.

Setting the ship's cost at Point D, in other words, may eliminate the risk of cost growth on the ship, but does so at the expense of creating a risk of the government paying more for the ship than was actually necessary. DOD could avoid cost growth on new procurement programs starting tomorrow by simply setting costs for those programs at each program's equivalent of Point D. But as a result of this strategy, DOD could well wind up leaving money on the table in some instances—of not, in other words, minimizing procurement costs.

DOD does not have to set a cost precisely at Point D to create a potential risk in this regard. A risk of leaving money on the table, for example, is a possible downside of requiring DOD to budget for its acquisition programs at something like an 80 percent confidence factor—an approach that some observers have recommended—because a cost at the 80 percent confidence factor is a cost that is likely fairly close to Point D.

Procurement cost growth is embarrassing for DOD and industry, and can damage their credibility in connection with future procurement efforts. Procurement cost growth can also disrupt congressional budgeting by requiring additional appropriations to pay for something Congress thought it had fully funded in a prior year. For this reason, there is a legitimate public policy value to pursuing a goal of having less rather than more procurement cost growth.

Procurement cost growth, however, can sometimes be in part the result of DOD efforts to use lower initial cost targets as a means of pressuring industry to reduce production costs—efforts that, notwithstanding the cost growth, might be partially successful. A sustained, singular focus on avoiding or minimizing cost growth, and of punishing DOD for all instances of cost growth, could discourage DOD from using lower initial cost targets as a means of pressurizing industry, which could deprive DOD of a tool for controlling procurement costs.

The point here is not to excuse away cost growth, because cost growth can occur in a program for reasons other than DOD's attempt to pressurize industry. Nor is the point to abandon the goal of seeking lower rather than higher procurement cost growth, because, as noted above, there is a legitimate public policy value in pursuing this goal. The point, rather, is to recognize that this goal is not always synonymous with minimizing procurement cost, and that some amount of cost growth might need to be accepted as part of optimal government strategy for minimizing procurement cost. Recognizing that the goals of seeking lower rather than higher cost growth and of minimizing procurement cost can sometimes be in tension with one another can lead to an approach that takes both goals into consideration. In contrast, an approach that is instead characterized by a sustained, singular focus on avoiding and minimizing cost growth may appear virtuous, but in the end may wind up costing the government more.

Term of Office

As a final point, my observation of Navy and other DOD acquisition programs over the last 30 years gives me the impression that long terms of office for program officials can be a key contributor to achieving success in defense acquisition programs. Program officials with long terms of office understand that they will still be in office years from now, and consequently that they will be held personally accountable for the results of decisions they make (at least those they make during their earlier years in office). By contrast, officials with shorter terms of office face less risk of being held personally accountable for the results of their decisions, because those results may not become manifest until after

their terms in office are complete. Indeed, they might even feel an incentive to make decisions that achieve what they view as near-term success for a program (such as getting a program started), even if those decisions increase the program's risk of experiencing execution problems later.

The Navy's nuclear propulsion program and the Aegis development effort, both of which are generally considered as areas of acquisition success, were run during their formative years by officials (Admiral Hyman Rickover and Rear Admiral Wayne Meyer, respectively) who had long tenures in office. The term of office for Admiral Rickover's successors, as mentioned earlier, is eight years. In contrast, I have attended program-oversight hearings in recent years (such as those on cost growth in the LCS program or problems in the Coast Guard's Integrated Deepwater Systems program, to cite two examples) where the witnesses stated that the problems experienced by programs, while regrettable, resulted from decisions made by their predecessors. These contrasting experiences suggest that Congress might consider exploring options for lengthening the terms of office for some defense acquisition program officials well beyond the four years or so that many top program officials currently serve.

Mr. Chairman, this concludes my statement. I will be pleased to respond to any questions the Committee may have.