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TESTIMONY

Statement of

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Before

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Hearing on

Oversight Review of the U.S. Navy's Littoral Combat Ship (LCS) Program

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Chairwoman Hartzler, Ranking Member Speier, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss the Navy's Littoral Combat Ship/Frigate (LCS/Frigate) program, a program that I have tracked for CRS since its inception 15 years ago.[1] In my 32 years as a naval issues analyst for CRS, no program has been more complex to track, or has posed more potential oversight issues for Congress, than the LCS program.

A Program at a Crossroads for Multiple Reasons

The LCS/Frigate program is at a crossroads not only because of the Navy's proposal to shift from production of the baseline LCS design to production of the frigate variant of the LCS, but also because of three significant additional factors:

- the rapidly shifting international security environment, which could alter requirements for U.S. naval forces, including small surface combatants such as the frigate variant of the LCS;
- the possibility that the incoming Trump administration might make significant changes in U.S. foreign and security policy—changes that might further alter requirements for U.S. naval forces, including small surface combatants such as the frigate variant of the LCS; and
- the Trump campaign organization's announced objective of building the Navy toward a goal of 350 ships, rather than the Navy's current 308-ship force-level objective, which if adopted as policy by the incoming Trump administration, could alter the Navy's desired numbers of small surface combatants such as the frigate variant of the LCS.

These three factors—particularly the rapidly shifting international security environment and possibility of significant changes in U.S. foreign and security policy—profoundly affect the circumstances for conducting oversight of U.S. defense programs, including the LCS/Frigate program. They introduce oversight issues and considerations that differ from those that have characterized oversight of U.S. defense programs, including the LCS/Frigate program, in recent years. In short, for U.S. defense programs, including the LCS/Frigate program, the ground beneath us is shifting in a fundamental way, complicating the task of conducting oversight. A number of the comments that follow reflect this challenging situation.

Issue for Congress

Regarding the future of the LCS/Frigate program, the Government Accountability Office (GAO) has framed the question as follows: "A more basic oversight question today is whether a ship that costs twice as much [as originally estimated] yet delivers less capability than planned warrants an additional investment of nearly $14 billion."[2] That is one way to frame the question. Another would be: "What capability gaps will the Navy have in coming years, what are the likely costs and capabilities of the frigate variant of the LCS, and is the Navy's proposal for procuring the frigate variant of the LCS

[1] See, for example, the current CRS report on the program—CRS Report RL33741, *Navy Littoral Combat Ship (LCS)/Frigate Program: Background and Issues for Congress*, by Ronald O'Rourke—as well as two earlier CRS reports on the program, CRS Report RL32109, *Navy DDG-1000 (DD(X)), CG(X), and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke (this report now focuses on the DDG-51 and DDG-1000 destroyer programs), and CRS Report RS21305, *Navy Littoral Combat Ship (LCS): Background and Issues for Congress*, by Ronald O'Rourke.

[2] Government Accountability Office, *Littoral Combat Ship Program: Congress Faced with Critical Acquisition Decisions*, GAO-17-262T, December 1, 2016 (Testimony Before the Committee on Armed Services, U.S. Senate, Statement of Paul L. Francis, Managing Director, Acquisition and Sourcing Management), summary page.

consequently the most cost-effective approach for addressing those capability gaps?" These are not the only two ways of framing the question.

Analytical Foundation

A key oversight issue for the Navy's proposal for procuring the frigate variant of the LCS concerns its analytical foundation. The question of a program's analytical foundation is not a mere academic matter. Rather, it gets to whether the service has a rigorously formed and compelling basis for what it is proposing to do. In this case, the service (the Navy) is proposing to build a certain number of LCS variants (twelve), to a certain design (the currently envisioned frigate design), at a certain annual rate (as shown in the Navy's shipbuilding plan), using a certain acquisition strategy (a single shipyard chosen in a down select between the two current LCS shipyards).

Some observers might refer to a program's analytical foundation as its business case, although that term can also be used to mean other things. Creating a rigorous analytical foundation involves performing disciplined, structured analyses. Such analyses may either confirm intuitions and subjective judgments that policymakers and uniformed officials may have about a proposed program, or instead produce unanticipated or counterintuitive results that challenge those intuitions and judgments. Indeed, a major reason for performing rigorous analyses is to uncover unanticipated or counterintuitive results. Another major reason is to provide the service with a strong case for convincing others about the merits of the service's proposed program.

As a result of how the LCS/Frigate program was restructured twice in less than two years at the direction of two Secretaries of Defense, the Navy's proposal for procuring the frigate variant of the LCS now appears to have three potential weaknesses in its analytical foundation:

- The first and second apparent potential weaknesses, which arise from the absence of an analytically rigorous capability gap analysis (what might also be called a mission-need analysis) and the absence of an analytically rigorous analysis of multiple concepts (an analysis of broadly different potential approaches for filling the identified capability gaps), resulted from the way in which then-Secretary of Defense Hagel directed the program's first restructuring in 2014. In short, Secretary Hagel's direction to the Navy in 2014 appears to have left the Navy with little opportunity to perform these two analyses.
- The third apparent potential weakness concerns the absence of a detailed analytical foundation for the decision by Secretary of Defense Carter in the program's second restructuring in 2015 to reduce planned procurement in the LCS/Frigate program from a total of 52 ships to 40 ships, resulting in a planned procurement of 12 frigate variants (and 28 baseline LCSs), rather than 20 frigate variants (and 32 baseline and transitional LCSs).

Although the 2014 restructuring of the program left the Navy with little opportunity to perform an analytically rigorous capability gap analysis and an analytically rigorous analysis of multiple concepts, the Navy did perform an analytically rigorous analysis of alternatives (AoA), which is the third study that would follow a capability gap analysis and an analysis of multiple concepts.

(For further details on the above situation, see **Appendix A** of this statement, which is adapted from the CRS report on the LCS/Frigate program.)

The fact that the 2014 and 2015 restructurings of the program created these three apparent potential weaknesses in the program's analytical foundation does not mean that the changes to the program made in these two restructurings were wrong—they might very well have been the right changes to make. Nor does it mean that the Navy's proposal for procuring the frigate variant of the LCS is not the most cost

effective approach for meeting the Navy's future needs—it might very well be the most cost effective approach.

These three apparent potential weaknesses do, however, reduce the Navy's ability to demonstrate to others that its proposal for procuring the frigate variant of the LCS is the most cost effective approach. They also create additional room for skeptics to question the Navy's proposal using arguments that might themselves lack a firm analytical foundation. A situation where there are weaknesses in the service's analytical foundation for defending its proposal, and parallel weaknesses in the analytical foundation of the skeptics' arguments for questioning the service's proposal, can lead to a sprawling and disorganized debate that can make it difficult to keep key issues in focus and reach a well-founded conclusion regarding the merits of the service's proposal.

As I discuss in the CRS report on the LCS/Frigate program, the Navy 15 years ago did not perform a rigorous analysis of multiple concepts prior to announcing the original version of the LCS program. The Navy acknowledged this in testimony to the then-Projection Forces subcommittee of the House Armed Services Committee in April 2003. This created a weakness in the analytical foundation of the original version of the program that can be viewed as the root cause of some (perhaps much) of the controversy over the program's cost effectiveness that continued from the program's inception until its 2014 restructuring.

The rapidly shifting international security environment and the possibility of significant changes in U.S. foreign and security policy compound the three existing apparent potential weaknesses in the analytical foundation for the Navy's proposal for procuring the frigate variant of the LCS. This compounded situation does not prove that the Navy's proposal is not the most cost effect approach for meeting the Navy's future needs. It might very well be the most cost effective approach. But as a result of these compounded weaknesses, the Navy now has less of a basis for being certain that its proposal is the most cost effective approach, and less ability to demonstrate this compellingly to others.

The rapidly shifting international security environment and the possibility of significant changes in U.S. foreign and security policy also, however, create a fresh opportunity for the Navy to create a new analytical foundation for the effort that is both rigorous and fully up to date. Following the development of an updated national military strategy that reflects the incoming Trump administration's foreign and security policy goals, the Navy would have an updated basis for performing a rigorous capability gap analysis, a rigorous analysis of multiple concepts, and a rigorous new AoA for procuring small surface combatants. These analyses would take some time to perform, but performing them would not prevent some variant of the LCS from being procured in FY2017 and FY2018 while the analyses were being done.

The LCS/Frigate program is by no means the only DOD program affected by the situation created by the rapidly shifting international security environment and the possibility of significant changes in U.S. foreign and security policy. But it is one of the programs that are affected.

The shifting international security environment involves the ending of the post-Cold War era that first took shape in the late 1980s and early 1990s, and its replacement by a new international security situation featuring renewed great power competition. As such, the shifting of the international security environment can be viewed as a once-in-a-generation event. The changes in U.S. foreign and security policy that some observers, noting comments made on the campaign trail, believe might be implemented by the incoming Trump administration would, in the view of some of these observers, have the potential of being the largest changes since World War II. The combination of an approximately 25-year event and (in the view of some observers) a potential 70-year event, respectively, would create a situation for conducting oversight of defense programs that in fundamental ways would not be business as usual. A key current challenge in conducting oversight of DOD programs, including the LCS/Frigate program, is to be fully

cognizant of how current circumstances are shifting the ground under our feet and potentially changing familiar oversight frameworks.

Program Quantity

As part of its vision for national defense, the Trump campaign organization announced an objective of "Rebuild[ing] the U.S. Navy toward a goal of 350 ships, as the bipartisan [2014] National Defense Panel [NDP] has recommended."[3] The Trump campaign organization did not specify the composition of this 350-ship fleet.

A CRS report on the idea of a bigger Navy provides a notional composition for a fleet of about 350-ships.[4] This notional fleet, which happens to total 349 ships, is not based on any analysis of Navy mission requirements; it was derived by simply scaling up the Navy's 308-ship force structure proportionately (while holding the planned number of ballistic missile submarines constant) and adjusting some of the resulting numbers so that they would reflect numbers for certain categories of ships that have appeared in Navy plans in recent years for fleets of 300 to 400 ships.

This notional 349-ship fleet may be of value as a point of departure for those interested in discussing the idea of a 350-ship fleet. It may also be of value as a tool for quickly understanding how other proposals for 350-ship fleets depart from a proportional scaling up of the Navy's 308-ship fleet. And it can serve as a placeholder, pending a proposal from the incoming Trump administration that provides a detailed composition of its desired 350-ship fleet.

The notional 349-ship fleet presented in the CRS report includes 56 small surface combatants—four more than the 52 small surface combatants included in the Navy's 308-ship force-level objective. The CRS report shows a notional procurement profile for achieving a force level of 56 small surface combatants over a 30-year shipbuilding period. This notional profile is shown in **Appendix B** of this statement. Compared to the Navy's FY2017 30-year shipbuilding plan, this notional profile would add 17 small surface combatants in the period FY2017-FY2025 and remove five small surface combatants in the period FY2029-FY2035, for a net addition of 12 small surface combatants through FY2035.

A key oversight issue regarding an objective of building the Navy toward a goal of 350 ships is that there currently is no rigorous, up-to-date analytical basis for a fleet of 350 ships. As noted above, the Trump campaign organization's announced objective regarding a 350-ship fleet references the recommendation of the 2014 NDP. As discussed in the CRS report on the idea of a bigger Navy, the 2014 NDP, in making its recommendation, referenced DOD's 1993 Bottom-Up Review (BUR), a major review that reshaped U.S. defense strategy, plans, and programs in response to the end of the Cold War and the start of the post-Cold War era.[5]

The analytical foundation of the 346-ship fleet called for in the 1993 BUR reflected the international security environment of the early post-Cold War era, as well as Navy ship types, technologies, operational concepts, basing arrangements, and deployment cycles of that time, all of which have changed over the

[3] Source: National Defense, Donald J. Trump's Vision, accessed December 5, 2016, at: https://www.donaldjtrump.com/policies/national-defense.

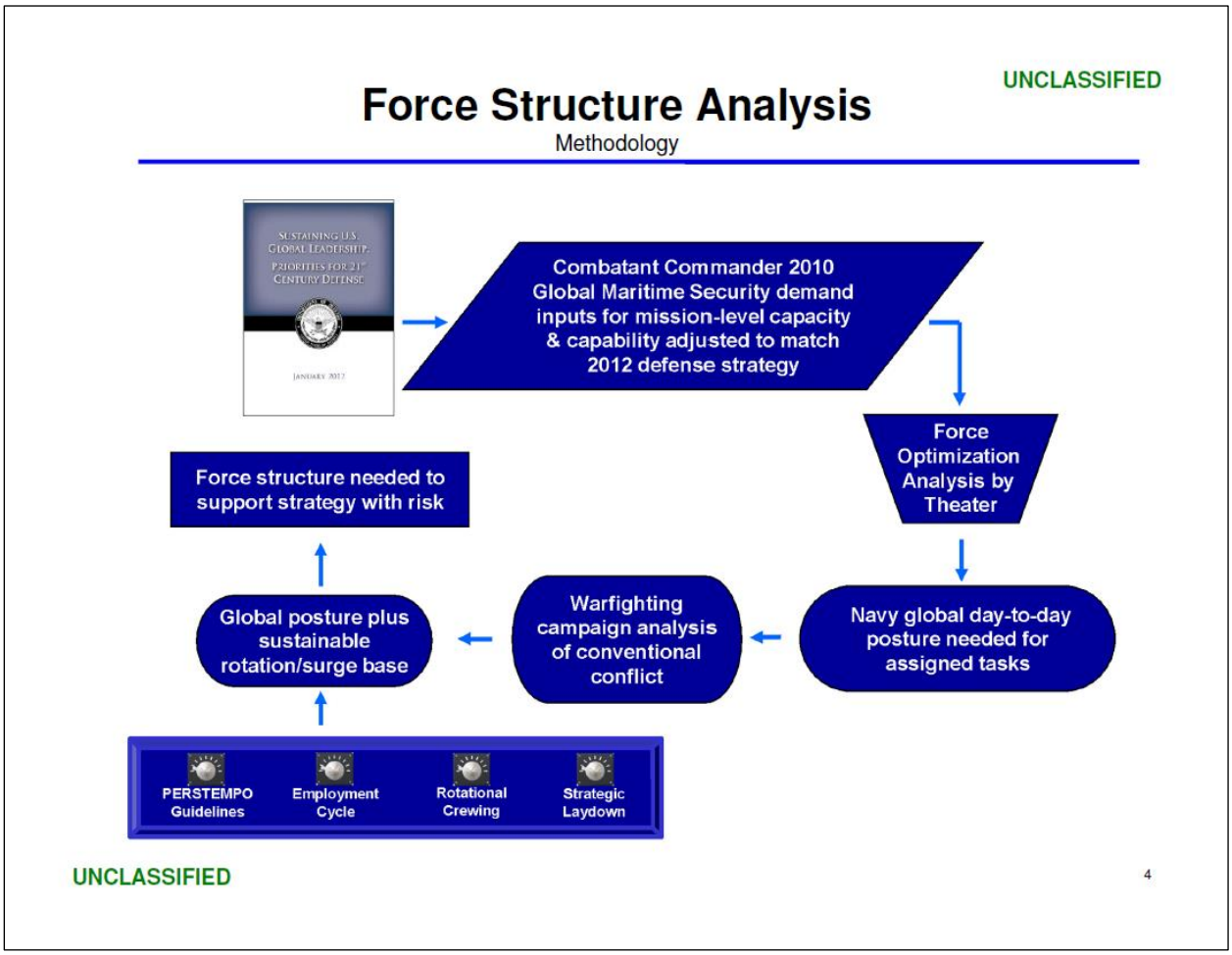
[4] CRS Report R44635, *Navy Force Structure: A Bigger Fleet? Background and Issues for Congress*, by Ronald O'Rourke.

[5] For more on the 1993 BUR, see Department of Defense, *Report on the Bottom-Up Review*, Les Aspin, Secretary of Defense, October 1993, 109 pp. See also CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by Ronald O'Rourke. See also CRS Report 93-839 F, *Defense Department Bottom-Up Review: Results and Issues*, October 6, 1993, 6 pp., by Edward F. Bruner, and CRS Report 93-627 F, *Defense Department Bottom-Up Review: The Process*, July 2, 1993, 9 pp., by Cedric W. Tarr, Jr. (both out of print but available from the author of this testimony).

past 20-plus years. The analytical foundation for the 1993 BUR's 346-ship fleet consequently is now out of date. (It can also be noted that a detailed composition of the 1993 BUR's 346-ship fleet was not presented to Congress; when the Navy eventually provided Congress with a detailed composition of its planned fleet, the numbers added to a total of 331 to 341 ships rather than 346.[6])

The absence of a rigorous, up-to-date analytical basis for a fleet of 350 ships doesn't prove that a 350-ship fleet would be inappropriate for meeting the Navy's future mission demands. But the case for a 350-ship fleet would be more compelling if it had a rigorous, up-to-date analytical basis. The Navy's Force Structure Analysis (FSA) process provides a mechanism for creating a rigorous, up-to-date analytical basis for the Navy's force-level objectives. The FSA takes inputs from U.S. regional combatant commanders for desired Navy capabilities for warfighting and day-to-day forward-deployed presence, and then translates those desired capabilities into ship quantities based on ship capabilities, basing arrangements, and deployment cycles. **Figure 1** summarizes the FSA process.

Figure 1. Navy Force Structure Analysis (FSA) Process



Source: Navy briefing on Navy force-level requirements, October 11, 2013.

[6] See Table B-1 in CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

The development of an updated national military strategy reflecting the foreign policy and security goals of the incoming Trump administration would permit U.S. regional combatant commanders to provide updated inputs to the FSA concerning their desired Navy capabilities for warfighting and day-to-day forward-deployed presence. The FSA could then translate those updated inputs into updated desired quantities for various ships types, including small surface combatants such as baseline LCSs and frigate-variant LCSs. The result could be a force-level goal for a fleet of about 350 ships, less than 350 ships, or more than 350 ships.

Down Select

Another oversight issue concerning the Navy's proposal for procuring the frigate variant of the LCS concerns the plan (directed by Secretary of Defense Carter as part of the program's 2015 resutructuring) to conduct a down select between the two LCS designs and build all the frigate-variant LCSs to a single design. This is generally understood as meaning that the 12 planned frigate-variant LCSs would all be built by a single shipyard.

As shown in **Appendix B**, building up to a notional force of 56 small surface combatants over the next several years could notionally involve increasing the small combatant procurement rate to three or four ships per year during the period FY2017-FY2025. A similar profile might result from building up to a notional force of 52 small surface combatants—the number included in the Navy's 308-ship force-level objective. In terms of industrial base capacity, it might be easier to execute a procurement rate of three or four LCS variants per year with two LCS builders rather than one.

As discussed in the next section, whether the 12 planned frigate-variant LCSs would be acquired via annual contracting or block buy contracting is not yet settled. If the ships are acquired with annual contracting, then depending on the annual procurement rate, maintaining two LCS builders might enhance the Navy's ability to use competition effectively in the procurement of all 12 ships. This might be true even if the procurement rate were no more than two ships per year. Under that scenario, the Navy could allocate one ship per year to each shipyard and use Profit Related to Offer (PRO) bidding (i.e., competition for profit) to generate competitive leverage for the government.[7] Conversely, conducting a down select to a single shipyard and using annual contracting could limit the government's ability to use competitive pressures in procuring frigate-variant LCSs, potentially increasing procurement costs for those ships.

Block Buy Contracting

As mentioned above, another oversight question concerns whether to use annual contracting or block buy contracting for procuring the frigate variants of the LCS. Annual contracting preserves flexibility for Congress regarding whether and when to procure follow-on units in an ongoing procurement program, while multiyear contracting in the form of block buy contracting or multiyear procurement (MYP) reduces that flexibility in return for reducing the procurement costs of the units being procured.[8]

[7] For more on PRO bidding, see Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, Before the House Armed Services Committee on Case Studies in DOD Acquisition: Finding What Works, June 24, 2014, p. 7.

[8] Stated more fully, from a congressional perspective, trade-offs in using block buy contracting include the following:

- reduced congressional control over year-to-year spending, and tying the hands of future Congresses;
- reduced flexibility for making changes in acquisition programs in response to unforeseen changes in strategic or budgetary circumstances (which can cause any needed funding reductions to fall more heavily on acquisition programs not covered by multiyear contracts);

(continued...)

One question that sometimes arises in connection with the LCS/Frigate program, which has used block buy contracting for units 5 through 26, is the relationship between the past cost growth in the procurement of LCSs and the use of block buy contracts to procure LCSs. The relationship can be summarized as follows: The growth in the procurement cost of LCSs came primarily, if not entirely, before the use of block buy contracts. Procurement costs under the block buy contracts appear to have stabilized. The block buy contracts are fixed price incentive contracts, which limits the government's exposure to cost growth. The block buy contracts may have reduced LCS procurement costs, perhaps by upwards of about five percent, due to cost reductions at shipyards that are possible when shipyards, viewing a commitment by the government to procure ships over a period of several years, have the confidence in future business needed to make investments in their work force and capital plant that can better optimize the shipyards for production of the ships covered by the contract.

Another question is whether the use of block buy contracts would reduce Congress' ability to conduct effective oversight of the Navy's activities for procuring frigate variants of the LCS. In connection with this question, it can be noted that the LCS program has been executed under block buy contracts since December 2010. In the period since then, the LCS program has been a recurring topic of oversight questions at annual hearings on the Navy's budget, the subject of numerous legislative provisions and instances of report language in annual national defense authorization acts, and the subject of multiple oversight reports from GAO. Additional oversight on the program has been provided in GAO's annual report assessing selected DOD weapon programs, the periodically updated CRS report on the program, and reports from the Congressional Budget Office (CBO) that discuss potential costs for the program.

Although the use of a block buy contract reduces the government's flexibility regarding whether and when to procure follow-on units in the program, Congress and the executive branch retain the ability to terminate a block buy contract should circumstances dictate. A block buy contract can be written to exclude a termination penalty, and a block buy contract can be implemented without the use of an up-front batch order of components intended for ships to be procured in fiscal years after the first year of the contract. (The block buy contracts that the Navy has used for procuring Virginia-class submarines, LCSs, and TAO-205 class oilers have not used up-front batch orders of components.)

Congress or the executive branch might wish to terminate or suspend procurement of a ship class due to causes such as cost growth, schedule slippage, problems in production quality, or changes in the government's need for the ships. Block buy contracts can be (and in the LCS program, have been) fixed price contracts, reducing the government's exposure to cost growth. If one or more of the other factors just mentioned emerge as a problem serious enough to convince Congress or the executive branch that procurement of the ships should be terminated or suspended, the question is how much more difficult it would be to terminate or suspend procurement if the ships were being procured under a block buy contract rather than annual contracts. Supporters of annual contracts could argue that block buy contracts by design make it more difficult for the government to change its plan to procure the ships. Supporters of block buy contracts, while acknowledging this, might argue that the relative rarity of terminations or suspensions of DOD procurement programs suggests that the primary source of reluctance to terminate or

(...continued)

- a potential need to shift funding from later fiscal years to earlier fiscal years to fund economic order quantity (EOQ) purchases (i.e., up-front batch purchases) of components;
- the risk of having to make penalty payments to shipbuilders if multiyear contracts need to be terminated due to unavailability of funds needed to the continue the contracts; and
- the risk that materials and components purchased for ships to be acquired in future years might go to waste if those ships are not eventually acquired.

For more on 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.

suspend procurement arises from the fact that procurement has begun, regardless of the contract type being used, and that using a block buy contract might add to that reluctance in a secondary or marginal manner.

Another question concerns the signal that could be sent to other DOD acquisition programs by not agreeing to a Navy request (should the Navy make one) to use a block buy contract for procuring the frigate variants of the LCS. The effective cost of sending that signal might be upwards of $400 million in terms of savings under a block buy contract for 12 frigate-variant LCSs that would not be realized. There would also be a question of the signal that would be received by other DOD acquisition programs. Would the signal received be the (presumably) intended one that Congress will not tolerate poorly performing programs? Would the signal received instead be a (presumably) unintended one—that even when DOD and a military service take actions to restructure a program so as to avoid a recurrence of the problems experienced by the original version of the program, the restructured program might still be penalized for the problems of the original version of the program? Would the signal received be something else?

An additional consideration concerns the relationship between the contracting approach for the frigate-variant LCSs and the currently planned down select. As noted in the previous section, down selecting to a single LCS design (and consequently to a single LCS shipyard) and then using annual contracting could limit the government's ability to use competitive pressures in procuring frigate-variant LCSs, potentially increasing procurement costs for the ships.

Survivability

Another oversight issue for the LCS/Frigate program concerns ship survivability, meaning the ship's ability to avoid, withstand, and recover from battle damage. The issue has been a matter of debate in connection with both baseline LCSs and the proposed frigate-variant LCSs.

It is important to note that in terms of oversight, the survivability issue encompasses two questions. One is whether tests of the ship's survivability against its designed survivability standard accurately emulate threats and operating circumstances the ship might face, and whether the tests demonstrate that the ship is meeting its survivability design standard. The other question is whether the designed survivability standard itself is appropriate, given the ship's projected uses. This is a requirements question rather than a test-and-evaluation question. These two questions have sometimes been conflated in discussions of the survivability of LCSs.

The baseline LCS was designed to what used to be called a Level 1+ survivability standard, meaning that the ship was designed to something more than what used to be called Level 1 survivability standard.[9] The choice of the Level 1+ survivability standard might be viewed as a reflection of how baseline LCSs are

[9] In an April 2011 briefing on LCS survivability, the Navy summarized the baseline LCS's Level 1+ survivability standard as follows:

> [The] LCS design includes Level 1 [survivability] plus tailored survivability enhancements ("Level 1+"), such as:
>
> – Electro-magnetic pulse (EMP) hardening
>
> – Individual Chemical, Biological, Radiological protection with decontamination stations
>
> – Shock hardening of damage control (DC) and propulsion systems
>
> – Redundant, automated firefighting systems
>
> – Select fragmentation armor
>
> – Ability to survive in sea state 8
>
> (Navy briefing on LCS survivability, April 29, 2011, slide 2.)

intended to perform missions previously performed by ships such as patrol combatants and mine warfare ships, which were designed to a Level 1 standard, as well as missions performed by frigates, which were designed to the higher Level 2 standard. (Ships designed to the old Level 3 standard, the Navy's highest survivability standard, include aircraft carriers, cruisers, and destroyers.)[10] The Navy's Level 1/2/3 nomenclature for ship survivability standards was replaced in 2012 by a new and different framework for discussing surface ship survivability, but ships designed under the old Level 1/2/3 nomenclature, such as the baseline LCS, are still discussed in connection with the old nomenclature.[11]

The frigate-variant of the LCS has some survivability improvements compared to the baseline LCS, but apparently not enough to qualify under the old survivability nomenclature as a ship with Level 2 survivability. One might say that, in terms of its intended survivability standard, the frigate variant of the LCS under the old survivability nomenclature might be considered a Level 1++ ship. It might be possible to change the design of the frigate variant of the LCS to further increase its survivability. Whether such changes would be enough to convert the frigate variant of the LCS into a Level 2 ship under the old survivability nomenclature is not clear, but the changes could make the ship more expensive to procure. Whether the current survivability standard for the frigate variant of the LCS is appropriate is a question that should now be evaluated in the context of the rapidly changing international security environment and possible significant changes in U.S. foreign and security policy.

Mine Countermeasures (MCM) Mission Module

Much of the oversight activity related to the LCS/Frigate program in recent years concerns the development and testing of the mine countermeasures (MCM) mission module. The fielding of the MCM mission module has been delayed several years compared to earlier schedules, and these delays have contributed significantly to the debate and controversy over the LCS program.

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[10] A table showing the survivability standards for various categories of Navy ships is presented in OPNAVINST 9070.1, Survivability Policy for Surface Ships of the U.S. Navy, September 23, 1988, Enclosure 3, Survivability Protection Requirements by Ship Class.

[11] The Navy's old Level 1/2/3 nomenclature for surface ship survivability standards is outlined in OPNAVINST 9070.1 of September 23, 1988. This document was superseded by OPNAVINST 9070.1A of September 13, 2012, which sets forth the Navy's new framework for discussing surface ship survivability policy and standards. Under the old Level 1/2/3 nomenclature, Levels 1, 2, and 3 were defined as follows:

> Level I represents the least severe environment anticipated and excludes the need for enhanced survivability or designated ship classes to sustain operations in the immediate area of an engaged Battle Group or in the general war-at-sea region. In — this category, the minimum design capability required shall, in addition to the inherent sea keeping mission, provide for EMP and shock hardening, individual protection for CBR, including decontamination stations, the DC/FF capability to control and recover from conflagrations and include the ability to operate in a high latitude environment.
>
> Level II represents an increase of severity to include the ability for sustained operations when in support of a Battle Group and in the general war-at-sea area. This level shall provide the ability for sustained combat operations following weapons impact. Capabilities shall include the requirements of Level I plus primary and support system redundancy, collective protection system, improved structural integrity and subdivision, fragmentation protection, signature reduction, conventional and nuclear blast protection and nuclear hardening.
>
> Level III, the most severe environment projected for combatant Battle Groups, shall include the requirements of Level II plus the ability to deal with the broad degrading effects of damage from anti-ship cruise missiles (ASCMS), torpedoes and mines.
>
> (OPNAVINST 9070.1, Survivability Policy for Surface Ships of the U.S. Navy, September 23, 1988, Enclosure 2, Definition of Survivability Levels for Surface Ships.)

Much of the oversight of regarding the MCM module has focused on the question of whether the module is meeting its stated performance requirements. This is a key oversight question. In focusing on this question, however, it is possible to lose track of another question, which is whether the MCM module, even if it is not meeting its stated performance requirements, is nevertheless demonstrating a level of performance that is better than the legacy MCM capability that forward-deployed Navy forces have today.

In the absence of a significant mine threat to forward-deployed Navy forces, this second question might not be very important. But if Navy forces are exposed to such a threat, as they might be when operating, for example, in the Persian Gulf region, this second question can take on greater importance. Congress and the Navy have an interest in seeking to ensure that the MCM module meets its stated performance requirements as much as possible. But Congress and the Navy also have a potential interest seeking to ensure that forward-deployed Navy forces facing a significant mine threat are not deprived of a new MCM capability that performs better than the legacy MCM capability, should the new capability demonstrate such a level of performance, on the grounds that the new capability has not met its stated performance requirements.

A second point concerning the MCM module is that the Navy does not plan to use the frigate variants of the LCS for the MCM mission. (The Navy plans to use only baseline LCSs for the MCM mission.) In this sense, problems experienced in developing and testing the MCM module might not speak directly to the merits of the Navy's proposal for procuring frigates variants of the LCS.

A third point is that problems experienced in developing and testing the MCM module appear to relate more to the MCM systems themselves than to the ship from which they are being deployed (i.e., the LCS). To the extent that these same MCM systems would be used by other Navy ships that could be assigned the MCM mission, terminating procurement of LCSs and procuring some other ship for the MCM mission might not do that much to directly improve the situation. In this sense, the challenges the Navy currently faces with the MCM module may be less an LCS issue than an MCM issue that would exist whether the Navy procures LCSs or some other type of ship.

Propulsion Equipment Problems

The multiple propulsion equipment problems (aka propulsion equipment casualties) experienced by commissioned LCSs raise a number of potential oversight questions for Congress, including the following:

- How many of these casualties were due to design problems? How many were due to production quality issues? How many were due to issues relating to crew training and operation?
- Are there any common factors linking most or all of the casualties?
- What are the costs associated with fixing the damage to the LCSs caused by these casualties? Who is responsible for paying these costs?
- Are propulsion casualties on LCSs more common, less common, or about as common as propulsion casualties on other classes of Navy surface ships? If they are more common, what are the reasons why?
- What is the Navy's plan for reducing the frequency of propulsion casualties on LCSs? When does the Navy expect to see results from this plan?

The Navy's December 1 written testimony to the Senate Armed Services Committee regarding the propulsion casualties, which addresses some of these questions, is shown in **Appendix C** of this statement.

New Crewing and Operating Approach

In September 2016, the Navy announced a new approach for crewing and operating the first 28 baseline LCSs. This new approach is referred to as the Blue/Gold approach (because it involves maintaining two crews, known as the Blue and Gold crews, for certain individual LCSs), or as the 7-4-3 approach (because it involves maintaining a total of seven crews for each four-ship group of LCSs, with three of the LCSs in each group forward deployed). The 7-4-3 approach replaces the previous 3-2-1 approach, so-called because it involved maintaining three crews for every two LCSs, so that one of those two LCSs would always be available for deployment. The 7-4-3 approach is summarized in **Appendix D** of this statement. The Navy states that the 7-4-3 approach is intended to:

- reduce disruptions to the deployment cycles of LCSs that were being caused by LCS mission module testing under the 3-2-1 approach;
- improve training and proficiency of LCS crews;
- enhance each LCS crew's sense of ownership of (and thus responsibility for taking good care of) the ship it operates; and
- achieve a percentage of LCSs in deployed status, and numbers of forward-stationed LCSs, similar to or greater than what the Navy aimed to achieve under the 3-2-1 plan.

Potential oversight questions regarding the 7-4-3 approach include the following:

- How was this new approach developed?
- Why does the Navy believe the new approach is the best approach?
- How fully developed is the new approach this point? If further details need to be developed, when does the Navy anticipate developing them?
- How will the new approach affect the total number of personnel needed to operate the Navy's force of LCSs?
- How will it affect projected life cycle operation and support (O&S) costs for LCSs?
- What is the Navy's schedule for transitioning to the new approach?
- When does the Navy expect to start seeing benefits from the new approach?
- How does the Navy intend to measure the effectiveness of the new approach?
- What was the thinking behind the previous 3-2-1 approach for crewing and operating LCSs, and what turned out to be wrong with this thinking?
- How likely is it that the Navy at some point in the future might need to again change its approach for crewing and operating LCSs?

Defense-Acquisition Policy Lessons Learned[12]

Another oversight issue for Congress concerns what defense-acquisition policy lessons, if any, the LCS program may offer to policymakers, 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). One possible perspective is that the LCS program demonstrated that reducing acquisition cycle time can be done. Supporters of this

[12] This section is adapted from a section in CRS Report RL33741, *Navy Littoral Combat Ship (LCS)/Frigate Program: Background and Issues for Congress*, by Ronald O'Rourke.

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, 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, 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) hull form and hull materials.

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 (i.e., building the lead ships before their designs were fully developed), a practice long known to increase risks in 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 has faced in terms of developing an LCS concept of operations (CONOPS), 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 had reached IOC (initial operational capability) did not occur until 2014. 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,[13] 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 applicable defense-acquisition policy lessons because the LCS differs so much from other Navy ships and the Navy and DOD are 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 from a supplier firm that forced the shipbuilder to build the lead ship in a significantly revised and sub-optimal construction sequence.

Chairwoman Hartzler, this concludes my statement. Thank you again for the opportunity to testify, and I will be pleased to respond to any questions the subcommittee may have.

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

Appendix A. Analytical Foundation

This appendix presents additional discussion on the issue of the analytical foundation for the Navy's proposal for procuring the frigate variant of the LCS. It is adapted from the CRS report on the LCS/Frigate program.

Three Analyses That Can Strengthen an Analytical Foundation

The analytical foundation for an acquisition program can be strengthened by performing three formal, rigorous analyses prior to the start of the program:

- an analysis to identify capability gaps or mission needs;[14]
- an analysis to compare potential general approaches for filling those capability gaps or mission needs, so as to identify the best or most promising approach;[15] and
- an analysis to refine the approach selected as the best or most promising.[16]

Original LCS Program Lacked One of These Analyses Prior to Announcement of Program

As discussed in CRS reports covering the LCS program going back more than a decade, the Navy, prior to announcing the establishment of the LCS program on November 2001, performed the first and third studies listed above, but it did not perform the second. In other words, the Navy, prior to announcing the establishment of the LCS program on November 1, 2001, did not perform a formal, rigorous analysis to show that a small, fast modular ship was not simply one way, but rather the best or most promising way, to fill the three littoral warfare capability gaps (for countering mines, small boats, and diesel-electric submarines) that the Navy had identified. Instead of performing such an analysis, which at the time might have been called an analysis of multiple concepts, the Navy selected the concept of a small, fast, modular ship based on the judgment of senior Navy leaders.[17] In testimony to the House Armed Services

[14] Such a study might be referred to under the defense acquisition system as a Capabilities-Based Assessment (CBA), as referenced, for example, on page A-1 of Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01H of January 10, 2012, entitled "Joint Capabilities Integration and Development System." Such analysis might lead to a "validated capability requirements document" or "equivalent requirements document" as referenced on page 5 of DOD Instruction (DODI) 5000.02 of January 7, 2015, entitled "Operation of the Defense Acquisition System." An example of such a requirements document is an Initial Capabilities Document (ICD), which is also mentioned on page 5, although that might not be the correct term to use in this instance, which concerns an effort to acquire ships in the latter portion of an existing shipbuilding program. For additional background discussion on the defense acquisition system, see CRS Report RL34026, *Defense Acquisitions: How DOD Acquires Weapon Systems and Recent Efforts to Reform the Process*, by Moshe Schwartz.

[15] Such a study, like the third study listed above, might be referred to under the defense acquisition system as an Analysis of Alternatives (AoA). (In earlier years, a study like the second of the three studies listed above might have been referred to as an Analysis of Multiple Concepts, or AMC.) In discussing the AoA for a new acquisition program, it can be helpful to understand whether the AoA was more like the second or third of the studies listed here.

[16] Such a study, like the second study listed above, might be referred to under the defense acquisition system as an AoA. In discussing the AoA for a new acquisition program, it can be helpful to understand whether the AoA was more like the second or third of the studies listed here.

[17] For example, the October 28, 2004, version of a CRS report covering the DD(X) (aka, DDG-100) and LCS programs stated:

> In contrast to the DD(X), which reflects the outcome of a formal analysis intended to identify the best or most promising way to perform certain surface combatant missions (the SC-21 COEA of 1995-1997), the Navy prior to announcing the start of the LCS program in November 2001 did not conduct a formal analysis—which would now be called an analysis of multiple concepts (AMC)—to demonstrate that a ship like the LCS would be more cost-effective than potential alternative approaches for performing the LCS's stated missions.

(continued...)

Committee in April 2003, the Navy acknowledged that, on the question of what would be the best approach to perform the LCS's stated missions, "The more rigorous analysis occurred after the decision to move to LCS."[18] This issue may have led to some of the controversy that the program experienced in subsequent years,[19] which in turn formed the backdrop for Secretary of Defense Chuck Hagel's February 24, 2014, announcement of the program's restructuring.

2014 Restructuring of LCS Program Appears to Have Been Announced Without Two of These Analyses

The Navy's restructured plan for the frigate design appears to have potential weaknesses in its analytical foundation due to two formal, rigorous analyses that do not appear to have been conducted prior to Secretary of Defense Chuck Hagel's announcement on February 24, 2014, of the effort to restructure the program. Specifically, neither the Office of the Secretary of Defense nor the Navy has presented

- a formal, rigorous analysis to identify capability gaps or mission needs that was done prior to the Secretary of Defense Hagel's February 24, 2014, announcement, or
- a formal, rigorous analysis that identified "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate" as not simply one way, but rather the best or most promising way, to fill those capability gaps or mission needs that was done prior to the February 24, 2014, announcement.

(...continued)

> Potential alternative approaches for performing the LCS's stated missions include (1) manned aircraft, (2) submarines equipped with UVs, (3) a larger (perhaps frigate-sized) surface combatant equipped with UVs and operating further offshore, (4) a noncombat littoral support craft (LSC) equipped with UVs, or (5) some combination. An AMC is often performed before a service starts a major acquisition program.
>
> The absence of an AMC raises a question regarding the analytical basis for the Navy's assertion that the LCS is the most cost-effective approach for performing the LCS's stated missions, particularly given the Navy's pre-November 2001 resistance to the idea of a smaller combatant. As a result, the issue of whether a ship like the LCS represents the best or most promising approach has become a subject of some debate.
>
> (CRS Report RL32109, Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress, by Ronald O'Rourke. The title of this report is now *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*.)

[18] Spoken testimony of Vice Admiral John Nathman, Deputy Chief of Naval Operations (Warfare Requirements and Programs), at an April 3, 2003, hearing on Navy programs before the Projection Forces subcommittee of the House Armed Services Committee. At this hearing, the chairman of the subcommittee, Representative Roscoe Bartlett, asked the Navy witnesses about the Navy's analytical basis for the LCS program. The witnesses defended the analytical basis of the LCS program but acknowledged that "The more rigorous analysis occurred after the decision to move to LCS." See U.S. Congress, House Committee on Armed Services, Subcommittee on Projection Forces, Hearing on National Defense Authorization Act for Fiscal Year 2004—H.R. 1588, and Oversight of Previously Authorized Programs. 108th Cong., 1st sess., Mar. 27, and Apr. 3, 2003, (Washington: GPO, 2003), p. 126. For an article discussing the exchange, see Jason Ma, "Admiral: Most LCS Requirement Analysis Done After Decision To Build," *Inside the Navy*, April 14, 2003.

[19] A January 2015 journal article on the lessons of the LCS program stated:

> As Ronald O'Rourke of the Congressional Research Service described it early on [at a presentation at the Surface Navy Association annual symposium in January 2003], the LCS had come about through an "analytical virgin birth… that is going to be a problem for this program down the road." This can be argued to be the root cause of the subsequent LCS woes. One hopes that the new surface combatant [i.e., the Navy's design for the frigate] won't suffer the same problem.
>
> (Gregory V. Cox, "Lessons Learned from the LCS," *U.S. Naval Institute Proceedings*, January 2015: 37-38 (ellipse as in original), citing (for the quoted remark) Hunter Keeter, "O'Rourke: Lack Of Pedigree May Haunt LCS Program," *Defense Daily*, January 16, 2003.)

Given a July 31, 2014, deadline for the Navy to complete its work, the Navy's Small Surface Combatant Task Force (SSCTF) charged with analyzing options for "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate" apparently did not have enough time to conduct either of the two above analyses. Instead, the task force surveyed Navy fleet commanders to collect their judgments on capability gaps and mission needs, and to get their judgments on what capabilities would be the best to have in "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate."[20]

In addition to permitting the task force to complete its work by July 31, 2014, surveying fleet commanders offered the advantage of collecting the "wisdom of the crowd" on the issues of capability gaps and mission needs and what features "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate" should have. One potential disadvantage of this approach is that it deprived the Navy of a chance to uncover the kind of counterintuitive results that a formal analysis can uncover. (Indeed, this is a key reason why formal, rigorous analyses are done.) Another potential disadvantage is that fleet commanders can be focused on what they see the Navy needing today, based on current Navy operations, which might not be the same in all respects as what the Navy will need in the future, given the evolving international security environment, potential changes in technology, and resulting potential changes in the nature of warfare and operational concepts. The risk, in other words, is of fielding years from now the best possible improved LCS for the world of 2014.

Using the results it had gathered from surveying fleet commanders, the SSCTF then performed the third of the three above-listed studies—a formal, rigorous analysis to refine the concept for "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate."

A question for Congress is whether the analytical foundation for the frigate design will provide sufficient stability for acquiring those ships in coming years. Navy officials stated that, having refined the design concept for the modified LCS design, the Navy will now define and seek approval for the operational requirements for the ship.[21] Skeptics might argue that definition and approval of operational requirements

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[20] A January 8, 2014, press report, for example, states that "The task force canvassed fleet commanders for ways to improve" the baseline LCS design. (Tony Capaccio, "Navy Fixes Won't Much Help Littoral Ship, Tester Says," *Bloomberg News*, January 8, 2015. A January 16, 2015, press report similarly states:

> Fleet commanders told Navy officials over the past year that they see anti-submarine warfare, surface warfare and ship self-defense as the most important capabilities for a new small surface combatant, Surface Warfare Director Rear Adm. Peter Fanta said Jan. 13 during the Surface Navy Association's annual symposium. This feedback led the Navy to its decision to move to a modified LCS that will have enhanced weapons, sensors and armor—along with increased weight and a slower top speed.
>
> "What we did first was we went and asked all the warfighters ... what do you want most?" [said] Fanta, who served as one of the co-chairs of the small surface combatant task force that was stood up last year to provide the defense secretary with alternatives for a more lethal and survivable LCS. "They said 'well, we'd like a small surface combatant that does a lot of ASW work, covers our mine mission and still does a lot of surface engagements depending on different parts of the world."
>
> (Lara Seligman, "Upgunned LCS Will Trade Speed, Weight For Offensive Capabilities," *Inside the Navy*, January 16, 2015 [with additional reporting by Lee Hudson] Ellipse as in original.)

[21] A January 11, 2014, press report, for example, quotes Sean Stackley, the Assistant Secretary of the Navy for Research, Development, and Acquisition (i.e., the Navy's acquisition executive) as stating "We've gone from 'here's the concept,' now we have to go through the formal requirements review board... to define requirements in terms of updating the capabilities document." (As quoted in Christopher Cavas, "Small Combatant Effort Cranks Up," *Defense News*, January 11, 2015. [Ellipse as in original.]) A January 16, 2015, press report similarly states: "The Navy needs to take all the task force's conepts for capabilities and translate them into specific, formal requirements, Stackley explained. Those requirements then need approval by a Resources and Requirements Review Board (R3B)." (Sydney J. Freedberg Jr., "What's In A name? Making The LCS 'Frigate' Reality," *Breaking Defense*, January 16, 2015.) A January 26, 2015, press report similarly states that "the Navy needs to firm up the concept for the new ship's capabilities and translate them into formal requirements, Stackley explained. Those requirements then need to each be approved by a Resources and Requirements Review Board, which is set to occur in the spring." (Lara (continued...)

should come first, and conceptual design should follow, not the other way around. One possible alternative to the Navy's approach would be to put the announced design concept for the modified LCS design on hold, and perform both a formal, rigorous analysis of capability gaps/mission needs and a formal, rigorous analysis of general approaches for meeting those identified capability gaps/mission needs, and be prepared to follow the results of those analyses, whether they lead back to the announced design concept for the modified LCS design, or to some other solution (which might still be a design of some kind for a modified LCS).

Potential Oversight Questions Regarding December 2015 Restructuring of LCS/Frigate Program

Regarding the analytical foundation for the December 2015 restructuring of the LCS/Frigate program, potential oversight questions for Congress include the following:

- What is the Office of the Secretary of Defense's (OSD's) analytical basis for directing the Navy to reduce the LCS/Frigate program from 52 ships to 40, and to redirect the savings from this action to the other Navy program priorities shown in the December 14, 2015, memorandum from the Secretary? What is the analytical basis for directing the Navy to reduce the LCS/Frigate program to 40 ships, as opposed to some other number smaller than 52? What studies were done within OSD to form the analytical foundation for the directions in the memorandum?
- What are the potential operational advantages and disadvantages of reducing the LCS/Frigate program from 52 ships to 40 ships and redirecting funding to the other Navy program priorities?
- How would unit procurement costs for LCSs/Frigates be affected by reducing the program's procurement rate to two ships in FY2017, one ship per year in FY2018-FY2020 and two ships in FY2021?
- How much is OSD's direction to the Navy to reduce the LCS/Frigate program from 52 ships to 40 ships and redirect funding to the other Navy program priorities dependent on an assumption that limits on defense spending under the Budget Control Act of 2011 (S. 365/P.L. 112-25 of August 2, 2011), as amended, will remain in place? How might the merits of this direction be affected, if at all, by a decision to further amend or repeal these limits?
- Between the program's 2014 restructuring and the direction in the December 14, 2015, memorandum, the program has now been changed by OSD substantially twice in a period of two years. Although these changes are intended by OSD to improve program effectiveness and better optimize Navy spending, what impact might changing the program substantially twice in a period of two years have on program's stability and the ability of the Navy and industry to implement the program efficiently?

At a February 25, 2016, hearing before the Seapower and Projection Forces subcommittee of the House Armed Services Committee, the Navy testified that

> The 2014 FSA update [i.e., the Navy's most recently completed Force Structure Assessment for determining the Navy's force-level goals for ships] outlines the requirement for 52 Small Surface Combatants (SSCs) and determined a need for 26 deployed SSCs to meet the Navy's global

(...continued)

Seligman, "Navy Working To Iron Out Details Of Plan For Backfitting LCS Upgrade," *Inside the Navy*, January 26, 2015.)

> peacetime and wartime requirement. The Navy's 2016 Long Range Shipbuilding Plan and the FY2016 Future Years Defense Plan (FYDP) included procurement of 14 LCS/Fast Frigate (FF) ships in FY2017-2021. In order to balance current and future capability needs within the FY 2017 top line constraints, the procurement plan for LCS/FF was reduced to seven ships within the FYDP and the overall inventory objective was reduced from 52 to 40 ships. The Navy will evaluate the risk associated with this budget decision, in the broader context of total large and small surface combatant ship inventory, in the course of the 2016 FSA update to inform future shipbuilding plans.[22]

A February 26, 2016, press report states:

> During hearings on the budget held Thursday on Capitol Hill, top Defense Department officials revealed a stark difference of opinion over the direction of the Littoral Combat Ship (LCS) program, which was slashed from 52 to 40 ships in the fiscal year 2017 budget request.
>
> Defense Secretary Ashton Carter told House appropriators Thursday afternoon that the decision to move to 40 ships—which was dictated to the service through a December memo written by Carter—was driven by longterm national security considerations.
>
> But in a House Armed Services Committee seapower and projection force subcommittee hearing that afternoon, the Navy's top acquisition official Sean Stackley painted a very different picture.
>
> "This budget cycle, the decision was made [to cut the program]," he said. "It comes down to reductions in the budget. Reductions in the budget drove trades in terms of capability in the near term, and long term. The decision was made not based on a force structure assessment."
>
> The latest force structure assessment, which lays out the size and shape of the Navy, was published in 2014 and stated a 52-vessel small surface combatant requirement, which would be made up of 40 LCS and 12 of the "fast frigate" variant of the ship. That requirement has not changed, Stackley said.
>
> "The Navy's analysis is captured by the force structure analysis, which still requires 52 small surface combatants," he said. "The decision to go from 52 to 40 becomes a budget-driven decision and accepts risk."...
>
> In the House Appropriations defense subcommittee hearing, Carter characterized the reduced buy differently.
>
> "The Littoral Combat Ship is a successful program. It is an excellent ship," he said. "The Navy's warfighting analysis concluded 40 of them were enough. And, yes we did want to apply resources elsewhere to the lethality of our ships. That's critically important, that we not only have enough ships…but that they're the very best."[23]

A March 6, 2016, press report states:

> A controversial request to cap the Littoral Combat Ship (LCS) and follow-on frigate programme at 40 hulls, instead of 52, was made because Pentagon officials felt the lower number was still sufficient for a 'presence' role and funding was prioritised elsewhere.
>
> "A fleet of 40 of those is going to be fully capable of providing more presence than the fleet it replaces," Jamie Morin, director of the Department of Defense's (DoD's) Cost Assessment and

[22] Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition) and Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and Resources and Lieutenant General Robert S. Walsh, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, Before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on department of the Navy Seapower and Projection Forces Capabilities, February 25, 2016, p. 15.

[23] Valerie Insinna, "On Capitol Hill, OSD and Navy Officials at Odds Over LCS," *Defense Daily*, February 26, 2016: 1-2.

> Program Evaluation office, said during a 7 March briefing at the Center for Strategic and International Studies....
>
> Morin said the navy had a 52-ship total for LCSs because that accounted for replacing 'warfighting' requirements as well as 'presence' requirements, but the Pentagon believes it can do both with fewer ships and thereby free resources to buy more advanced munitions, bolster USN aviation, and protect investments for readiness and for future capabilities.[24]

[24] Daniel Wasserbly, "US Official: 40 LCSs Sufficient for Navy's 'Presence' Role," *IHS Jane's Defence Weekly*, March 6, 2015.

Appendix B. Notional Procurement Profile for a Force of 56 Small Surface Combatants

This appendix shows a notional procurement profile for achieving a force of 56 small surface combatants, and compares it to the procurement profile for small surface combatants in the Navy's FY2017 30-year shipbuilding plan. The notional profile is shown in the table below, which appears in the CRS report on the idea of a bigger Navy.[25]

Table B-1. Frigate and LCS procurement profiles

Fiscal year	Current 30-year shipbuilding plan	Notional profile for 56-ship force	Annual difference	Cumulative difference
17	2	3	+1	+1
18	1	3	+2	+3
19	1	4	+3	+6
20	1	4	+3	+9
21	2	4	+2	+11
22	2	4	+2	+13
23	2	4	+2	+15
24	2	3	+1	+16
25	1	2	+1	+17
26				
27				
28				
29	1		-1	+16
30				
31	1		-1	+15
32	1		-1	+14
33	1	1	0	+14
34	2	1	-1	+13
35	2	1	-1	+12

Source: Table prepared by CRS based on U.S. Navy data.

[25] CRS Report R44635, *Navy Force Structure: A Bigger Fleet? Background and Issues for Congress*, by Ronald O'Rourke.

Appendix C. December 1 Navy Testimony on LCS Propulsion Casualties

This appendix presents the Navy's written testimony on LCS propulsion casualties for a December 1, 2016, hearing on the LCS program before the Senate Armed Services Committee. The Navy's testimony states:

> As we increase our operational experience with LCS, we are closely monitoring material readiness and making changes, as warranted to improve operational availability. In total, LCS readiness as reflected in operational availability and casualty report metrics is consistent with other combatant ship classes. However, we are quickly and strongly addressing issues as they emerge to raise the system reliability to yet higher levels sooner in this new class. Of particular concern, five LCS class ships have been operationally impacted by propulsion casualties in the past year. The Navy has conducted formal engineering reviews and command investigations to assess the root cause and corrective action for each of the casualties. In general, the root causes can be broken into three separate categories: procedural non-compliance (failure to follow approved engineering procedures); design related deficiencies; or production-related deficiencies.
>
> Two of the five engineering casualties were related to procedural (non-) compliance:
>
> The first such casualty occurred onboard USS FORT WORTH while [it was] inport [at] Singapore, after 12 months of her 14 month maiden deployment. As a result of improper alignment of the lube oil service system (as outlined by the ship's Engineering Operating Procedures), three of the five bearings in the Combining Gear were damaged and USS FORT WORTH was unable to continue her mission in the western Pacific. Upon completion of repairs, the ship departed Singapore and returned to San Diego in early October 2016.
>
> The second casualty related to procedural (non-) compliance occurred onboard USS FREEDOM while inport San Diego. Improper corrective action following the routine failure of FREEDOM's Main Propulsion Diesel Engine (MPDE) attached seawater pump mechanical seal resulted in seawater contamination of the engine. Upon subsequent inspection, significant corrosion and damage was discovered inside the MPDE. The affected engine is planned for replacement commencing December 2016.
>
> In response to these procedural compliance issues, the Type Commander has conducted a formal investigation and root cause analysis on both casualties. The Commander, Naval Surface Forces directed an engineering stand down for all LCS Class crews to review, evaluate, and renew their commitment to safe ship operation, procedural compliance, and good engineering practices. Additionally, the Navy's Surface Warfare Officer's School Command is revising the current LCS training program, to include LCS specific engineering training and related proficiency examinations. In parallel, the Naval Sea Systems Command (NAVSEA) is reviewing design details for potential design enhancements that may mitigate the possibility of such operator errors.
>
> One of the five engineering casualties was specifically design-related:
>
> While operating USS MILWAUKEE (LCS 5) on all four engines at full power during transit in the Atlantic, an emergency stop of the gas turbine engines led to excessive wear of the high speed clutch causing damage to the high speed clutch and combining gear. Root cause analysis is in progress, but the combining gear on LCS 5 and follow is a new design (prior manufacturer ceased operations), and changes to the control logic for the de-clutch sequence and clutch piston release speed associated with the new design are apparent causes. Design modifications based on root causes have been developed and are being tested by Lockheed Martin and RENK (the gear manufacturer), in parallel with ongoing root cause analysis efforts. Pending satisfactory testing this month (December 2016), the associated high speed clutch modifications and machinery control software updates will be applied to LCS 9 and follow prior to delivery and LCS 5 and 7 during their Post Shakedown Availabilities (PSAs). LCS 1 and LCS 3 gear sets are not affected.

The remaining two engineering casualties trace to deficiencies in the ship construction process:

USS CORONADO (LCS 4) experienced a failure of the flexible shaft coupling between the starboard MPDE reduction gear and stern tube during transit from Hawaii to Singapore. A failure review board was convened, and while material testing of the failed coupling is still in progress, shaft misalignment has been identified as a contributing factor in the root cause analysis. An alignment summit with the shipbuilder, NAVSEA design engineers, the Original Equipment Manufacturer, the Supervisor of Shipbuilding, and the Program Office has since been conducted to review, validate, and better document waterborne alignment procedures. The coupling in LCS 4 was replaced with a new coupling design in Hawaii. USS CORONADO is now on station in Singapore on her maiden deployment. This new coupling design has already been installed on LCS 6 and follow ships.

USS MONTGOMERY (LCS 8) experienced a production deficiency related propulsion casualty shortly after sail away from the new construction shipyard. Prior to getting underway, the crew discovered seawater contamination in the steering hydraulic system for one of the four waterjets. The shipbuilder drained the system, replaced the system's seawater cooler, and flushed the system restoring full waterjet functionality. The root cause assessment determined that the cooler had not failed, but rather contamination was introduced into the system most likely in conjunction with the repair of a component external to the hull in the period between delivery and sailaway from the building yard. The shipbuilder has since implemented an improved procedure for waterborne waterjet hydraulic work.

The Navy has taken a consistent and rigorous approach in assessing and addressing root causes of equipment casualties in LCS. Early deficiencies in the designs of each variant have been addressed in follow ships, but there is still work to be done in increasing the operational availability of the ships in-service. In response, NAVSEA has initiated a comprehensive engineering review of both propulsion trains, to include logistics and training, and will report their findings upon completion of the review.[26]

[26] Statement of The Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition) and VADM Thomas S. Rowden, Commander, Naval Surface Forces, Before the Senate Armed Services Committee on the Littoral Combat Ship, December 1, 2016, pp. 8-10.

Appendix D. New Crewing and Operating Approach

This appendix presents additional background information on the Navy's new 7-4-3 approach for crewing and operating LCSs. It is adapted from the CRS report on the LCS/Frigate program.

In September 2016, the Navy announced a new approach for crewing and operating the first 28 baseline LCSs. This new approach is referred to as the Blue/Gold approach (because it involves maintaining two crews, known as the Blue and Gold crews, for certain individual LCSs), or as the 7-4-3 approach (because it involves maintaining a total of seven crews for each four-ship group of LCSs, with three of the LCSs in each group forward deployed). Key elements of the 7-4-3 approach include the following:[27]

- the first four LCSs (LCSs 1 through 4) will each by operated by a single crew and be dedicated to testing and evaluating LCS mission packages (though they could be deployed as fleet assets if needed on a limited basis);
- the other 24 LCSs (LCSs 5 through 28) will be divided into six divisions (i.e., groups) of four ships each;
- three of the divisions (i.e., 12 of the 24 ships), all of them built to the LCS-1 design, will be homeported at Mayport, FL;
- the other three divisions (i.e., the remaining 12 ships), all of them built to the LCS-2 design, will be homeported at San Diego, CA;
- among the three divisions on each coast, one division will focus on MCM, one will focus on ASW, and one will focus on SUW;
- in each of the six divisions, one ship will be operated by a single crew, and will focus on training the crews of the other three ships in the division;
- the other three ships in each division will each be operated by dual crews (i.e., Blue and Gold crews), like the Navy's ballistic missile submarines;
- the crews for the 24 ships in the six divisions will be unified crews—the distinction between core crew and mission package crew will be eliminated;
- the 24 ships in the six divisions will experience changes in their mission packages (and thus in their mission orientations) infrequently, if at all; and
- 13 of the 24 ships in the six divisions (i.e., more than 50%) are to be forward stationed at any given point for periods of 24 months, with three at Singapore, three at another Western Pacific location, such as Sasebo, Japan, and seven at Bahrain.

The Navy states that the 12 frigates to be procured after the 28 baseline LCSs will also use this new crewing and operating approach,[28] and that as the fleet continues to accumulate experience in operating and maintaining LCSs, elements of this new plan might be modified.[29]

[27] Source: Navy briefing on new LCS crewing and operating approach given to CRS and CBO, September 26, 2016. See also "Navy Adjusts LCS Class Crewing, Readiness and Employment," *Navy News Service*, September 8, 2016; Sam LaGrone, "Results of New LCS Review is Departure from Original Vision," *USNI News*, September 8, 2016; Sydney J. Freedberg Jr., "Navy Sidelines First 4 LCS; Overhauls Deployment, Crewing," *Breaking Defense*, September 8, 2016; Justin Doubleday, "Navy Introduces Major Change to Littoral Combat Ship Operations," *Inside the Navy*, September 9, 2016; David B. Larter, "Rebooting LCS: Hundreds More Sailors Needed in Sweeping Overhaul," *Navy Times*, September 9, 2016; Justin Doubleday, "Navy Begins Implementing Changes to Littoral Combat Ship Program," *Inside the Navy*, October 10, 2016.

[28] See "Navy Adjusts LCS Class Crewing, Readiness and Employment," *Navy News Service*, September 8, 2016.

[29] See, for example, Sydney J. Freedberg Jr., "Navy Sidelines First 4 LCS; Overhauls Deployment, Crewing," *Breaking Defense*, September 8, 2016.