S. HRG. 114–736

THE OVERSIGHT, ACQUISITION, TESTING, AND EMPLOYMENT OF THE LITTORAL COMBAT SHIP (LCS) AND LCS MISSION MODULE PROGRAMS

HEARING

BEFORE THE

COMMITTEE ON ARMED SERVICES UNITED STATES SENATE

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

THURSDAY, DECEMBER 1, 2016

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THE OVERSIGHT, ACQUISITION, TESTING, AND EMPLOYMENT OF THE LITTORAL COMBAT SHIP (LCS) AND LCS MISSION MODULE PROGRAMS

THURSDAY, DECEMBER 1, 2016

U.S. SENATE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

The committee met, pursuant to notice at 9:35 a.m., in Room SD–G50, Dirksen Senate Office Building, Senator John McCain (chairman) presiding.

Committee members present: Senators McCain, Inhofe, Wicker, Ayotte, Fischer, Cotton, Rounds, Ernst, Tillis, Sullivan, Graham, Cruz, Reed, Nelson, McCaskill, Manchin, Shaheen, Gillibrand, Blumenthal, Donnelly, Hirono, Kaine, King, and Heinrich.

OPENING STATEMENT OF SENATOR JOHN MCCAIN, CHAIRMAN

Chairman MCCAIN. Since a quorum is now present, I ask the committee to consider a list of 2,385 pending military nominations. Of these nominations, five nominations are six days short of the committee's requirement that nominations be in committee for seven days before we report them out.

No objection has been raised to these nominations. I recommend the committee waive the seven-day rule in order to permit the confirmation of the nomination of these officers before the Senate adjourns the 114th Congress, thank God.

Is there a motion to favorably report these 2,385 military nominations?

Senator REED. So moved.

Chairman MCCAIN. Is there a second?

Senator INHOFE. Second.

Chairman MCCAIN. All in favor, say aye.

[A chorus of ayes.]

[The information referred to follows:]

MILITARY NOMINATIONS PENDING WITH THE SENATE ARMED SERVICES COMMITTEE WHICH ARE PROPOSED FOR THE COMMITTEE'S CONSIDERATION ON DECEMBER 1, 2016.

1. **BG Robert N. Polumbo, USAFR to be major general** (Reference No. 1206)
2. In the Air Force there are 15 appointments to the grade of colonel (list begins with Daniel J. Bessmer) (Reference No. 1553)
3. In the Army there is 1 appointment to the grade of major (Brian C. Garver) (Reference No. 1557)

4. **MG Jerry D. Harris, Jr., USAF to be lieutenant general and Deputy Chief of Staff, Strategic Plans and Requirements, Headquarters US Air Force** (Reference No. 1617)
5. In the Navy there is 1 appointment to the grade of lieutenant commander (Suzanne L. Hopkins) (Reference No. 1633)
6. **LTG James M. Holmes, USAF to be general and Commander, Air Combat Command** (Reference No. 1664)
7. **RADM William K. Lescher, USN to be vice admiral and Deputy Chief of Naval Operations for Integration of Capabilities and Resources, N8, Office of the Chief of Naval Operations** (Reference No. 1671)
8. In the Army there is 1 appointment to the grade of major (Clifford D. Johnston) (Reference No. 1689)
9. In the Army there is 1 appointment to the grade of major (Reinaldo Gonzalez II) (Reference No. 1692)
10. In the Army there is 1 appointment to the grade of major (Graham F. Inman) (Reference No. 1712)
11. **Capt. Kelly A. Aeschbach, USN to be rear admiral (lower half)** (Reference No. 1767)
12. **VADM Dixon R. Smith, USN to be vice admiral and Deputy Chief of Naval Operations for Fleet Readiness and Logistics, N4, Office of the Chief of Naval Operations** (Reference No. 1804)
13. **In the Air Force Reserve there are 6 appointments to the grade of brigadier general (list begins with Joel E. DeGroot)** (Reference No. 1811)
14. **In the Air Force Reserve there are 13 appointments to the grade of major general (list begins with David P. Baczewski)** (Reference No. 1812)
15. **BG Jesse T. Simmons, Jr., ANG to be major general** (Reference No. 1813)
16. **In the Air Force Reserve there are 2 appointments to the grade of major general (list begins with David M. McMinn)** (Reference No. 1814)
17. **Col. William E. Dickens, Jr., USAFR to be brigadier general** (Reference No. 1815)
18. **In the Air Force Reserve there are 12 appointments to the grade of brigadier general (list begins with Brian K. Borgen)** (Reference No. 1817)
19. **BG Randolph J. Staudenraus, ANG to be major general** (Reference No. 1818)
20. **In the Air Force Reserve there are 6 appointments to the grade of major general (list begins with Craig L. LaFave)** (Reference No. 1819)
21. **Col. Stephen C. Melton, ANG to be brigadier general** (Reference No. 1820)
22. **MG Paul E. Funk II, USA to be lieutenant general and Commanding General, III Corps and Fort Hood** (Reference No. 1821)
23. **MG Gary J. Volesky, USA to be lieutenant general and Commanding General, I Corps and Joint Base Lewis-McChord** (Reference No. 1822)
24. **MG James H. Dickinson, USA to be lieutenant general and Commanding General, US Army Space and Missile Defense Command/US Army Forces Strategic Command** (Reference No. 1823)
25. **BG Patrick M. Hamilton, ARNG to be major general** (Reference No. 1824)
26. **In the Army Reserve there are 18 appointments to the grade of major general (list begins with Benjamin F. Adams III)** (Reference No. 1826)
27. **Col. Mark A. Piterski, ARNG to be brigadier general** (Reference No. 1827)
28. **Col. Ellis F. Hopkins, ARNG to be brigadier general** (Reference No. 1828)
29. **In the Army Reserve there are 70 appointments to the grade of brigadier general (list begins with Michael A. Abell)** (Reference No. 1829)
30. **RADM(lh) Mary M. Jackson, USN to be vice admiral and Commander, Navy Installations Command** (Reference No. 1830)

31. In the Air Force there are 28 appointments to the grade of major (list begins with Kip T. Averett) (Reference No. 1832)
32. In the Air Force there are 2 appointments to the grade of major (list begins with Shawn M. Garcia) (Reference No. 1833)
33. In the Air Force there are 1,903 appointments to the grade of major (list begins with Daniel C. Abell) (Reference No. 1834)
34. In the Air Force Reserve there is 1 appointment to the grade of colonel (Gary A. Fairchild) (Reference No. 1835)
35. In the Air Force there is 1 appointment to the grade of major (Megan M. Luka) (Reference No. 1836)
36. In the Air Force Reserve there are 2 appointments to the grade of colonel (list begins with Brandon D. Clint) (Reference No. 1837)
37. In the Air Force Reserve there are 90 appointments to the grade of colonel (list begins with Isamettin A. Aral) (Reference No. 1838)
38. In the Army there is 1 appointment to the grade of lieutenant colonel (Eileen K. Jenkins) (Reference No. 1839)
39. In the Army Reserve there is 1 appointment to the grade of colonel (Jeffrey M. Farris) (Reference No. 1840)
40. In the Army there is 1 appointment to the grade of lieutenant colonel (Matthew T. Bell) (Reference No. 1841)
41. In the Army there is 1 appointment to the grade of major (Melissa B. Reister) (Reference No. 1842)
42. In the Army Reserve there is 1 appointment to the grade of colonel (Charles M. Causey) (Reference No. 1843)
43. In the Army Reserve there are 2 appointments to the grade of colonel (list begins with Stephen A. LaBate) (Reference No. 1844)
44. In the Army there is 1 appointment to the grade of lieutenant colonel (Roxanne E. Wallace) (Reference No. 1845)
45. In the Army there is 1 appointment to the grade of major (Eric A. Mitchell) (Reference No. 1846)
46. In the Army Reserve there is 1 appointment to the grade of colonel (Jonathan J. Vannatta) (Reference No. 1847)
47. In the Army there is 1 appointment to the grade of lieutenant colonel (Dennis D. Calloway) (Reference No. 1848)
48. In the Army Reserve there are 3 appointments to the grade of colonel (list begins with Kenneth L. Alford) (Reference No. 1849)
49. In the Army Reserve there is 1 appointment to the grade of colonel (Henry Spring, Jr.) (Reference No. 1850)
50. In the Army Reserve there is 1 appointment to the grade of colonel (Craig A. Yunker) (Reference No. 1851)
51. In the Army there is 1 appointment to the grade of lieutenant colonel (Cornelius J. Pope) (Reference No. 1852)
52. In the Army Reserve there is 1 appointment to the grade of colonel (Anthony K. McConnell) (Reference No. 1853)
53. In the Army there is 1 appointment to the grade of lieutenant colonel (Jennifer L. Cummings) (Reference No. 1854)
54. In the Army Reserve there are 2 appointments to the grade of colonel (list begins with Donald J. Erpenbach) (Reference No. 1855)
55. In the Army there is 1 appointment to the grade of colonel (Carl I. Shaia) (Reference No. 1857)
56. In the Army there is 1 appointment to the grade of lieutenant colonel (Lisa M. Barden) (Reference No. 1858)
57. In the Army Reserve there is 1 appointment to the grade of colonel (Roger D. Lyles) (Reference No. 1859)
58. In the Army there is 1 appointment to the grade of lieutenant colonel (Clara A. Bieganek) (Reference No. 1860)
59. In the Army there is 1 appointment to the grade of major (Isaiah M. Garfias) (Reference No. 1861)
60. In the Army Reserve there is 1 appointment to the grade of colonel (Louis E. Herrera) (Reference No. 1862)

61. In the Army there is 1 appointment to the grade of major (Schnicka L. Singleton) (Reference No. 1863)
62. In the Army there is 1 appointment to the grade of colonel (John R. Burchfield) (Reference No. 1864)
63. In the Army there is 1 appointment to the grade of major (Elizabeth S. Eatonferenzi) (Reference No. 1865)
64. In the Army there is 1 appointment to the grade of major (Richard D. Mina) (Reference No. 1866)
65. In the Army there is 44 appointments to the grade of lieutenant colonel (list begins with Temidayo L. Anderson) (Reference No. 1867)
66. In the Army there is 1 appointment to the grade of major (Richard A. Gautier, Jr.) (Reference No. 1869)
67. In the Army Reserve there is 1 appointment to the grade of colonel (Joseph A. Papenfus) (Reference No. 1870)
68. In the Army Reserve there are 9 appointments to the grade of colonel (list begins with Stuart G. Baker) (Reference No. 1871)
69. In the Army Reserve there is 1 appointment to the grade of colonel (David S. Yuen) (Reference No. 1872)
70. In the Army there is 1 appointment to the grade of major (Donta A. White) (Reference No. 1873)
71. In the Army there is 1 appointment to the grade of major (Tony A. Hampton) (Reference No. 1874)
72. In the Army Reserve there are 18 appointments to the grade of colonel (list begins with Charles C. Anderson) (Reference No. 1875)
73. In the Army Reserve there is 1 appointment to the grade of colonel (David A. Yasenchock) (Reference No. 1876)
74. In the Army there is 1 appointment to the grade of major (Aaron C. Ramiro) (Reference No. 1877)
75. In the Army there is 1 appointment to the grade of lieutenant colonel (Richard M. Strong) (Reference No. 1878)
76. In the Army there is 1 appointment to the grade of major (Brendon S. Baker) (Reference No. 1879)
77. In the Army there are 19 appointments to the grade of colonel (list begins with Lanny J. Acosta, Jr.) (Reference No. 1880)
78. In the Navy there are 46 appointments to the grade of lieutenant commander (list begins with Jafar A. Ali) (Reference No. 1881)
79. In the Navy Reserve there is 1 appointment to the grade of captain (Meryl A. Severson III) (Reference No. 1882)
80. In the Navy there is 1 appointment to the grade of lieutenant commander (Ashley R. Bjorklund) (Reference No. 1883)
81. In the Navy there is 1 appointment to the grade of lieutenant commander (Adeleke O. Mowobi) (Reference No. 1884)
82. In the Navy there are 2 appointments to the grade of lieutenant commander (list begins with Mary K. Arbuthnot) (Reference No. 1885)
83. In the Navy there is 1 appointment to the grade of lieutenant commander (Stephen W. Hedrick) (Reference No. 1886)
84. In the Navy there is 1 appointment to the grade of lieutenant commander (Vincent M.J. Ambrosino) (Reference No. 1887)
85. In the Navy Reserve there is 1 appointment to the grade of captain (Neal P. Ridge) (Reference No. 1888)
86. In the Navy there is 1 appointment to the grade of lieutenant commander (Abdeslam Bousalham) (Reference No. 1891)
87. In the Navy there is 1 appointment to the grade of lieutenant commander (Scott M. Morey) (Reference No. 1892)
88. In the Navy there is 1 appointment to the grade of lieutenant commander (Christian R. Foschi) (Reference No. 1893)
89. In the Army Reserve there is 1 appointment to the grade of colonel (Andrew J. Wade) (Reference No. 1900)
90. In the Army there is 1 appointment to the grade of lieutenant colonel (Christopher S. Besser) (Reference No. 1902)

91. In the Army there is 1 appointment to the grade of major (Chad C. Black) (Reference No. 1903)
92. In the Army Reserve there is 1 appointment to the grade of colonel (Thomas D. Starkey) (Reference No. 1904)
93. In the Marine Corps there is 1 appointment to the grade of major (Joshua D. Fitzgarrald) (Reference No. 1905)
94. In the Marine Corps there is 1 appointment to the grade of lieutenant colonel (Anthony C. Lyons) (Reference No. 1906)

TOTAL: 2,385

Chairman MCCAIN. The committee meets this morning to receive testimony on the oversight, acquisitions, testing, and employment of the Littoral Combat Ship [LCS] and LCS mission module programs. We welcome our witnesses, who are key officials responsible for acquiring, testing, employing, and overseeing these programs.

The Honorable Sean Stackley, Assistant Secretary of the Navy for Research, Development, and Acquisition, has been the Navy's acquisition executive since 2008. Vice Admiral Thomas Rowden, Commander of Naval Surface Forces, is responsible for manning, training, and equipping the Navy's in-service surface ships. The Honorable J. Michael Gilmore, Director of Operational Testing and Evaluation [DOT&E], has been the senior adviser to the Secretary of Defense for operational live fire test and evaluation of weapons systems since 2009. Mr. Paul Francis, Managing Director of Acquisition and Sourcing Management, at the Government Accountability Office [GAO], whose 40-year career with GAO has focused mostly on major weapons acquisitions, especially shipbuilding.

The Littoral Combat Ship, or LCS, is an unfortunate, yet all too common, example of defense acquisition gone awry. Since the early stages of this program, I have been critical of fundamental LCS shortcomings. Here we are 15 years later with an alleged warship that, according to Dr. Gilmore's assessment, cannot survive a hostile combat environment, and has yet to demonstrate its most important warfighting functions, and a program chosen for affordability that, as the GAO has reported, has doubled in cost with the potential for future overruns.

Like so many major programs that preceded it, LCS' failure followed predictably from an inability to define and stabilize requirements, unrealistic initial cost estimates, and unreliable assessments of technical and integration risk, made worse by repeatedly buying ships and mission packages before proving they are effective and can be operated together.

What is so disturbing is that these problems were not unforeseen. In 2002, the Navy first requested Congress to authorize funding for the LCS program. After reviewing the Navy's plan, the consensus of the members of the two Armed Services Committees was "LCS has not been vetted through the Pentagon's top requirements setting body called the Joint Requirements Oversight Council." The Navy's strategy for the LCS does not clearly identify the plan and funding for development and evaluation of the mission packages upon which the operational capabilities of LCS will depend.

Despite such serious concerns, it will not come as a surprise to many members of this—of this committee, to you, that Congress then approved funding for LCS. When the Navy awarded the first LCS construction contract in 2004, it did so without well-defined

requirements, a stable design, realistic cost estimates, or a clear understanding of the capability gaps the ship was needed to fill.

Taxpayers have paid a heavy price for these mistakes. The LCS was initially expected to cost $220 million per ship, but the cost of each ship has more than doubled to $478 million, and we are not through yet.

The LCS' first urgently needed combat capability and mine countermeasures was supposed to be delivered in 2008. That capability is still not operational, nor is it expected to be until 2020, 12 years late. Twelve years late. Today, 26 ships of the planned 40-ship LCS fleet have either been delivered, are under construction, or are on contract. In other words, taxpayers have already paid for 65 percent of the planned LCS inventory.

LCS' combat capability is supposed to come from three mission packages: mine countermeasures, surface warfare, and anti-submarine warfare. Taxpayers have invested more than $12 billion to procure LCS seaframes and another $2 billion in these three mission packages. Yet for all this investment, all three of these mission packages are years delayed with practically none of the systems having reached the initial operational capability.

So far, the LCS has fielded only the most basic capabilities: a 30-millimeter gun with a range of two miles and the ability to launch and recover helicopters and small boats. The surface package was five years late. The mine package is 12 years late. The anti-submarine package is nine years late.

The Navy failed to meet its own commitment to deploy LCS seaframes with these mission packages in part because for some reason, Navy leaders prioritized deploying a ship with no capability over completing necessary mission package testing. In other words, the taxpayers have paid for, and are still paying for, 26 ships that have demonstrated next to no combat capability. This is unacceptable, and this committee wants to know, Secretary Stackley, who is responsible and who has been held accountable.

Let me be the first to say that Congress belongs on the list of those responsible. We could have intervened more forcefully and demanded more from the Department of Defense and the Navy. We did not. But as long as I'm chairman, this committee will.

Mission packages are not the only problem. Keeping the LCS seaframe underway at sea has also been challenging. Despite commissioning the first ship eight years ago in 2008, the Navy continues to discover "first of class problems." This year is 2016. Since 2008 when it was commissioned first, we continue to discover "first of class problems."

Since 2013, five of the eight LCSs delivered have experienced significant engineering casualties resulting in lengthy import repair periods. Amazingly, despite nearly no proven LCS combat capability and persistent debilitating engineering issues in both design and operation, the Navy is charging ahead with an ambitious plan that keeps most ships deployed more than half the time, stationed around the world far from supports of facilities in the United States. In contrast, most Navy destroyers are planned to be deployment—deployed from the United States far less than 25 percent of their service lives. The rush to put four ships forward in Singapore by 2018 without proven combat capability, and to maintain a de-

ployment tempo more than twice that of destroyers, is a recipe for more wasted taxpayers' dollars.

Although the LCS may yet deliver some capability, the Nation still needs a capable small surface combatant that addresses the LCS' critical shortfalls, including the ability to attack enemy surface ships at over-the-horizon ranges with multiple missile salvos, defend nearly non-combatant ships from air—nearby non-combatant ships from air and missile threats, as an escort conduct long-duration missions, including hunting enemy submarines, without frequent refueling, and exhibit robust survivability characteristics.

The recent—the recently concluded LCS review was long overdue, and it yielded some promising initiatives. But I am concerned that several critical fundamental assumptions of the program were not challenged, including excessive operational availability goals, insufficient in-house technical support for LCS, unexamined manpower requirements, and no urgency in transitioning to a new small surface combatant.

Fortunately, the Department of Defense is curtailing the LCS program at 40 ships and downselecting to a single ship design. Given the cost overruns, mission package testing lows, and the rate of engineering failures, reducing the size of this program is a necessary first step. I am prepared to go even further by taking a hard look at any further procurement of ships until all of the mission packages reach IOC [initial operational capability].

It is up to the Navy to explain to this committee and to the American taxpayers why it makes sense to continue pouring money into a ship program that has repeatedly failed to live up to its promises. The LCS continues to experience new problems, but it is not a new program. That is why the Department's leaders must not delay in reconciling their aspirations for the LCS with the problems—troubled reality by demanding accountability and reducing the size of this program.

Senator Reed.

STATEMENT OF SENATOR JACK REED

Senator REED. Thank you, Mr. Chairman. I want to join the chairman in welcoming Director Gilmore, Secretary Stackley, Admiral Rowden, and Mr. Francis to the committee this morning to testify on various aspects of the Navy's Littoral Combat Ship, LCS program, and we are grateful to each of you for your service.

The Navy's fundamental architecture of the LCS program separate changes in the mission package from changes that would disrupt the ship design and ship construction. In the past, when there were problems with developing the right combat capability on a ship, that would almost inevitably cause problems in the construction program. What the LCS architecture means is that changes inside the mission packages should not translate into changes in the ship construction schedule.

However, since the mission packages and the vessels are divorced from each other, we are now experiencing a new set of difficulties, many of them indicated by Senator McCain. While the shipbuilders had problems with costs and schedule early in the program, that has not been the big issue since the Navy conducted the competition for fixed price contracts in 2010. The shipbuilders and

shipyard workers have been performing well under those contracts since then, so well, in fact, that we now have built are in the process of building 26 of the LCS vessels, when not a one of the single—of the three types of mission modules has passed full operational testing. Since LCS combat capability largely resides in the mission packages, the Navy will have to operate LCS vessels for several more years in relatively benign circumstances, waiting on combat capability to complete testing.

Chairman McCain and I wrote to Admiral Richardson, the chief of naval operations, and Secretary Stackley about the LCS program in September, which raised a number of concerns. We asked that the Navy consider reducing the planned operational availability of the LCS to a sustainable level, or see if the Navy can support normal deployment availability before expanding availability to 50 percent under a blue/gold crewing concept.

The CNO [Chief of Naval Operations] respond that the Navy is going to continue to plan for 50 percent availability with the blue/gold crew concept because that is what the Navy needs to support the Optimized Fleet Response Plan. I believe that some of the problems we are experiencing now with LCS vessels is because we got too far in front of ourselves by trying to deploy ships before they were ready to deploy, which in turn reduced testing resources and focus.

Saying that we will attain the 50 percent deployment availability goal for LCS because that is what we need to make the Optimized Fleet Response Plan achievable rings a little hollow with me. It sounds a lot like previous assurances that there would be no problem in shifting from the original LCS blue/gold crewing concept to a three crews for every two ship concept, which has now been found wanting, and now we are back trying to make the blue/gold concept work.

In our letter, the chairman and I also asked the Navy to establish the land-based LCS propulsion and machinery control test site because the Navy is not providing sufficient in-house LCS engineering technical support for the LCS program. The CNO responded that the Navy will consider a land-based propulsion machinery control test site at some later date, but not now. I am willing for the moment to let the Navy play out this string of trying—to try to enhance support for the deployed LCS without such a facility, but I am concerned that LCS fleet material support will suffer without such a facility when such support is available for all other Navy combatants.

The chairman I also asked that the Navy conduct a bottom-up review of the manpower requirements for each LCS to validate or re-validate the quantity and quality of manpower requirements to determine if sufficient personnel are assigned to perform all watch standing, warfighting, damage control force, protection, maintenance, and other duties. The CNO responded that the Navy's LCS Review Team have already assessed manpower requirements. I would just say that I am skeptical that the LCS Review Team would have had sufficient time to do much more than decide how to allocate the 70 sailors which building space would be available. Such an allocation process would not constitute the manpower requirements review that I had in mind at least.

Finally, the chairman and I suggested that the Navy should start planning new—now rather—to procure and begin deliveries of a new small surface combatant as soon as possible in 2020. The CNO responded that the Navy will address the future small surface combatant at some later date after the Navy has completed an analysis of future fleet requirements.

I understand that CNO Richardson needs time to review overall future fleet requirements. However, I believe that when the Navy begins a program for a follow-on small surface combatant, it should avoid repeating what we did with the LCS program, where we were in such a hurry to field the ship we did not take the time to go through important parts of the acquisition process, such as deciding what our requirements are, deciding how much we are willing to pay to achieve those requirements, and programming ahead of time for the manpower and logistics programs that we needed to support the program. If the Navy waits too long, we may face similar urgency in the schedule.

Again, thank you Mr. Chairman. I look forward to the hearing.

Chairman MCCAIN. Thank you. We will begin with you, Director Gilmore. Welcome, Dr. Gilmore.

STATEMENT OF HONORABLE J. MICHAEL GILMORE, Ph.D., DIRECTOR, OPERATIONAL TEST AND EVALUATION, UNITED STATES DEPARTMENT OF DEFENSE, WASHINGTON, DC

Dr. GILMORE. I apologize. Thank you, Mr. Chairman, Senator Reed, members of the committee.

As you pointed out, Mr. Chairman, although the first LCS was commissioned in 2008, the LCS program has not yet demonstrated effective warfighting capability in any of its originally envisioned missions by the Navy's—according to the Navy's own requirements, surface warfare, or SUW, mine countermeasures, or MCM, and anti-submarine warfare, ASW.

The Increment II Surface Warfare Mission Package is the only fielded system on LCS seaframes. It has demonstrated a modest ability to aid the ship in defending itself against small swarms of fast in-shore attack craft, although not against threat representative numbers and tactics, and the ability to support maritime security operations, such as launching and recovering boats and conducting pirate interdiction operations. However, when [the] Hellfire [missile] is fielded as part of the next increment of the surface warfare package, its capability should improve, and it will be important to solve the problems and do the testing with Hellfire that have—that have enabled us to discover so many of the problems that exist with the current ships.

In a June 2016 report based on the testing conducted before 2016, I concluded that the LCS employing the current Mine Countermeasures Package would not be operationally effective or suitable if called upon to conduct mine countermeasures missions in combat. That testing demonstrates the LCS Mine Countermeasures Package did not achieve the sustained area mine clearance rate of the Navy's legacy systems, nor can the package be used to meet the Navy's reduced Increment I mine countermeasures requirements for mine area clearance rate, even under ideal benign conditions,

achieving at best one-half of those requirements, which are a fraction of the Navy's full requirements.

The ships, as well as the mine countermeasure systems, are not reliable, and all the mine countermeasure systems, not just the Remote Minehunting System [RMS] and the Remote Multi-Mission Vehicle [RMMV] that were recently cancelled, had significant shortfalls or limitations in performance. Based on those results, after more than 15 years of development, the Navy decided this past year to cancel the Remote Minehunting System, halted further procurement of the Remote Multi-Mission Vehicle, abandoned plans to conduct operational testing of individual mine countermeasures mission package increments, at least in the interim, and delayed the start of fully-integrated LCS mine countermeasures mission package operational testing until at least fiscal year 2020.

As the Navy attempts to fill capability gaps and correct the shortfalls in performance of these cancelled and restructured key elements of the LCS Mine Countermeasures Package, it is very likely operational testing of either LCS variant, equipped and fully integrated with the final fully-capable Mine Countermeasures Package, will not be completed until at least 2023, more than a decade after the schedule set forth in the Navy's original requirements documents.

All of the LCSs have suffered from significant and repeated reliability problems with both sea frame and mission package equipment. No matter what mission equipment is loaded on either LCS variance, the lower reliability and variability of sea frame components, coupled with the small crew size, impose significant constraints on mission capability.

For example, when averaged over time, LCS–4 was fully mission capable for surface warfare missions just 24 percent of the 2015 test period. Both variants fall substantially short of the Navy's reliability requirements, and have a near zero chance of completing a 30-day mission, and a sustained 30-day mission is the Navy's requirement, without a critical failure one or more sea frame subsystems essential for wartime operations.

Testing conducted during the past two years on LCS–2, 3, and 4 also revealed significant cybersecurity deficiencies. Now, the Navy is developing plans and taking actions to correct some of the problems identified, but the severity of the problems discovered will degrade the effectiveness of both LCS variants until the problems are fully corrected.

In closing, I want to emphasize the importance of realistic testing. It was only through testing of full mission packages at sea and aboard the ship with a crew from the fleet that the significant problems and shortfalls I have just discussed were clearly revealed. In fact, the Navy's Independent Mine Countermeasures Review Team emphasized that a reliance on segmented shore-based testing "provided a false sense of system maturity." Similarly, only with an operationally realistic testing of the Surface Warfare Mission Package were the inaccuracies of the gun, limitations of the ships maneuvering and tactics, and the deficient training revealed.

Therefore, my strongest and most important recommendation to you and to the Navy is to fund and execute realistic and rigorous testing of LCS and its mission packages as we go forward.

Thank you.
[The prepared statement of Dr. Gilmore follows:]

PREPARED STATEMENT BY J. MICHAEL GILMORE

Chairman McCain, Ranking Member Reed, and distinguished members of the Committee, thank you for the opportunity to discuss my assessment of the Littoral Combat Ship (LCS) program. The first LCS was commissioned in 2008, and the Navy now has in commission a total of eight ships, with two more anticipated in the coming months. The Navy has also deployed three LCSs in the past three years, with each of the three ships conducting freedom of navigation and forward presence missions in the western Pacific. Despite the success of delivering ships to the Navy, and recent peacetime operations during deployments, the LCS program has not yet demonstrated effective warfighting capability in any of its originally-envisioned missions: surface warfare (SUW), mine countermeasures (MCM), and anti-submarine warfare (ASW). The effectiveness of the ship is closely tied to the capabilities of the installed mission packages; yet, the Navy has not yet delivered effective mission packages that meet the Navy's own requirements for any of these missions. Furthermore, all of the ships have suffered from significant and repeated reliability problems with both seaframe and mission package equipment. No matter what mission equipment is loaded on either of the ship variants, the low reliability and availability of seaframe components coupled with the small crew size imposed significant constraints on mission capability. Unless corrected, the critical problems that I have highlighted in multiple DOT&E reports and multiple formal memoranda over the last seven years will continue to prevent the ship and mission packages from being operationally effective or operationally suitable in war.

With respect to survivability, neither LCS variant is expected to be survivable in high-intensity combat because the Navy's requirements accept the risk of abandoning the ship under circumstances that would not require such an action on other surface combatants. As designed, the LCS lacks the shock hardening, redundancy, and the vertical and longitudinal separation of equipment found in other combatants. Such features are required to reduce the likelihood that a single hit will result in loss of propulsion, combat capability, and the ability to control damage and restore system operation. Thus far, the results of the LCS Live Fire Test and Evaluation (LFT&E) program confirm this assessment. While there is still much work to be done, the LFT&E program has already identified over 100 technical improvements that could be applied to improve LCS's performance against threat weapons, although, given the ships' fundamental limitations, none of these improvements will make the ships' survivability comparable to that of the Navy's other surface combatants. Once I have all the shock trial data in hand and have analyzed it in conjunction with the data from the Total Ship Survivability Trials (TSST) and the Navy's Survivability Assessment Reports, I will issue a more comprehensive assessment of both seaframes' survivability.

Understandably, the Navy's concept of employment and concept of operations (CONOPS) for these ships has changed over time. The original vision for the class was to rely heavily on off-board and largely unmanned systems, which would allow engagement of the threats well away from the seaframe, thus enabling the ship to remain out of harm's way and survivable. Second, the Navy championed the idea of interchangeable mission packages through modularity in order to add to LCS's flexibility and contribution to a dynamic war effort. As the Navy stated several years ago, "By having the flexibility to swap out mission packages, Navy has a ship that can adapt to meet the ever-changing spectrum of mission requirements." [1] Notably, both of these cornerstones of the program have been either abandoned or not yet realized, as the limitations of the mission packages and seaframes have become clear through testing and experimentation.

The Navy has most recently decided, following a program review, to employ a "semi-permanent" installation of specific mission packages, making any given ship dedicated to a single mission, a sharp and limiting contrast from the Navy's original concept, as well as from the traditional multi-mission frigates that LCS is now envisioned to replace. Moreover, the off-board, unmanned systems that would have enabled the seaframes to stay far from danger have not yet been developed: neither the SUW or ASW mission packages plan to use unmanned undersea or unmanned

[1] Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development, and Acquisition) and Vice Admiral Richard Hunt, Director, Navy Staff before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee, July 25, 2013.

surface vehicles to accomplish those missions, and the MCM mission package's off-board vehicles have encountered significant developmental delays or cancelation, the primary MCM system, the Remote Minehunting System (RMS), being recently canceled after more than 15 years of development. Although all the mission packages will employ a helicopter or an unmanned aerial vehicle, those assets will not obviate the need for the ship itself to be engaged in high-intensity battle where the crews will face threats like small boats, submarines, naval combatants, and shore defenses that are likely to employ weapons like anti-ship cruise missiles (ASCMs), torpedoes, and mines. Therefore, the use of LCS as a forward-deployed combatant, where it will be involved in intense naval conflict, is inconsistent with the ships' inherent survivability in those same environments.

One of the primary design features and selling points of the LCS seaframe was its speed. With the ability to sprint at 40 knots, the ship enjoys some enhanced ability to defeat fast small boats (albeit not the ever growing numbers that are faster) and some lightweight torpedoes, thereby protecting itself in some scenarios. However, such speed capabilities provide no benefit in conducting ASW or MCM; furthermore, the Navy's CONOPS require LCS, in some scenarios, to remain stationed near much slower units who are providing the LCS with dedicated air defense support to have any reasonable chance of surviving attacks using ASCMs launched in the littorals also obviates the need for the high speed. Moreover, this CONOPS implies that destroyers and cruisers will be required to provide this protection to LCSs, which is contrary to the concept that independently operated LCSs will free up the Navy's destroyers and cruiser and "allow [them] to focus on the high-end missions," which is what the Navy has touted in the past. The realities of intense Naval conflict and the multitude of threats in the littoral environment paired with the evolved CONOPS has therefore also called into question the need for high speed as one of the primary design considerations for this class of ship. Indeed the Navy plans to modify future LCSs (the so-called frigate design) by eliminating the high top speed requirement.

I want to correct one misconception about LCS and my assessments. LCS was bought to "punch below its weight class," to specifically counter asymmetric threats in the littorals. LCS was not designed to be a destroyer, which has survivability and lethality capabilities to counter peer threats. No evaluation should hold LCS to that standard with respect to survivability or mission capabilities. Nevertheless, I have found no evidence to date that LCS will be effective or survivable even in the scenarios and missions in which it was designed to be successful. Those capabilities may yet appear as the Navy progresses in the development of the Increment 3 SUW mission package, the incorporation of an over-the-horizon missile onto the seaframes, a restructuring of the MCM mission package, and the long-awaited ASW mission package, which showed some promise in early developmental testing. To date, however, LCS does not provide a lethal capability in the primary missions it was built for, and given the change in CONOPS, its design is not survivable in those missions either.

SEAFRAME SUITABILITY

After operational testing of the *Freedom* variant equipped with the Increment 2 SUW mission package in 2014, and recent operational testing in 2015 – 2016 of the *Independence* variant equipped with the same mission package, DOT&E has sufficient data to conclude that both seaframe variants are not operationally suitable because many of their critical systems are unreliable, and their crews do not have adequate training, tools, and documentation to correct failures when they occur. No matter what mission equipment is loaded on either of the ship variants, the low reliability and availability of seaframe components coupled with the small crew size imposed significant constraints on mission capability. During this last year, problems with main engines, waterjets, communications, air defense systems, and cooling for the combat system occurred regularly and required test schedules to be revised or operations to be conducted with reduced capability (e.g., conducting MCM missions without operational air defense systems). These reliability problems are often exacerbated because, by design, the ship's force is not equipped to conduct extensive repairs; problems cannot be corrected quickly due to the need to obtain vendor support, particularly when several vendor home bases are at disparate overseas locations. The inability of the ship to be ready at all times to reach maximum speed, keep its main air defense system in operation, and to cool its computer servers are substantially detrimental to the ships' ability to defend themselves in time of war, much less conduct their assigned missions in a lengthy, sustained manner. As an example, when averaged over time, and accounting for both planned and unplanned maintenance downtimes, LCS 4 was fully mission capable for SUW missions just 24

percent of the 2015 test period. Failures of the propulsion and maneuvering subsystems and the ship's computing network, which are fundamental to ship operations, caused LCS 3 to return to port for repairs or reduced readiness while at sea for weeks at a time during its 2014 operational test period. Both variants fall severely short of the Navy's reliability requirements, and have a near-zero chance of completing a 30-day mission (the Navy's requirement) without a critical failure of one or more seaframe subsystems essential for wartime operations. The trend of poor reliability of critical seaframe systems has also affected the deployments of LCS 1 and 3, and most recently LCS 4, and these deployments did not exercise the ships in stressing wartime operational tempo. The poor suitability demonstrated during the operational test periods are therefore, not anomalous, but in fact, a clear indication that these ships will not be operationally available nor fully mission capable more than a fraction of the time in wartime conditions. The recent problems observed during peacetime are likely only the tip of the iceberg for the problems crews might deal with when in more severe combat. Such results also have grave implications for operations and sustainment costs, which will plague the Navy for years to come if these inherent engineering problems are not corrected.

The intentionally small crew size has limited the mission capabilities, combat endurance, maintenance capacity, and recoverability of the ships. For example, the small crew size has limited the *Independence* variant from operating with sufficient watchstanders to maintain an alert posture for extended periods of time. By design, the ship's small crew does not have the capacity to effect major repairs. Instead, the Navy's support concept depends on the use of remote assistance in troubleshooting problems and the use of Navy repair organizations and contractors for repair assistance. However, the Navy's limited stock of repair parts for LCS systems, many of which were sourced from offshore vendors, can result in long logistics delays and occasionally forces the Navy to resort to cannibalization of another ship in order to expedite repairs. Because of the planned reliance on shore-based contractor support, in many cases the LCS crew lacks the documentation, training, test equipment, and tools required to troubleshoot and repair serious problems as they emerge. An example of this limitation occurred during LCS 4's operational testing during 2015 and 2016, where the ship's primary air defense system, SeaRAM, suffered from seven long periods of downtime (greater than 48 hours). Each repair required the delivery of replacement components that were not stocked aboard the ship, and most required assistance from shore-based, subject matter experts. These failures left the ship defenseless against ASCMs, and would likely have forced it to return to port for repairs if it had been operating in an ASCM threat area. During the LCS 3 operational test period, the crew was unable to repair multiple critical systems, such as the ship's navigation data distribution system, the air search radar, and Link 16 tactical link, each of which resulted in multiple days of downtime while awaiting assistance from contractors to troubleshoot and repair the systems. The limited ability of the crew to effect repairs became particularly acute during the 2015 MCM technical evaluation period; the LCS 2 crew relied on shore-based maintenance personnel to complete repairs of the ship's twin boom extensible crane, main propulsion diesel engines, electrical systems, boat davit, straddle lift carrier, and air conditioning units and the mission package's Remote Multi-Mission Vehicles (RMMV) and Airborne Mine Neutralization System (AMNS) Launch and Handling Systems. In the preceding six month work-up period, the ship also called on contractor personnel to troubleshoot, diagnose, and correct problems. It remains to be seen whether the Navy can provide the same level of support in theater for wide-area, multi-LCS MCM operations that must be completed quickly, let alone during combat at sea.

In September 2016, the Navy released new plans to change the LCS crewing structure. The Navy now plans to phase out the 3:2:1 crewing construct and transition to a Blue/Gold model similar to the one used in crewing Ballistic Missile submarines. Originally, core crews and mission module crews were intended to move from hull to hull independently of one another, but core crews will now merge with mission module crews and focus on a single warfare area – either SUW, MCM, or ASW. DOT&E does not yet have sufficient information to assess whether the new crewing model will solve some of the problems observed in the previous testing of both variants.

AIR DEFENSE CAPABILITIES OF LCS

Air defense testing has not yet been completed for either LCS variant. The Navy has not conducted any of the planned live-fire air defense test events or the modeling and simulation studies necessary to definitively determine the ship's ability to defend itself against ASCMs. Despite the dearth of testing, DOT&E has compared

the capabilities of LCS's air defense system to other ships in the Navy. I assess that LCS likely has less or nearly equivalent capability to the LPD 17 air defense systems, which also employ Rolling Airframe Missile (RAM) but have a more capable combat system. In 2011, I assessed the LPD 17 class ships are not operationally effective against several modern classes of ASCMs. Therefore, it is unlikely that LCS will be able to meet the Navy's requirements for air defense based on the results available from LPD testing. More recently, limitations in the SeaRAM system (currently installed on *Independence* variants) revealed some significant classified concerns.

For the *Freedom* variant, DOT&E learned in fiscal year 2015 (FY15) that the Navy stopped work on the air defense modeling and simulation test bed because it did not have the intellectual property rights and detailed technical information for the ship's air defense radar (AN/SPS–75). The lack of intellectual property for these foreign radars has been a problem for both variants of LCS, making it difficult for engineers to develop high-fidelity models and understand the capabilities and limitations of these radars or effect changes when problems are found. I proposed alternative test strategies to overcome this difficulty; however, in 2016, the Navy decided it is not satisfied with the *Freedom* variant's radar and RAM system for defense against ASCMs. The Navy now plans to replace the RAM system with SeaRAM, which is the system installed on the *Independence* variant. Because of this decision, the Navy does not plan to test (at all) the existing *Freedom*-variant air defense systems installed on LCS 1 through 15. This is a high risk for deploying crews, given that many *Freedom*-variant ships will deploy between now and 2020 when backfits of the SeaRAM system on those hulls are scheduled to begin. Although the Navy has conducted some training events where a single subsonic drone is shot down in non-stressing, operationally *unrealistic* conditions (not emulating actual threats), the fact remains that no end-to-end operationally realistic live-fire testing has been conducted. The crews of these ships will remain unaware of any problems with their air defense systems that might have been discovered during testing, and will likely discover these problems at the worst possible time: when under attack. The need for this testing is all the more acute given the recent ASCM attacks against Navy ships off the coast of Yemen.

For the *Independence* variant, air defense testing continues to be delayed and its completion is now in doubt as well because of higher priority testing of the CVN 78 air defense systems. Additionally, the Program Executive Office for LCS sent a letter to the Navy's Surface Warfare Director (N96) stating that *Independence* variant air warfare testing cannot be executed at current funding levels. The Navy had planned to conduct the first of the planned operationally realistic live-fire events on the self-defense test ship in fiscal year 2016, but postponed the test indefinitely because of anticipated poor performance predicted by pre-test modeling and analysis of the planned test event scenario. Without these tests, an adequate assessment of the *Independence*-class probability of raid annihilation requirement is not possible. Based on the Navy's most recent plans, DOT&E expects that the *Independence* variant will have been in service nearly 10 years by the time that air defense testing is complete, which at the time of this testimony is not anticipated before fiscal year 2020.

Although the Navy has postponed indefinitely its plans to conduct live-fire testing of the LCS air defense systems, the Navy has conducted some initial testing of the SeaRAM system, as it is employed aboard *Arleigh Burke* destroyers. In December 2015, the Navy-conducted a live-fire event aboard the self-defense test ship, the SeaRAM system was successful at defeating a raid of two GQM–163 supersonic targets. Although a stressing event, these targets were not representative of the threats they were attempting to emulate. The Navy does not currently have an aerial target that is capable of emulating some modern ASCM threats. During this test, SeaRAM employed the RAM Block 2 missile, which is different than the current LCS configuration that employs the RAM Block 1A missile. However, if the Navy decides to deploy LCSs with the Block 2 missile, then this test and others planned are germane to an LCS evaluation, however incomplete. DOT&E and the Navy continue to conduct test planning to make best use of the available resources and ensure that LCS's air defense testing reflects the capabilities of deploying LCSs.

The Navy has also successfully completed some non-firing air defense tests that provide some initial insights into the capabilities and limitations of components of the air defense systems. For the *Freedom* variant, these tests revealed that because of the limited capabilities of the air defense radar, the crew was unable to detect and track some types of air threats well enough to engage them. The lack of integration between the WBR–2000 Electronic Support Measures (ESM) system and the RAM system limited the ship's capability to make best use of its limited RAM inventory. For the *Independence* variant, although the ships relies on the SeaRAM sys-

tem, the ship's air surveillance radar provided LCS crews with only limited warning to defend itself against ASCMs in certain situations. The *Independence* variant's ESM system is able to detect the presence of the ASCM seekers in most instances but did not reliably identify certain threats, and in some cases did not provide LCS crews with adequate warning to defend itself.

Finally, with respect to air defense, the ship is expected to struggle to defend itself against low, slow-flying aircraft such as unmanned aerial vehicles, helicopters, and small planes. In the Navy's developmental test events, we learned that the electro-optical system used to target the seaframe's gun was unable to provide reliable tracking information against some targets. Furthermore, the safety standoff requirements on Navy test ranges were so severe that they precluded meaningful live-fire gun engagements against these targets. Because of these problems and constraints, the program decided to cancel all subsequent live-fire events, including those scheduled for operational testing, conceding that the *Independence* variant is unlikely to be consistently successful when engaging some of these threats until future upgrades of the tracking system can be implemented.

CYBERSECURITY

Much of my assessment of the two seaframes' cybersecurity posture and capabilities is classified and covered in detail in my recent operational test reports. However, I will state that the testing conducted in fiscal year 2014 on LCS 3, testing conducted in 2015 on LCS 2, and finally the most recent test aboard LCS 4 have revealed significant deficiencies in the ship's ability to protect the security of information and prevent malicious intrusion. Although the Navy is developing plans to modify the network architecture in the both *Freedom* and *Independence* variants to enhance cybersecurity, the severity of the cybersecurity problems discovered on LCS will degrade the operational effectiveness of either variant until the problems are corrected.

In early 2016, the Navy made substantial changes to the LCS 4's networks, calling the effort "information assurance (IA) remediation," to correct many of the deficiencies in network security on the baseline *Independence* variant's total ship computing environment. The Navy designed and implemented the IA remediation program to mitigate or eliminate some of the vulnerabilities found during the 2015 test aboard LCS 2 and was successful in eliminating some of the deficiencies that placed the ship at risk from cyber-attacks conducted by nascent (relatively inexperienced) attackers.

Unfortunately, because of numerous limitations, the Navy's testing aboard LCS 4 was inadequate to fully assess the LCS 4's survivability against cyber-attacks originating outside of the ship's networks (an outsider threat). The testing was adequate to determine that some deficiencies remain when attacks occur from an insider threat; however, it was not adequate to determine the full extent of the ship's cybersecurity vulnerability or the mission effects of realistic cyber-attacks.

Although the Navy's IA remediation corrected some of the most severe deficiencies known prior to the test period, the testing revealed that several problems still remain which will degrade the operational effectiveness of *Independence*-variant seaframes until the problems are corrected. The Navy plans a second phase of IA remediation to correct additional network deficiencies; however, DOT&E is unaware of the plans to install or test these changes on future ships, or whether these changes will correct the problems observed during the LCS 4 test. Nevertheless, routine and thorough cybersecurity assessments of each ship, and each configuration of mission packages, particularly those being deployed, should be a core strategy for LCSs as well as all Navy ships. The inadequacies in test execution and poor performance discovered in recent LCS cybersecurity testing strongly suggest that the Navy must undertake a more concentrated and focused effort to improve cybersecurity for these ships.

SELF-DEFENSE AGAINST SURFACE THREATS

Both variants of LCS rely exclusively on the seaframe's MK 110 57 mm gun and a gunfire control system that is fed by an electro-optical/infrared sensor to defend the ship against attacking surface threats, such as a small fast boat. Unless the SUW mission package is installed, this one gun is the ship's only defense against these targets (as well as low, slow-flying targets). Too few data exist on the *Freedom* variant to provide a definitive evaluation of that ship's ability to defend itself with only the 57 mm gun. Furthermore, the test that was conducted was limited to a single target boat attacking LCS and the events were not conducted in a realistic cluttered environment where identification of threats will be more challenging.

On the *Independence* variant, however, the Navy conducted seven test events, each consisting of a single attacking small boat. LCS failed to defeat the small boat in two of these events, because of gun failures that have since been corrected. Overall, the 57 mm gun demonstrated inconsistent performance even in benign conditions, which raises doubts about the ship's ability to defend itself without the SUW mission package installed. The inaccuracy of the targeting systems, the difficulty in establishing a track on the target, and the requirement to hit the target directly when using the point-detonation fuze combine to severely impair effective employment of the gun, and limit effective performance to dangerously short ranges. The Navy has not conducted any testing to determine how well the ship will perform when faced with an attack in a realistic cluttered maritime environment including both neutral and hostile craft; the Navy has also not conducted operational testing to determine how well the ship (without the SUW mission package) will perform against multiple attacking boats. Nevertheless, given the performance observed during operational testing, the combination of faster threats, multiple threats, threats with longer-range standoff weapons, cluttered sea traffic, or poor visibility are likely to make it difficult for LCS (without the SUW mission package) to defend itself.

The ship's electro-optical/infrared camera, SAFIRE, is the primary sensor for targeting the 57 mm gun. The system suffers from a number of shortcomings that contribute to inconsistent tracking performance against surface and air targets, including a cumbersome human-systems interface, poor auto-tracker performance, and long intervals between laser range finder returns. These problems likely contributed to the poor accuracy of the 57 mm gun observed during live-fire events, though the root cause(s) of the gun's inaccuracy have not been determined definitively.

In the most recent of the seven live-fire test events the Navy conducted against a single-boat target, the crew employed the 57 mm differently than it had in previous live-fire events, and defeated the attacking boat with less ammunition and at a slightly longer range than in previous events. One event does not provide conclusive evidence that the ship can be effective in these scenarios, and such performance was never observed during the swarm-defense test events. Nevertheless, these results are encouraging and suggest that the Navy should examine tactics and alternative gun employment modes, including different projectile fuze settings, as a means to enhance LCS's currently limited capabilities.

SELF-DEFENSE AGAINST SUBSURFACE THREATS

As I have stated in multiple reports, LCS will have no capability to detect or defend against torpedoes unless the ASW mission package is embarked, specifically the lightweight tow countermeasure. This is in contrast to the USS *Oliver Hazard Perry*-class Frigates (FFG), which had some inherent capability to detect threat torpedoes and could employ a torpedo countermeasure system. The lack of capability implies that a submarine could launch an attack on an LCS, without the crew knowing that they were under attack, and successfully hit the ship.

Because an LCS equipped with the SUW mission package has no ASW capability, nor any torpedo defense capability, many areas of operation where multiple threats are present will require multiple LCSs to work together for mutual protection, or for the likely multi-mission character of many Navy warfare scenarios. Such groups of two or three LCSs with disparate single-mission packages is in addition to the now-acknowledged need for destroyer/cruiser support for air defense in some scenarios. The Navy's CONOPS documents acknowledge the difficulty of planning LCS surface action groups because of the inherent lack of multi-mission capabilities, making three or four ships sometimes necessary to enable mission accomplishment and ensure survivability. The same mission scenarios might be accomplished by fewer ships, provided those ships had multi-mission capabilities. The original vision, therefore, of a nimble, mission-focused ship has been overcome by the realities of the multi-mission nature of naval warfare combined with the multiple threat environments of high-intensity naval conflicts.

SURVIVABILITY

As I have previously reported, neither of the LCS designs includes survivability features necessary to conduct sustained operations in a combat environment. Furthermore, during DOT&E's review of the work completed by the Navy's Small Surface Combatant Task Force in 2014, it became clear that LCS does not have the survivability features commensurate with those inherent in the FFG it is intended to replace. The FFG is designed with shock-hardened mission and propulsion systems. It has redundancy and separation of major combat and engineering systems and equipment. These design features are meant to enable the ship to not only exit

the area once hit by significant threat weapons, but also to retain critical mission capability and continue fighting if need be. LCS is not designed to do so.

The LCS CONOPS acknowledges LCS vulnerabilities to some air, surface, and subsurface threats and suggests that LCS is best suited for missions such as Theater Security Cooperation and Maritime Security Operations. At the same time, the LCS CONOPS states that LCS is expected to spend the majority of its time operating independently or in surface action groups, ahead of the strike group, preparing the environment for joint force access to critical littoral operating areas. Such operations could expose LCS to the full spectrum of potential threats, and the CONOPS acknowledges that the limited air defense and survivability capabilities of LCS will necessitate an appropriate defense plan provided by the very forces LCS is supporting. Providing additional warships for LCS protection means stretching already limited battle group air defense assets. Furthermore, the presence of such air defense ships to aid LCS does not guarantee the susceptibility to these attacks will be reduced to zero or its survivability improved, given the potential threats that LCS might encounter as one of the first assets present in a hostile combat environment.

Aluminum Ship Vulnerability

The Navy has not yet adequately assessed the LCS aluminum hull and deckhouse fire vulnerability; however, this is an obvious survivability concern for these ships. Aluminum structure is vulnerable to melting and loss of structural integrity during shipboard fires. This is not a problem for steel hulled ships. Battle damage and collision incidents involving ships with aluminum superstructures, such as USS *Stark* and USS *Belknap,* highlighted these survivability concerns for the Navy. The Navy's Survivability Review Group concluded in the 1980s that aluminum ship structure was highly vulnerable to fire spread and loss of strength, which was codified in the 1985 edition of the General Specifications for Ships of the United States Navy, section 150a, by requiring deckhouses and superstructure to be steel. This policy was reversed for LCS. More recently, an aluminum ship, HSV *Swift,* suffered extensive structural damage from blast and fire when she was hit by a missile off the coast of Yemen. This recent attack serves as a grim reminder of the increased risk inherent in the *Independence* variant, which is constructed primarily from aluminum.

The Navy has not yet assessed the likelihood of major structural damage from a weapon-induced fire on LCS. These assessments have not been done because the Navy was not equipped with the analytical tools necessary to model this problem. The LCS LFT&E program included tests to gather data for model development and validation, but that process is still ongoing. The *Independence*-variant survivability assessment report that is due in fiscal year 2017 will not include comprehensive analysis of fire induced structural damage potential.

Based on testing of fire insulation conducted by the LCS program, the Navy reported that it is unlikely that major structural damage will occur to aluminum structures from an internal fire in an undamaged compartment (i.e., all fire suppression systems are operable and fire insulation is intact). This nuanced reporting did not address the fact that internal blast effects can damage fire insulation and suppression systems that would normally be available to mitigate the fire effects in an undamaged compartment. It is, therefore, premature to draw any other conclusions about the structural integrity of the LCS hull.

Shock Trials

This year, the Navy conducted reduced severity shock trials on the *Independence*-variant USS *Jackson* (LCS 6) and the *Freedom*-variant USS *Milwaukee* (LCS 5). I approved the reduced severity trial geometries for LCS 6 because of serious concerns about the potential for damage to non-shock hardened mission critical equipment and ship structure. There was also concern about the damage tolerance of the ship's hull structure relative to steel hulled ships. Unlike other surface combatants the combat systems on LCS are not shock hardened. Also, the main propulsion system on the *Independence* variant is not shock hardened. The Navy argued that the reduced severity approach was necessary because they lacked specific test data and a general understanding of how the non-Grade A systems (Grade A systems must remain functional after shock) would respond to shock. To further mitigate potential equipment damage and personnel injury, some mission systems were removed, other equipment was modified to improve shock resistance, and construction deficiencies were corrected.

LCS 6 was tested in June and July 2016. The trial consisted of three shots of increasing severity, ending at 50 percent of the required shock design level. At these reduced levels, most non-Grade A components and systems, including electrical power generation systems and the SeaRAM air defense system, remained operable

or were restored to a limited or full capability prior to the ship's return to port after each shot. The Navy is still analyzing the structural response data.

Based on the LCS 6 shock trial lessons learned and limited equipment damage, I directed the Navy to conduct a traditional three shot shock trial for LCS 5, with the final shot at two-thirds the required shock design level. The Navy conducted the first two shots from August 29 through September 23, 2016, starting the trial at the same shock severity as other modern surface combatants. However, the Navy stopped the LCS 5 trial after the second shot, thereby not executing the planned third shot due to concerns with the shock environment, personnel, and equipment. The Navy viewed the third LCS 5 trial as not worthwhile because the Navy was concerned shocking the ship at the increased level of that trial would significantly damage substantial amounts of non-hardened equipment, as well as damage, potentially significantly, the limited amount of hardened equipment, thereby necessitating costly and lengthy repairs. The Navy view is that its modeling could be used to confidently conclude what would occur if the third shot were conducted based on the results of the first two shots. I disagree and maintain that the third LCS 5 shot is needed: the Navy's models have not correctly predicted important aspects of the response of the LCS 6 and LCS 5 seaframes to the shock events that were conducted; nor have those models accurately predicted the responses of the equipment installed and integrated onto the ships.

As planned and conducted, neither shock trial resulted in catastrophic damage, yet both shock trials exposed critical shock deficiencies, which I will detail in an upcoming classified report. These deficiencies, which were only identified in the shock trial, can now be specifically addressed and corrected by Navy engineers to make the ships more survivable.

Total Ship Survivability Trials (TSST)

As an element of the LFT&E program, the TSST is the primary source of recoverability data and is intended to provide a damage scenario-based engineering assessment of the ability of the ship's crew to utilize the installed firefighting and damage control systems to control damage, reconfigure, and reconstitute mission capability after combat damage.

The LCS 3 TSST revealed significant deficiencies in the *Freedom*-variant design. Much of the ship's mission capability would have been lost because of damage caused by the initial weapons effects or from the ensuing fire. The weapons effects and fire damage happened before the crew could respond, and the ship does not have sufficient redundancy to recover the lost capability. Some changes could be made to make the ship less vulnerable and more recoverable without major structural modifications. Examples include providing separation for the water jet hydraulic power units, redesigning the Machinery Plant Control and Monitoring System, and reconfiguring the chilled water system into a zonal system with separation for the air conditioning (chilled water) plants. The Navy has not yet made any plans to make such changes in future ships, however.

The LCS 4 TSST, conducted in January 2016, exposed weaknesses in the *Independence*-variant design. While the shock-hardened auxiliary bow thruster would have provided limited post-hit propulsion, much of the ship's mission capability would have been lost because critical support systems such as chilled water are not designed for reconfiguration and isolation of damage caused by the initial weapons effects or from the ensuing fire and flooding. There were many survivability improvements identified by the trial team that could be implemented in the *Independence*-variant ships, for example, outfitting the rescue and assistance locker with additional damage control gear to make it a third damage control locker, and modifying the damage control and chill water systems to increase the ability to reconfigure and isolate damaged sections.

MISSION PACKAGES

The ability of LCS to perform the bulk of its intended missions (SUW, MCM, and ASW) depends on the effectiveness of the mission packages. To date, despite LCS having being in service since 2008, the Navy has not yet demonstrated effective capability for LCSs equipped with the MCM, SUW, or ASW mission packages. The Increment 2 SUW mission package is the only fielded system on LCS seaframes; it has demonstrated some modest ability to aid the ship in defending itself against small swarms of fast-inshore attack craft (though not against threat-representative numbers and tactics), and the ability to support maritime security operations, such as launching an recovering boats and conducting pirate interdiction operations.

Surface Warfare (SUW)

The Navy has now conducted one operational test of the Increment 2 SUW mission package installed aboard a *Freedom* variant and one operational test of the mission package installed aboard an *Independence* variant. The ship's organic 57 mm gun is augmented with two 30 mm guns and an MH–60R helicopter, which can be armed with a machine gun and HELLFIRE missiles.

For the *Freedom* variant, the Navy conducted three live-fire engagements aboard LCS 3 consisting of a small swarm of fast-inshore attack craft (small boats) under the specific conditions detailed in the Navy's reduced and interim requirement. LCS 3 achieved mixed results against these small swarms during fiscal year 2014 testing. In the first developmental test, the ship successfully defeated a small swarm beyond the prescribed keep out range. In the second developmental test, LCS 3 was not successful. Following intensive remedial training to hone the crew's tactics, shiphandling, and gunnery, LCS 3 repeated the test and was successful in the one operational test event. Although the tests demonstrated that the *Freedom* variant could defeat a small swarm under benign conditions, there is little evidence that such results are repeatable under these same conditions as well as other less favorable conditions. Moreover, the Navy does not have in place intensive training programs for small boat defense that enabled the crew to be successful in the last test event, nor has the Navy taken my recommendation to develop a shore-based operator-in-the-loop team trainer, which has the potential to alleviate some of the uncertainty in LCS SUW performance, enable more adequate testing of the ship's capabilities in these scenarios where test resources are scarce, and potentially examine other conditions (such as varying sizes of swarms and interfering traffic).

In 2015, LCS 4, similar to LCS 3, participated in three engagements with small swarms of small boats. LCS 4 failed the Navy's reduced requirement for interim SUW capability, failing to defeat each of the small boats *before* one penetrated the prescribed keep-out zone in two of the three events. Although LCS eventually destroyed or disabled all of the attacking boats in these events, these operational test results confirmed that the Increment 2 SUW mission package provides the crew with a moderately enhanced self-defense capability (relative to the capability of the 57 mm gun alone) but not an effective offensive capability. LCS 4's failure to defeat this relatively modest threat routinely under test conditions raises questions about its ability to deal with more realistic threats certain to be present in theater, and suggests that LCS will be unsuccessful operating as an escort (a traditional frigate role) to other Navy ships. Additional details about the LCS gun performance and the factors and tactics that contribute to the ship's effectiveness are discussed in my November 2016 classified report. In it, I also detail my recommendations for improving performance and tactics so that these ships might be effective in these scenarios.

The Navy has begun work on developing and testing the Surface-to-Surface Missile Module (SSMM), the core component of the Increment 3 mission package. Although early developmental testing has shown the Longbow HELLFIRE missile employed from the SSMM has the needed lethality to defeat some of these small boat threats, operational testing in 2015 and 2016 revealed some potential limitations in the targeting capability of the ship. The Navy intends to conduct additional developmental testing to better understand these limitations; and the results of these tests will be used to inform future decisions by the Navy to modify missile targeting algorithms and tactics, as needed to overcome the limitations. The Navy plans to demonstrate the ability to meet the LCS requirements for SUW swarm defense during operational testing of the Increment 3 mission package in fiscal year 2018. These tests will be the first time that the Navy will have investigated LCS's ability to defend ships other than itself.

Mine Countermeasures (MCM)

In 2009, the Navy recognized that its legacy MCM capabilities, particularly *Avenger*-class and *Osprey*-class surface ships and MH–53E Sea Dragon helicopters, were aging while the worldwide mine threat continued to modernize.[2] In response to the advancing mine threat abroad and planned retirement of legacy assets at home, the Navy articulated an overarching vision for 21st-century mine warfare hailing the LCS as the "keystone" of the future MCM force.[3] The principal objective of the Navy's MCM vision was "to decrease significantly the time required to conduct countermeasures operations, while ensuring low risk to naval and commercial vessels, and to remove the man from the minefield." The plan was based on the

[2] Legacy MCM capabilities also include Explosive Ordnance Disposal Units and Marine Mammals.

[3] "Ensuring Global Access and Commerce—21st Century U.S. Navy Mine Warfare," PEO(LMW) / OPNAV N85 Mine Warfare Primer, June 2009.

premise that a suite of MCM systems, deployed from an LCS stationed outside the minefield, could replace and outpace legacy capabilities that put sailors in harm's way.

After initially setting high expectations for LCS MCM performance, the Navy continues to temper its outlook. As the Navy embarked on efforts to transform its MCM vision to reality, analysts employed performance modeling to estimate the area clearance rates of each LCS equipped with a package of MCM systems in a variety of operational scenarios, including large-scale scenarios requiring operations of multiple LCSs for sustained periods. These modeling estimates formed the basis for the MCM requirements the Navy documented in the LCS Flight 0+ Capabilities Development Document (CDD) approved in 2010. In the CDD, the Navy also postulated that remaining development and integration of the systems needed to complete the fully capable MCM mission package could be accomplished quickly, indicating that "delivery of the first baseline Spiral Alpha MCM mission package is on schedule for fiscal year 2012."[4] As it became clear that this optimistic goal would not be met, the Navy developed a plan to test and field three "increments" of partial Spiral Alpha capability before achieving full Spiral Alpha capability in a fourth and final increment. In doing so, the Navy asserted that an LCS equipped with the first partial Spiral Alpha MCM mission package (or Increment 1 MCM mission package) would replace aging legacy systems and improve clearance rates by a factor of two.

The Navy has not yet delivered on the promise of its 21st-century MCM vision, even at reduced expectations. The Navy has not yet demonstrated in end-to-end testing that the sustained area clearance rate of an LCS equipped with the current MCM mission package exceeds its own estimates of legacy clearance rate, nor has it demonstrated that an LCS could meet the Navy's Increment 1 requirements for area clearance rate. The Navy has also not yet demonstrated the capability of an LCS to conduct efficient MCM operations in an operationally realistic shipping channel. Given the currently ineffective and limited line-of-sight communications between LCS and off-board vehicles, an LCS is forced to clear a series of operating areas that allow the ship to follow MCM operations as they progress along the channel while remaining within operational range of its off-board systems. This alone has the negative effect of vastly increasing mission timelines regardless of the effectiveness of the minehunting and clearing systems LCS employs. In addition, the performance demonstrated during LCS developmental testing that has been completed since 2014 provides ample evidence that the small number of LCSs equipped with the current MCM mission package that the Navy might be able to muster before fiscal year 2020 would not provide an operational capability to complete MCM clearance missions at the levels needed by operational commanders. Even under the best conditions the Navy might hope to experience, the technical evaluation in 2015 revealed that an LCS with the current MCM mission package would deliver less than half the Increment 1 requirements, which themselves are a fraction of the full Spiral Alpha requirements.

In a June 2016 early fielding report, based exclusively on the testing conducted before 2016, I concluded that an LCS employing the current MCM mission package would not be operationally effective or operationally suitable if called upon to conduct MCM missions in combat. In the same early fielding report, I concluded that the current versions of the individual systems that comprise the current MCM mission package—specifically the RMS (consisting of the RMMV and AN/AQS–20A) and the MH–60S Airborne MCM (AMCM) helicopter equipped with the Airborne Laser Mine Detection System (ALMDS) or the AMNS—would not be operationally effective or operationally suitable if called upon to conduct MCM missions in combat.

The Navy has conducted limited operational testing of the individual systems it expected to field in the Increment 1 MCM mission package and has not initiated any operational testing of an LCS equipped with an integrated MCM mission package, other than a preliminary cybersecurity assessment. The lack of progress in developing, operationally testing, and fielding a credible, LCS-based MCM capability contrasts sharply with the timeline and performance expectations the Navy conveyed in the LCS Flight 0+ CDD. As the Navy attempts to fill capability gaps left by canceled programs and correct shortfalls in the performance of the original Spiral Alpha systems still in development, it is increasingly likely that the Navy will not *complete* Initial Operational Test and Evaluation (IOT&E) of either LCS variant equipped with the final (fully capable, Spiral Alpha) MCM mission package until at

[4] In Annex A section 5.4 of the LCS Flight 0+ CDD, the Navy further defined baseline mission packages as "those that will contain the full set of Spiral Alpha systems and achieve all Spiral Alpha performance attributes contained in this CDD." More recently, the Navy described the Increment 4 MCM mission package as the configuration expected to achieve LCS Flight 0+ CDD requirements.

least 2023, more than a decade after the optimistic schedule set forth in the CDD.[5] Moreover, it is not clear that any future version of the mission package will meet the MCM requirements the Navy established in the LCS Flight 0+ CDD. Not surprisingly, I understand the Navy is now considering changes that would reduce some requirements for the so-called Spiral Alpha (or final) MCM mission package. Although such reductions may ultimately prove necessary to realign expectations with technical reality, the operational implications of lower clearance rates include longer clearance timelines and more LCSs equipped with MCM mission packages, as scenario geometry permits.

In October 2015, the Navy delayed operational testing of the *Independence*-variant LCS equipped with the first increment of the MCM mission package pending the outcome of an independent program review, including an evaluation of potential alternatives to the RMS. The Navy chartered the review in response to an August 21, 2015, letter from Senators John McCain and Jack Reed, Chairman and Ranking Member of the Senate Committee on Armed Forces expressing concerns about the readiness to enter operational testing given the significant reliability problems observed during a technical evaluation in 2015, a topic I have repeatedly reported on in previous years. In early 2016, following the completion of the independent review, among other actions, the Navy canceled the RMS program, halted further RMMV procurement, abandoned plans to conduct operational testing of individual MCM mission package increments, and delayed the start of LCS MCM mission package IOT&E until at least fiscal year 2020. After canceling the RMS program, the Navy also announced its intention to evaluate alternatives to the RMS such as the unmanned surface craft towing improved minehunting sensors, and an improved version of the Knifefish unmanned undersea vehicle (UUV). However, the Navy has not yet fully funded these potential alternatives.

Ironically, the Navy's mine warfare resource sponsor (OPNAV N852) identified a multi-function LCS unmanned surface vessel (USV) as a "game changer" and potential RMMV replacement in 2012.[6] In the years that followed, however, Navy officials touted RMMV reliability improvements that never materialized and funded additional RMMV development, but did not prioritize development of a multi-function USV capable of integrating with the RMS's AN/AQS—20 sonar.[7] These choices could leave the Navy without a viable means of towing improved AN/AQS–20C sonars when the contractor delivers initial production units next year and could delay realistic testing and fielding of the system. By accepting objective analysis of RMMV performance and committing to the USV sooner, the Navy could have avoided this unfortunate position and saved millions in RMMV development costs.

The Navy is developing the AN/AQS–20C sonar with upgrades designed to correct RMS and AN/AQS–20A minehunting performance shortfalls observed in combined developmental and integrated testing. Unless corrected, AN/AQS–20A shortfalls will delay completion of LCS-based mine reconnaissance and mine clearance operations. Although the Navy has demonstrated the AN/AQS–20A can find some mines when employed in ideal conditions, the sonar does not meet its detection and classification requirements over the prescribed depth regimes and simultaneously provide adequate coverage against all threats spanning a representative range of operationally realistic conditions. In addition, testing has repeatedly shown that AN/AQS–20A sensor does not meet Navy requirements for contact depth localization accuracy or false classification density (number of contacts erroneously classified as mine-like objects per unit area searched). Contact depth localization problems complicate efforts to complete identification and neutralization of mines. False classifications, unless eliminated from the contact list, require identification and neutralization effort, result in the expenditure of limited neutralizer assets, and negatively affect the LCS sustained area coverage rate.

Because of funding constraints, the Navy is struggling to implement many of the independent review team's recommendations. Although the Navy now plans to em-

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[5] Since 2010, the Navy has canceled the RMMV, OASIS, and RAMICS programs and discontinued use of the MH–60S in towing missions (thereby eliminating its employment of the AN/AQS–20A).

[6] OPNAV N852 MIWIP 2012 briefing

[7] See Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development, and Acquisition) and Vice Admiral Richard Hunt, Director, Navy Staff before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee, July 25, 2013 and Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development, and Acquisition), Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and resources, and Lieutenant General Kenneth J. Glueck, Jr., Deputy Commandant, Combat Development and Integration and Commanding General, Marine Corps Combat Development Command before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee, March 26, 2014.

ploy the Common Unmanned Surface Vehicle (CUSV) and AN/AQS–20C as the primary replacement for the RMS, even by its own optimistic schedule the Navy will not complete IOT&E of the system until at least fiscal year 2021. In addition, the program does not appear to have sufficient funding to compare the capabilities of the AN/AQS–24 (currently operated in 5th Fleet) to the AQS–20, nor to examine different configurations of MCM mission packages with the two sonars. .

Many of the Navy's recent decisions regarding the future composition of the MCM mission package have focused on improving surface and subsurface MCM capabilities, but the suite of LCS-based airborne MCM systems, which the Navy plans to Initial Operational Capability (IOC) in fiscal year 2017, is not without problems requiring attention. For example, developmental and operational testing of the MH–60S with either the ALMDS or the AMNS has shown that the reliabilities of MH–60S and its AMCM mission kit do not support sustained operations at a high tempo. Although the ALMDS pods themselves have not been the primary source of mission downtime, at least during stateside testing, the associated equipment for conducting missions with ALMDS, including the helicopter and AMCM mission kit, together experience a high failure rate (approximately once every 12 flight hours), making sustained LCS-based operations difficult. Similarly, the combined results of MH–60S, AMCM mission kit, and AMNS reliability suggest that the integrated AMCM system experiences one operational mission failure every 7 neutralizer launches and 5.9 flight hours, on average, during AMNS operations. By any measure, system reliability precludes timely and sustained operations.

The ALMDS does not meet Navy detection/classification requirements, except in particularly benign conditions such as those observed during the technical evaluation in 2015. Earlier testing revealed that the system does not meet the Navy's detection requirement in all depth bins or Navy's requirement for the average probability of detection and classification across a specified depth band. When the system and operator detect and classify a smaller percentage of mines than predicted by fleet planning tools, the MCM commander will likely underestimate the residual risk to transiting ships following clearance operations. In favorable conditions, tactics, techniques, and procedures, specifically a multiple-pass technique, has been successful in reducing false classifications (erroneous indications of mine-like objects) to the Navy's acceptable limits. However, in other conditions, the system generates a large number of false classifications that can delay near-surface minehunting operations until conditions improve or slow mine clearance efforts because of the need for additional search passes to reduce the number of false classifications. In 2016, the Navy reportedly reallocated funding intended to support near-term development of ALMDS pre-planned product improvements, to correct some of the detection and classification limitations and improve false classification rates. The Navy also reported that the improved system would not be available to the LCS MCM mission package until at least fiscal year 2021.

The current increment of the AMNS cannot neutralize mines that are moored above the system's prescribed safe operating ceiling, which will preclude neutralizing most of the mines expected in some likely threat scenarios. In addition to this fundamental limitation which precludes the system's use against many threat mines, AMNS performance is frequently degraded by the loss of fiber-optic communications between the aircraft and the neutralizer. The system often experiences loss of fiber-optic communications in a wide range of operationally relevant operating conditions, including those that are relatively benign, and has not demonstrated the ability to neutralize mines in even moderate water currents. Although the Program Office has stated that it intends to develop an improved AMNS to extend its depth range and potentially improve performance in coarse bottom conditions and higher currents, none of these efforts are funded. The Navy is now considering the Barracuda Mine Neutralization System as a potential alternative to the AMNS, but does not expect to commence Barracuda developmental testing until at least fiscal year 2022. In the meantime, legacy forces will be needed in all MCM missions requiring clearance of near-surface mines.

The Navy is continuing to develop the Coastal Battlefield Reconnaissance and Analysis (COBRA), Knifefish UUV, and Unmanned Influence Sweep System (UISS), but has not yet conducted any operational testing of these systems. However, early developmental testing or contractor testing of COBRA Block I and Knifefish have revealed problems that, if not corrected, could adversely affect the operational effectiveness or suitability of these systems, in operational testing planned in fiscal year 2017 or fiscal year 2018, and subsequently the future MCM mission package. In addition, LCS-based communications and launch and recovery problems observed in earlier testing of the RMS are likely to affect the upcoming phases of Knifefish and UISS operational testing. Thus, it is critically important that developmental and operational testing of these systems include end-to-end operations encompassing

multiple sorties and realistic conditions and communications ranges to identify additional problems that must be corrected prior to fielding.

During developmental testing of COBRA Block I in early fiscal year 2016, test data revealed that the system's probability of detection is low against small mines and mines emplaced in some environmental conditions. Without improvements, the capability of the current system will likely be limited in some operationally realistic threat scenarios and will not provide the capability needed to satisfy LCS MCM requirements for minehunting in the surf zone and beach zone. The Navy expects the COBRA Block II system to include surf zone capability, improved beach zone detection capability against small mines, and nighttime capability. The Navy expects these improvements to provide the capability needed to meet LCS MCM requirements in the surf zone and beach zone and expects the Block II system to reach IOC in fiscal year 2022.

Knifefish contractor testing in September 2016 identified a significant problem with Knifefish watertight integrity that will require a redesign of components that will likely delay the start of operational testing. During testing in October 2016, an engineering development model Knifefish UUV broke in half as contractor personnel attempted to launch it into the water from a shore base. The Navy and contractor have suspended further testing pending the outcome of a root cause investigation of the latest failure. Although billed as another potential game changer following cancelation of the RMS program, pre-planned product improvements to Knifefish are currently unfunded. In fact, the entire Knifefish program is in jeopardy pending funding decisions. The program is currently examining the possibility of delaying Milestone C indefinitely until additional funding can be provided, which also places the delivery of a full MCM mission package in jeopardy on the timelines described above.

The UISS contractor delivered the first engineering development unit only recently and has not yet conducted testing of a production representative system. The Navy will need to consider integration challenges that include off-board communications, maintainability, launch and handling equipment and procedures, and the ability of the crew to recover the system safely and reliably. Although the Navy plans to characterize UISS performance in dedicated minesweeping scenarios during the initial phases of LCS-based testing, operationally realistic testing of the system in the combined MCM mission package is essential. The UISS program, similar to Knifefish, is also facing the potential of significant delays to the delivery of capability, because of funding shortfalls.

Anti-Submarine Warfare (ASW)

The Navy has not yet conducted any operational testing of the planned ASW mission package since it is still in the early stages of development. The Navy planned an IOC for the mission package in fiscal year 2016 following operational testing in fiscal year 2015. Now, however, the earliest the LCS program might achieve IOC for the ASW mission package is fiscal year 2019 for the *Freedom* variant and fiscal year 2020 for the *Independence* variant. The primary causes for these delays are higher testing priorities of the other mission packages and the lack of availability of ships, which in recent years have been affected by the push for deployments. Additionally much work has gone into a weight reduction program for the sonar and handling system, and a re-compete of the variable depth sonar. The Navy recently downselected from three vendors, selecting the variable depth sonar and handling system, and will begin ship integration efforts in the coming year. IOT&E is now planned for 2019.

The Navy did conduct an at-sea test of an advanced development model of the variable depth sonar in September 2014 aboard LCS 1, albeit that test was conducted with a different sonar than was selected in the Navy's recent decision. Those tests showed promising sensor performance in one acoustic environment, and demonstrated the potential of a variable depth sonar, which several other foreign navies already employ from their frigates. The operators were highly-cued in that test, since they were provided prior knowledge of the target submarine's position, and the submarine did not execute evasion tactics. Given the significant departures from operational realism in that test and given the Navy has now chosen to go with a different design and vendor, I cannot provide any assessment of the expected effectiveness of the ASW mission package in a real-world combat scenario at this time.

LCS's sonar system is specifically optimized for deep water and will not be suitable for some very shallow-water environments such as in the littorals. Its limitations in shallow water are yet to be determined, however, and operational testing against diesel-electric submarines will be essential for understanding the ship's capabilities. Nevertheless, in deep water environments, the ASW mission package has the potential to provide LCSs with comparable or enhanced detection capability rel-

ative to other surface ships that employ hull-mounted sonars. LCS will face challenges that other ships do not, particularly the need to tow two systems behind the ship reliably.

The Navy is developing a torpedo countermeasure as part of the ASW mission package, which will provide LCSs equipped with that system to counter some, but not all, threat torpedoes. The lightweight tow countermeasure is still in development, but the Navy has completed some initial testing of prototypes. Most recently the Navy has determined that LCS seaframes will need to be modified for the employment of this system; these changes will be implemented on LCS 7, LCS 10, and all future seaframes planned to receive an ASW mission package. The Navy has not yet addressed the plan for backfitting these changes in earlier seaframes. Nor is there any plan to outfit other LCSs equipped with MCM or SUW mission packages with torpedo defense capabilities, making those ships reliant on protection from a second LCS, equipped with the ASW mission package, or an Aegis combatant that is operating nearby.

With respect to the ability to engage a submarine once detected, LCS will be less capable than Navy frigates or other ASW-capable surface ships. LCS has no organic capability to engage submarines and must rely on a single embarked helicopter to deliver torpedoes, whereas FFGs have the capacity to launch two helicopters (meaning at least one is more likely to be available), or use over-the-side torpedo launchers to engage nearby targets immediately. LCS, along with other Navy units, will suffer from the limitations of the Mk 54 torpedo's effectiveness and lethality recently discovered in testing; these problems affect LCS, DDGs, P–8, P–3, and helicopter effectiveness in ASW missions, and warrant a concerted effort to correct as soon as possible.

LCS–FRIGATE DESIGN

In December 2015, the Secretary of Defense curtailed the buy of LCSs from 52 to 40, citing that a rebalancing of capability is needed to "reverse the trend of prioritizing quantity over lethality" and "reduce the number of LCS available for presence operations," a need that will be met by other high-end ships. The Secretary's decision is supported by the results of operational testing and the lack of lethality demonstrated by LCS to date. Of those 40, the Navy now plans to build the last 12 as a modified version of LCS that is more frigate-like. I have reported multiple times on the anticipated capabilities and limitations of the envisioned LCS-frigate; my most comprehensive assessment was provided in recent Congressionally-directed reporting requirements and in the assessment the Secretary requested of my office when the Small Surface Combatant Task Force was stood up in late 2014. I summarize some of my observations here from that and other recent reports.

The Navy's Small Surface Combatant Task Force identified that only major modifications to the existing LCS design could provide the Navy the survivability and lethality characteristics of past frigates desired for the future Small Surface Combatant. Because of the Navy's decision to keep the LCS seaframe, any future small combatant will, by and large, inherit the limited survivability characteristics inherent to the LCS design as well as the limitations in space, weight, power, and cooling.

The Joint Staff recently approved a CDD for the LCS–Frigate. The CDD requires that the modified LCS be multi-mission capable, more lethal, and more survivable. Its primary missions will be ASW and SUW, but is also required to be capable of launching an over-the-horizon missile, albeit without a clearly specified means of target designation. Because of the space, weight, power, and cooling limitations inherent in the current LCS design, the LCS-frigate most likely will *not* meet all of the requirements specified in the CDD simultaneously; this was a finding from the Navy's Small Surface Combatant Task Force. It will most likely require swapping mission modules or components of the modules to provide either the full mission capability for SUW or ASW, but not all of the capabilities of both mission sets simultaneously. In my estimation, the LCS-frigate will, therefore, not be a true multi-mission frigate. For example, the LCS-frigate configured with full SUW capability, would likely only retain an acoustic towed array and towed torpedo countermeasure to provide the ship some limited submarine detection capability and a torpedo defense capability, but not an active sonar. While such a configuration is clearly more capable than an LCS equipped with the SUW-mission package alone, it does not enable the LCS-frigate to conduct full ASW missions with an active sonar and act as an effective escort to high-value naval units.

Moreover, the ship's ability to simultaneously be equipped to conduct these missions plus others such as land-attack, anti-ship warfare, or provide local air defense to other Navy units (a traditional frigate role) are likely infeasible given the limita-

tions imposed by this design. The Navy's Small Surface Combatant Task Force identified that if a true multi-mission SUW, ASW, and local area defense air warfare capability (for the frigate to be able to act as an escort) are desired, then a major design change to the LCS seaframes or a new design would be required.

I have previously expressed my concern that the CDD relegates all mission performance measures, other than the two measures for force protection against surface and air threats, to Key System Attributes rather than Key Performance Parameters, which permits the combat capabilities desired in these follow-on ships to be traded away as needed to remain within the cost constraints. As a result, the new LCS-frigate could, in the extreme, be delivered with less mission capability than desired and with limited improvements to the survivability of the ship in a combat environment. In fact, the LCS-frigate could meet all its KPPs without having any mission capability.

The vulnerability reduction features proposed for the LCS-frigate, while desired and beneficial, provide no significant improvement in the ship's survivability. Notwithstanding potential reductions to its susceptibility due to improved electronic warfare system and torpedo defense, minor modifications to LCS (e.g., magazine armoring) will not yield a ship that is significantly more survivable than LCS when engaged with threat missiles, torpedoes, and mines expected in major combat operations. The vulnerability reduction features included in the FFGs the Navy has deployed in the past made them significantly more survivable than an LCS. The LCS-frigate requirements do not address the most likely causes of ship and mission loss against certain threats. Specifically, the current LCS seaframes do not have sufficient separation and redundancy in their vital systems to recover damaged capability. Because the LCS-frigate design is not substantially different from the LCS Flight 0+ baseline and will not add much more redundancy or greater separation of critical equipment or additional compartmentation, it will be less survivable than the Navy's previous frigate class.

The Navy does plan several susceptibility reduction features to offset the above-described limitations of the seaframes. Testing has demonstrated that while the proposed susceptibility reduction features are clearly desirable, they do not reduce susceptibility to being hit to a value at all close to zero. Therefore, the incorporation of these features does not allow the assumption the ships will not be hit in high-intensity combat. The susceptibility reduction features to be incorporated in the LCS-frigate would not eliminate the possibility of being hit, and would, therefore, not provide significant improvement in the ship's overall survivability relative to the current LCS.

Finally, while the Navy is examining methods to reduce weight, it is anticipated the LCS-frigate, because of the simultaneous employment of ASW and SUW equipment, will be significantly heavier than the existing LCS resulting in a lower maximum sprint speed and less fuel endurance. The loss of sprint speed will therefore affect its success in small boat swarm defense, and its ability to keep up with a carrier strike group.

At a recent Surface Navy Association national symposium, the Secretary of the Navy redesignated LCS as a frigate, stating that LCS can "deploy with a carrier strike group," has "robust anti-mine and anti-submarine warfare capabilities" and "is capable of putting the enemy fleet on the bottom of the ocean."[8] None of these claims appear to be supported by the current capabilities demonstrated in testing, and instead describe a ship that is not yet built and under current Navy plans may never be built. Current LCSs do not have the endurance to deploy with a carrier strike group, its ASW and MCM mission packages do not yet exist, LCS has no anti-ship weapon to sink enemy combatants, and only a limited capability to sink a few small fast attack craft as I previous described. Some subset of these capabilities may yet come to fruition in the coming years; however, currently, LCS's limited lethality make these ships a shadow of the abilities of modern navy frigates.

FUTURE TEST AND EVALUATION PLANS

In response to conditions that the fiscal year 2016 National Defense Authorization Act placed on the availability of LCS program funding, the Navy successfully completed a partial update of the LCS Test and Evaluation Master Plan (TEMP) to support future OT&E of the seaframes and mission packages. Congress required the update to support planning of the needed testing of the Increment 3 SUW mission package, the ASW mission package, to reflect the significant changes to the program's air defense plans, as well as MCM mission package development and com-

[8] See also the Senate Armed Services Committee letter to Secretary Mabus and Chief of Naval Operations Admiral Richardson dated February 5, 2016.

position. I approved the change pages to the TEMP in March 2016. Additional updates are now required to complete a revision to the TEMP, including developmental and integrated testing plans, changes to reflect the Navy's evolving plans for the MCM mission package, air defense testing of the seaframes, and plans for providing seaframes with an over-the-horizon missile capability.

In closing, I would like to emphasize that operational, live-fire, and operationally-realistic developmental testing have been essential in identifying the significant problems that need to be overcome for this program to be successful. Although I had predicted the poor performance in my earlier reporting on the MCM mission package, it was only in testing of the full mission package, at sea, and aboard the ship with a trained crew that the Department was able to discover the significant problems and shortfalls that crews would face in MCM missions. In fact, the Navy's independent review team emphasized that a reliance on shore-based metrics and shore-based testing "provided a false sense of [system] maturity". Similarly, only in operationally-realistic testing of the SUW mission package were the inaccuracies of the gun, the limitations of the ship's maneuvering and tactics, and the deficient training revealed, and the overall effectiveness of the ship in those missions characterized. Testing should not be limited to only self-defense scenarios (as has been suggested by a narrow reading of the requirements), but should examine the LCS's ability to escort other ships, as a frigate would. I continue to recommend to the Navy that adequate developmental and operational testing be funded and conducted to ensure that the future capabilities envisioned for LCS are adequately characterized, and problems discovered and fixed prior to deployment and future procurements.

Chairman MCCAIN. Thank you. Secretary Stackley?

STATEMENT OF HONORABLE SEAN J. STACKLEY, ASSISTANT SECRETARY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION, UNITED STATES DEPARTMENT OF NAVY, WASHINGTON, DC

Mr. STACKLEY. Yes, sir. Mr. Chairman, Ranking Member Reed, members of the committee, thank you for the opportunity to appear before you today to address the Littoral Combat Ship Program. With your permission, I would like to make a brief opening statement and have my full testimony entered into the record.

Chairman MCCAIN. Without objection.

Mr. STACKLEY. The Littoral Combat Ship, or LCS, is designed to fill critical warfighting gaps in anti-surface, anti-submarine, and mine countermeasure warfare mission areas. Within the Navy's overall balanced force structure, LCS is the replacement for three legacy small service command ship classes. It is about one-third the size of a DDG–51-class destroyer and designed for missions that the destroyer is not equipped to do or that could otherwise be well performed by a small surface combatant, thus freeing the destroyer for missions tailored for its higher-end capabilities.

LCS' reduced size results in greatly reduced procurement cost, manpower and operating and support costs. In fact, the procurement cost for LCS is about one-third that of a DDG–51 and, likewise, the manpower requirements for the ship.

The LCS hull is designed and built to provide the ship with its high-speed mobility, damage control survivability, aviation, and combat systems, including a 57-millimeter gun, surface to air missiles for self-defense, and an over-the-horizon missile that the Navy is currently adding for offensive firepower against long-range surface targets. In addition to this core capability, this ship carries a modular mission package tailored for the missions planned for each ship's deployment.

The Surface Warfare Mission Package adds 30-millimeter guns, an armed helicopter, unmanned aerial vehicle for extended surveillance, and surface-to-surface missiles. The Anti-Submarine Warfare, or ASW, Mission Package adds a variable depth sonar that operates in tandem with a multifunction towed array, an ASW helicopter with dipping sonar, sonobuoys and anti-drop torpedoes, anti-tow decoy. The Mine Countermeasure Mission Package adds air, unmanned surface, and unmanned underwater vehicles with associated sensors and systems to detect and neutralize mines.

There are four cornerstones of the program that I would like to briefly summarize. First, the shipbuilding program. As the committee is well aware, the LCS program was initiated with unrealistic cost and schedule estimates and with highly incomplete design, resulting in extraordinary budget overruns and scheduled growth. The program was subsequently restructured. Production was placed on hold pending the insertion of production readiness reviews to verify design quality and completeness. Authorizations to approve design requirement changes was raised to the four-star level, specifically the CNO and myself.

Navy oversight of the shipyards was greatly increased. The acquisition strategy was restructured to compete long-term contracts under fixed price terms and conditions. In response to the strategy, industry made significant investments in terms of skilled, labor, and facilities to improve productivity and quality.

As a result, costs, schedule, and quality have greatly improved such that current ships under construction are delivering at less than half the constant year-dollar cost of the lead ships, performance has stayed reliably within the budget throughout this time, and the quality of each ship has successively improved as measured by the Navy's Board of Inspection survey. Bottom line, LCS construction is stable, and performance continues to improve on a healthy learning curve.

Of note, the CNO and I have implemented a similar rule set across all of shipbuilding, and though we were not able to get out in front of all of our lead ship programs, cost discipline from requirements, to design, to production and testing has been firmly drilled into place throughout the Navy.

Second, mission packages. The program's acquisition strategy is that we will incrementally introduce weapon systems as part of a mission package when they are mature and ready for deployment. Consistent with this approach, the LCS has been successful at integrating mature weapon systems, such as the Image 60 helicopter, the Fire Scout unmanned aerial vehicle, 11-meter rigid hull inflatable boats [RHIBs], the Mark 50 30-millimeter gun system, and most recently we are seeing the Harpoon Block II over-the-horizon missile integrated and deployed. We are currently integrating the Hellfire Longbow Missile in support of testing in 2017. As a result, we have successfully fielded the first increments of the Surface Warfare Mission Package and are on track to complete the next increment in 2018.

The next mission package we will field is the Anti-Submarine Warfare, or ASW, Mission Package. The performance of this system, as demonstrated by its prototype in 2014, greatly exceeds that of any other ASW sensor system afloat. We are currently in the

process of awarding the contract to build the developmental model which will be put to sea for shipboard testing on LCS in 2018.

These are relative success stories that demonstrate the benefit provided by the LCS modular design and mission package approach. As the Navy develops or requires new weapons systems appropriate to the LCS mission, we will leverage the ship's modular design and flow these new weapons to this ship, and be able to do so in rapid fashion once they are mature.

We have run headlong, however, into challenges with developing these capabilities that are central to filling what is arguably one of the Navy's most critical warfighting gaps, and that is mine countermeasures, or MCM, warfare. The Navy requirements for LCS/MCM are to locate, identify, and clear mines at a rate that significantly exceeds our current capability, and to do so without putting the ship or the sailor into the minefield.

The MCM Warfare Mission Package airborne capability and MH–60 helicopter, carrying an Airborne Laser Mine Detection System that locates mines in the upper layer of the water column, and an Airborne Mine Neutralization System that destroys mines below the surface, has completed testing and we are ready to deploy it. Additionally, an unmanned aerial vehicle carrying a sensor capable of detecting mine-like objects in the surf zone close to shore is on track to complete testing in 2017.

The true workhorse of the MCM Mission Package, however, is the high-endurance unmanned vehicle with its towed sonar system, which we rely upon to achieve the high area clearance rate required by our operational plans. The Navy is satisfied with the performance of the towed sonar system and its ability to detect mines as demonstrated in developmental testing. We expect to demonstrate further improvements to the sonar in conjunction with ongoing upgrades.

The unmanned vehicle, however, which is actually a semi-submersible, referred to as a remote multi-mission vehicle, has failed to meet our reliability requirements. Despite extensive redesign efforts, following a series of test failures, we stopped testing and assigned an independent review team to assess and recommend. The results of this review were threefold: low confidence that continuing our current path would result in a reliable vehicle; higher confidence that advances in towed sonar handling and acoustic processing have greatly reduced the risk associated with towing the mine detection sonar with an alternative unmanned surface vehicle; and recognition that the long-term solution will be to eliminate the towed vehicle altogether, and operate with an unmanned underwater vehicle with an embedded sonar when technology can support it.

As a result of these findings, we have restructured the MCM Mission Package to utilize the unmanned surface vehicle that is currently being built to tow the Mine Sweeping System to likewise tow the mine detection sonar. Testing with this vehicle is scheduled to commence in 2019.

The third cornerstone is performance of in-service ships. Vice Admiral Rowden will address performance of the ships and operations and on deployment as well as the details of the LCS review he conducted. I would like to address the ship's material readiness.

In total, LCS material readiness, as reflected in operational availability metrics and casualty report metrics, is consistent with other combatant ship classes. However, over the past year five ships have been operationally impacted by engineering casualties of concern. The Navy has conducted formal engineering reviews and command investigations to assess the root causes and corrective actions for each of these casualties.

One was design related. A new manufacturer was required for the *Freedom*-variant propulsion gear, and operational deficiency traced to the gear itself resulted in the gear's clutch failure. Design modifications have been developed, and are being tested, and will be incorporated in future ships prior to delivery and during pro-shakedown availability for the two ships delivered that are affected. The manufacturer is being held accountable.

Chairman MCCAIN. Mr. Secretary, you will have to summarize here.

Mr. STACKLEY. Yes, sir.

Chairman MCCAIN. We have a limited amount of time and four witnesses. Please summarize if you can.

Mr. STACKLEY. Yes, sir. The manufacturer is being held accountable for these corrective actions.

Two of the five engineering casualties were due to crews departing from established operating procedures. The type commander is implementing corrective actions associated with those to ensure good order and discipline going forward, as well as reviewing training and operational procedures.

The remaining two casualties are traced to deficiencies in ship construction and repair. We are reviewing all those procedures across not just the shipbuilders, but the manufacturers, and the repair yards, and the Navy standards to ensure we have the right procedures in place and that they are properly being carried out by the shipbuilders and repair yards. In those specific cases where warranties apply, the shipbuilder is paying for those repairs.

More importantly, we do need to raise the level of engineering design, and discipline, and rigor on the new ship class to that of zero tolerance for departure from standards. In this vein the Naval Sea Systems Command has initiated a comprehensive engineering review, and will provide their findings to the committee upon completion of the review.

The fourth cornerstone is transition to the frigate. As you are aware, we have revised the plan going forward for small surface combatants. Commencing in 2019, our intention is to transition from LCS to a multi-mission ship that incorporates the ASW plus the Surface War Mission Package capabilities of the LCS into a multi-mission frigate going forward. We are working that design today.

The message I want delivered to this committee is that as we complete this design, before we proceed into production of a future frigate, we will conduct the production readiness reviews. We will ensure that the design is complete and ready to go. We will ensure that the requirements are stable, and we will open the books and invite this committee to participate throughout that review process.

Mr. Chairman, thank you for the opportunity to discuss this important program. I look forward to answering your questions.

[The prepared statement of Mr. Stackley and VADM Thomas S. Rowden follows:]

PREPARED STATEMENT BY THE HONORABLE SEAN J. STACKLEY AND VADM THOMAS S. ROWDEN

Chairman McCain, Ranking Member Reed, and distinguished members of the Committee, thank you for the opportunity to appear before you and discuss the current status of the Littoral Combat Ship (LCS) program, specifically to discuss the outcomes and implementation of the LCS Review, status of the delivered ships and the mission packages, and the current status of the transition from LCS to Frigate (FF). We appreciate the opportunity to provide the Navy's assessment of the various issues raised of late as well as provide an update on the significant progress we have made in the program over the last few years.

INTRODUCTION

The LCS program is of critical importance to our Navy. It consists of a modular, reconfigurable Seaframe, designed to meet validated Fleet requirements for Surface Warfare (SUW), Anti-Submarine Warfare (ASW), and Mine Countermeasures (MCM) missions in the littoral region through the use of modular mission packages (MPs). LCS was designed as a focused-mission surface combatant to replace our legacy small surface combatants; *Oliver Hazard Perry*-class Frigates, *Avenger*-class MCMs, and Patrol Craft. The ship, independent of an embarked mission, package provides air warfare self-defense capability with anti-air missiles, a high rate of fire 57mm gun, 3D air search radar, electronic warfare systems, and decoys for electronic warfare. The Navy is currently adding a capability improvement that outfits each deployed LCS with an Over the Horizon (OTH) Missile system. LCS ships will embark an aviation detachment and helicopter along with a vertical take-off unmanned air vehicle (referred to as Fire Scout). With its shallow draft, great speed, and interchangeable modules, LCS will provide increased warfighting flexibility to our Fleet and close critical warfighting gaps in mine warfare, anti-submarine warfare and surface warfare. The modular, open systems architecture inherent in LCS allows for rapid, affordable integration of new warfighting capabilities as technology evolves. This approach is consistent with the objectives of Defense Strategic Guidance directive to develop innovative, low-cost, and small-footprint approaches to achieve our security objectives. LCS complements our surface fleet and brings unique strengths and capabilities to the Fleet's mission. She will be our predominant MCM capability, and will deliver game changing ASW capability at an affordable cost while freeing up the higher end multi-mission large surface combatants to focus on their primary missions such as area air defense, land strike, and ballistic missile defense. With 67 percent of Surface Combatant Total Life Cycle Cost being driven by operations and sustainment (O&S) costs, the LCS and Frigate (deployed more than half of their lifecycle and costing less than one third the O&S of a DDG per deployed year) provide fleet commanders with the quantity of ships needed that are capable of accomplishing critical missions within a challenging budget environment.

The LCS is capable of operating in a wide range of environments, from the open ocean to coastal, shallow water regions known as the littorals. LCS uses an open architecture design, modular weapons and sensor systems, and a variety of manned and unmanned vehicles to help gain and sustain maritime supremacy in the littorals, assuring access to critical areas of operation. LCS will be an integral component in countering adversary anti-access/area denial operations: clearing mines; neutralizing enemy submarines; and defeating hostile swarming surface craft. The Navy plans for LCS to be used in rotational deployments in support of our nation's rebalance efforts to the Western Pacific. As LCS forward presence increases, these ships will play a significant role in defense cooperation and naval engagements that contribute to maintaining freedom of the seas while deterring conflict and coercion.

The 2013 deployment of USS *Freedom* (LCS 1) to the Asia-Pacific region demonstrated the ability of LCS to conduct several of the core missions of the Cooperative Strategy for 21st Century Seapower. *Freedom* and her crews conducted operations and exercises, ranging from demonstrating forward presence while executing operational tasking in the South China Sea to providing humanitarian assistance/disaster relief support in the Philippines following Super Typhoon Haiyan. USS *Fort Worth* (LCS 3) deployed to the Asia Pacific Region in November 2014 and assisted in the AirAsia plane recovery search efforts and multiple international exercises. Most recently, USS *Coronado* (LCS 4) deployed to Singapore which marks the first

overseas deployment of the *Independence* variant in which she will participate in a full range of LCS missions to include opportunities to operate with partner nations.

Currently, there are eight LCS in the Fleet, with another eighteen on contract. By 2018, LCS will be the second largest surface ship class in the Navy. The designs are stable, new yard facilities are in place, with a right-sized, qualified work force, and both shipyards and industry teams are in full serial production in order to ensure each can deliver two ships per year. Today, the LCS program is on budget and below the Congressional cost cap. The block buy contracts for the fiscal year (FY) 2010 through fiscal year 2016 ships resulted in continued reductions in the LCS shipbuilding program's production unit costs, and both shipyards are building these ships in an affordable manner.

With a stable design and a mature production line, we have been able to make significant progress in completing both ship and mission package testing requirements. Both variants have completed initial operational test and evaluation (IOT&E) and have achieved Initial Operational Capability (IOC). This year both variants conducted Director, Operational Test and Evaluation (DOT&E) approved Live Fire Test and Evaluation Full Ship Shock Trial (FSST) events. Our detailed analysis of the shock trial's results is in progress but all test objectives were met. Both the *Freedom* and *Independence* variant ships demonstrated the ability to survive the degrading effects of the underwater shock event associated with the close-proximity detonation of a 10,000 pound charge. We have now completed all required testing for the ships themselves and are incorporating lessons learned from that testing into future LCS and FF ships.

Additionally, we continue testing and making progress for all three mission packages on both variants, incrementally bringing new capability to the Fleet.

- Surface Warfare Mission Package (SUW MP): The SUW MP will make LCS the most capable ship in the Navy in countering the Fast Inshore Attack Craft/Fast Attack Craft (FIAC/FAC) threat. The Navy is delivering this capability in three increments with full MP IOC anticipated in fiscal year 2020: o Increments 1 and 2 consist of an Aviation Module (MH–60R with Hellfire Missiles), a Maritime Security Module (two 11-meter manned rigid-hull inflatable boats (RHIBs), and two 30mm guns. Increments 1 and 2 for the SUW MP, achieved IOC in 2014. This has allowed the Fleet to deploy LCS with enhanced SUW capability, most recently with the current deployment of USS *Coronado* to the Western Pacific.
  - o Increment 3 consists of the Vertical Take-off and Landing Tactical Unmanned Aerial Vehicle (VTUAV) and the Surface to Surface Missile Module (SSMM) armed with the Longbow Hellfire Missile.
  - o USS *Fort Worth* (LCS 3), with an embarked SUW MP, conducted an extended operational deployment based out of Singapore. This SUW MP included a composite aviation detachment of one MQ–8B Fire Scout VTUAV and one MH–60R helicopter. This was the first time that such a combination had been deployed. The SUW MP, through its Maritime Security Module and aviation components, was extensively employed during the ship's search and rescue efforts for Air Asia flight 8501 in January 2015.
- Anti-Submarine Warfare Mission Package (ASW MP): The ASW MP will significantly increase the Navy's ASW capability and capacity. It consists of three modules netted together to continuously exploit real-time undersea data: a Torpedo Defense and Countermeasures Module (Light Weight Tow); an ASW Escort Module (Multi-Function Towed Array Acoustic Receiver (MFTA) and Variable Depth Sonar (VDS)); and an Aviation Module (MH–60R Helicopter and VTUAV). The ASW MP had a successful at-sea demo in 2014. ASW Escort Mission Module testing will commence in fiscal year 2018 in support of IOC in fiscal year 2019.
- Mine Countermeasure Mission Package (MCM MP): The MCM MP will replace aging legacy MCM equipment, significantly reducing the timeline for access to the contested littorals and removing the ship and crew from the minefield. The Navy is delivering this capability in four increments, with full MP IOC in fiscal year 2021: o Increment 1 consists of a Minehunting Vehicle towing a Sonar Mine Detecting Set, an Airborne Laser Mine Detection Set (ALMDS), an Airborne Mine Neutralization System (AMNS), and the MH–60S Helicopter. This increment provides the capability to detect waterborne mine threats throughout the water column and on the sea floor. IOC was declared in November 2016 for ALMDS and AMNS.
  - o Increment 2 consists of Coastal Battlefield Reconnaissance and Analysis (COBRA) and VTUAV which provides the capability to detect mine threats and obstacles on the beach and in the surf zone.

- o Increment 3 consists of an Unmanned Influence Sweep System and an Unmanned Surface Vehicle which provides the capability to sweep acoustic and magnetic mine threats throughout the water column and on the sea floor.
- o Increment 4 consists of the Surface MCM Unmanned Underwater Vehicle (UUV) (Knifefish) which provides the capability to detect, classify and identify bottom and volume mines, including buried mines and stealthy mines.

As you are aware, the Navy is in the midst of a transition from focused mission LCS platforms with modular Mission Packages to a multi-mission FF capable of conducting simultaneous anti-surface warfare (ASuW) and anti-submarine warfare (ASW) missions as well as providing effective air, surface and underwater self-defense capabilities. It will be equipped with OTH surface-to-surface missiles in addition to LCS baseline SUW and ASW MP capabilities, and have additional upgrades to combat systems, electronic warfare systems, and ship survivability features. The FF will complement our inherent blue water capability and fill warfighting gaps in the littorals and strategic choke points around the world.

STATUS OF DELIVERED SHIPS

Each of the eight LCS that are in service was delivered at a successively lower cost, and with improved reliability as compared to their predecessors. We continue to capture lessons learned and refine the Concept of Operations (CONOPs) for operating these ships forward, as demonstrated, for example, by the development and execution of the Expeditionary Maintenance Capability (EMC). During USS *Fort Worth's* (LCS 3) deployment to the South China Sea from November 2014 through January 2016, she followed the LCS maintenance and sustainment model, pulling into port every 4–6 weeks for a week-long preventative maintenance availability and every 4–6 months for a two-week corrective maintenance availability and core crew turnover. Although this maintenance was typically conducted in the LCS Forward Operating Station (FOS) in Singapore, the EMC concept also allowed this maintenance to be conducted in Sasebo, Japan, to better support USS *Fort Worth's* tasking in the Northwest Pacific. This EMC approach has significantly expanded the operational employment of the LCS in theater, allowing the ships to operate for extended periods far removed from the FOS. The same capability was delivered to Singapore in advance of USS *Coronado's* arrival to support the execution of planned maintenance in remote locations for the *Independence* variant as well. This model was proven effective at supporting sustained forward deployed operations.

During her deployment, USS *Fort Worth* conducted U.S. and multinational operations from India to Japan and also successfully demonstrated the ability to perform in high-tempo environments just days after entering theater. USS *Fort Worth's* first 12 months forward offer significant insight into the potential of these ships:

- Operated side-by-side and hull-to-hull with valued Southeast and South Asia partners during seven theater security cooperation (CARAT) exercises, MALABAR with India and with Northeast Asian allies during OPLAN training operations (FOAL EAGLE);
- Contributed to theater CONOPs by executing freedom of navigation and presence operations in the South China Sea;
- Supported multi-national Humanitarian Assistance Disaster Response missions, such as the search and recovery mission for AirAsia flight 8501 on 96-hours' notice less than one week after arriving in Singapore; and
- Executed an expeditionary maintenance period in Sasebo, Japan and leveraged fueling resources in Subic Bay, Philippines, thus extending LCS's operational range and bringing the logistical hub-and-spoke model to life.

USS *Freedom* completed a 10-month (pre-IOC) deployment in 2013, conducting similar operations in the same locations as USS *Fort Worth.* Comparing the reliability and maintenance records of these two deployments, only a year apart, demonstrates how effectively the LCS Fleet has incorporated lessons learned and best practices to improve operational availability. During an equivalent 10-month period, USS *Fort Worth* was underway 33 percent more, spent less time pierside conducting maintenance, conducted maintenance away from Singapore, and experienced fewer casualties. These initial deployments of the USS *Fort Worth* and USS *Freedom* demonstrate the increasing capabilities that LCS will continue to bring to the Navy as the program matures.

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 inport 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.

LCS REVIEW

In February of this year, the Navy initiated a review of the LCS program to assess the concept of operations based on lessons learned from Fleet operations and the early operational deployments of the ships. The review focused on LCS crewing, training, and maintenance based on experience gained and lessons learned by the program and Fleet during operations and ship deployments. The review noted that USS *Fort Worth's* deployment many successes must be replicated on a larger scale and setting conditions for crews to excel forward is the Navy's first priority. With this in mind, the Review Team identified challenges with regard to manning, crew training, maintenance, and operational testing, identifying immediate and longer term recommendations to address those challenges, reduce risk, and strengthen the program. Immediate recommendations and enabling actions include the following:

- *Single crew Pre-Commissioning Unit (PCU) hulls*—As more hulls are delivered, pairing a single crew to a ship in construction for approximately 18 months allows the pre-commissioning crew to "grow with their ship" and places experienced crews where they matter most: on ships deployed forward.
- *Forward Deploy all LCS in Blue/Gold Crewing Construct*—Implementing a Blue/Gold crew rotation approach will result in two crews rotating to the same hull every 4–5 months, forging a "cycle of virtue" between the two crews who will consistently turn the same ship over to each other.
- *Fuse the Core Crew and Mission Modules Detachments*—Although the overall number of personnel remains the same, merging core crews and mission module detachments into a single fused crew dedicated to a single mission will improve enlisted rating utilization, create crew stability, and reduce complexity.
- *Stand up of a Maintenance Execution Team (MET)*—Due to a LCS' small crew size, maintenance that would traditionally be performed by the crew on other vessels is outsourced to contractors for LCS. The LCS review recommended standing up a MET comprised of support from off-hull, Active and Reserve Duty, and LCS Squadron Sailors to conduct preventive maintenance. The review found that minimally manned ships require a pool of trained personnel to fill watchbill and specialty qualification gaps. The MET would also serve to relieve the unforeseen tasking of "shadow hours" whereby crew members merely shadow contractors for force protection, security and safety purposes. The MET will conduct preventive maintenance while learning the operation and maintenance of their equipment, thereby reducing wasted manhours and increasing crew ownership. Additionally, a forward-deployed team (Destroyer Squadron 7) will complement MET functions overseas while also performing material assessments.
- *Lengthen LCS Crew Turnover in Theatre to Include an O–6 Assessment*—As recommended in the recent USS *Fort Worth* Command Investigation, this longer time period will enhance the oncoming crew's situational awareness and allow the combined crews to perform critical maintenance tasks together if needed. Broadly resembling an approach used in SSGN turnovers, O–6 assessments during turnovers will provide leadership greater awareness of crew readiness.

In addition to the immediate recommendations listed above, the review team identified the following longer-term recommendations:

- *Establish Testing Ships*—Assign the first four LCS ships (LCS 1 – 4) as dedicated CONUS-based testing, training, and surge platforms through Mission Package IOC, to be manned by a single crew and commanded by a post command LCS O–5 commander to insulate deploying ships from broader testing requirements. The ships will be maintained at deployable configurations and upgraded, as planned, to support the myriad of operational functions and integration intricacies of the associated mission packages to fully support testing. We will evaluate the effectiveness of these assets for this purpose in the near term, and if it becomes evident that a dedicated land-based facility would prove more efficient and effective, adjust accordingly.
- *Establish Training Ships*—Beyond the four test ships, divide the remaining 24 ships into six four-ship divisions of the same variant including a dedicated training ship in each division. Of the four ships, retain one training ship in

CONUS to certify the Blue/Gold crews that will man the three forward deployed ships of each division. This approach provides a surge-ready LCS Fleet with more operational availability forward and an improved blend of ownership and stability. To support this concept, we will also homeport all Independence variant ships in San Diego, CA and all *Freedom* variant ships in Mayport, FL over time.

- *Steady State: Establish Blue/Gold Crewing Construct with Training Ships*—A Blue/Gold deployment approach is projected to present a more optimal rotational posture. This concept creates six four-ship divisions of the same variant including a dedicated training ship in each division. Of the four ships, one training ship will remain in CONUS to certify the Blue/Gold crews that will man the three forward deployed ships of each division. Also referred to as 7:4:3 (seven crews, four hulls, three ships forward), this approach provides a surge-ready LCS Fleet with more operational availability forward and an improved blend of ownership and stability beyond the legacy LCS operational 3:2:1 concept.

In the course of this study, it became clear that the LCS crewing construct is the critical variable that most impacts other factors such as manning, training, maintenance, and—most importantly—operations. The LCS Review Team assessed manpower requirements in detail and implementation of these recommendations are underway. Changing to a Blue/Gold crew rotation (a tried-and-true model proven by the submarine Fleet) will increase LCS Sailors' familiarity with specific ship systems, enabling the crew to have a greater sense of ownership in their ships.

Our assessment is that the recommended solutions from the Navy's recent review of LCS will yield the results needed to increase forward presence and provide a proven capability to our fleet commanders.

FULL SHIP SHOCK TRIALS (FSST)

As part of the DOT&E approved Live Fire Test and Evaluation Plan for the LCS program, Full Ship Shock Trials were conducted on USS *Jackson* (*Independence* variant) and USS *Milwaukee* (*Freedom* variant) this summer. The unprecedented achievement of completing FSST on two different ships in a single test was the positive result of efficient test execution and effective ship performance under shock loading. Data collected during FSST is used to validate the models used to predict how a ship reacts to an underwater shock event. The results of the FSST, as well as other testing and modeling efforts, are then used to determine the overall survivability of the ship against the specified set of threats that the ship is required to meet.

The LCS Program Office accomplished all FSST test objectives within budget, for both ship variants, demonstrating that the ships and ships' systems are able to survive the degrading effects of an underwater shock event. Initial results indicate that ship performance was consistent with requirements and the data collected shows a strong correlation to the modeling and simulations done before the trials. Data analysis is ongoing with final test reports expected in the third quarter of fiscal year 2017.

In advance of the final report, the significant findings have been analyzed and recommended design changes are being assessed for incorporation into follow on hulls. In the *Independence* variant, modifications to some structural details in specific forward fuel tanks and bulkheads are being assessed and planned. The design work is complete and associated modifications will be accomplished in LCS 6 during her upcoming PSA. In the *Freedom* variant, there is need for modification to reduction gear lube oil bellows to allow for greater travel and improved bracing of lube oil piping in the vicinity of the bellows. The majority of the required changes were implemented in LCS 5 during the FSST period with the outstanding work to be completed in her PSA. For all follow ships of both variants, these relatively minor modifications will be accomplished at the most cost effective opportunity in the new construction window.

The trials also highlighted the value of planned survivability improvements, beyond LCS threshold requirements, for both the LCS and FF ships. These improvements, which include hardening of potable water systems, chill water systems, and the ship's Anti-Ship Cruise Missile system, are part of the fiscal year 2017 LCS solicitation and are integral to the FF design.

MISSION PACKAGE (MP) STATUS

Modular mission packages are a central feature of the LCS concept and provide the ship's main combat systems capability. The MP embarked is determined based on planned employment of the ship on a specific deployment or mission, optimized

as needed for MCM, SUW, or ASW. The LCS Mission Module program is integrating, testing, and fielding mission packages in accordance with Fleet needs coupled with cost, schedule, and performance requirements. Rigorous and thorough testing in realistic environments continues to validate the mission modules concept and the mature capabilities in each increment. Stable funding is key to ensuring the MPs continue successful procurement, development, and testing.

Surface Warfare (SUW) MP—The SUW MP provides a flexible capability to rapidly detect, track and prosecute small-boat threats, giving the joint force commander the capability to protect the Sea Base and move a force quickly through a choke point or other strategic waterway. The ship uses its speed and the SUW MP capabilities, including manned and unmanned aviation assets, to extend the ship's surveillance and attack potential. LCS configured with the SUW MP can also conduct maritime security operations, including those involving Maritime Interdiction Operation (MIO) and Expanded MIO for compliant and non-compliant VBSS. When augmented with the SUW MP, the LCS has enhanced detection and engagement capability against FIAC/FAC and similar littoral surface threats. The full SUW MP, when fielded and deployed, will make LCS the most capable ship in the Navy in countering the FIAC/FAC threat.

IOC was declared for the SUW MP (Increment 1 and 2) aboard a *Freedom* variant LCS on November 25, 2014, and aboard an *Independence* variant LCS on December 24, 2015. It was embarked aboard USS *Fort Worth* during her deployment to Singapore, the first time that such a combination has been deployed. The SUW MP, through its Maritime Security Module and aviation components, was extensively employed during the ship's search and rescue efforts for AirAsia flight 8501 in January 2015, highlighting the versatility of the LCS modular mission package concept.

The Surface-to-Surface Mission Module (SSMM) is the next capability to be added to the SUW MP. Beginning in 2015, the Navy completed a series of Guided Test Vehicle (GTV) test launches of the Longbow Hellfire missile to evaluate performance of the SSMM launcher and missile system in a littoral environment. The GTV–1 testing successfully conducted against multiple threat-representative targets in a relevant environment was completed in June 2015, achieving success in seven of eight missile engagements. The demonstration proved that the vertically-launched missiles could acquire the representative targets, discriminate among the targets and the surrounding environment, and engage the targets. The GTV–2A testing, the first tests of the Engineering Development Model (EDM) missile integrated with the LCS module prototype, was completed in December 2015, achieving success in three of four missile engagements.

The program conducted a restrained firing test that validated the structural design of the SSMM Missile Exhaust Containment Structure in August 2016. The program also successfully completed the GTV–2B testing, achieving success in six of eight missile engagements, demonstrating the system's ability to engage high speed, maneuvering targets and complete quick succession launches while withstanding the associated harsh environment caused from the rocket exhaust. Six successful engagements in eight missile tests were accomplished. SSMM Longbow Hellfire testing to date has resulted in 16 successful engagements out of 20 total tests, representing a success rate of 80 percent to date, with one of the unsuccessful engagements occurring during GTV–1 due to target failure. The program plans to complete the development of the first SSMM and then conduct a Tracking Exercise (TRACKEX), Structural Test Fire, and formal Developmental Test in fiscal year 2017 on the *Freedom* variant and a TRACKEX on the *Independence* variant in fiscal year 2017. The program is on track to operationally test the SSMM in fiscal year 2018 in support of IOC in the second quarter of fiscal year 2018.

Anti-Submarine Warfare (ASW) MP—The ASW MP systems will provide the joint force commander with both an in-stride and rapid ASW escort and large area search capability against modern diesel-electric and nuclear submarines. Through studies and testing, an LCS with an ASW MP embarked has consistently shown the ability to significantly increase detection range and overall ASW performance as compared to existing fleet systems in use on large surface combatants. The addition of this capability will significantly increase Fleet ASW capability and capacity.

The ASW MP completed its initial integration test onboard USS *Freedom* on September 30, 2014. All primary test objectives were completed successfully, including: verifying form, fit, and function of the ASW Escort Mission Module on the *Freedom* variant; evaluating mechanical and hydrodynamic characteristics, including maneuvering characteristics at up to 12 knots; deploying and retrieving the Variable Depth Sonar; verifying safe dual tow and measured dual hydrodynamic tow characteristics; and evaluating deep water (convergence zone) search performance.

The Navy released a Request for Proposal (RFP) for the ASW Escort Mission Module EDM on August 14, 2014. After evaluating proposals, three vendors were award-

ed base contracts on July 20, 2015. The base contract awards funded a study by each selected contractor to address ship integration issues, at-sea testing at the subsystem and mission module level, and the development of production/delivery schedules.

In August 2016, the Navy modified all three vendor contracts to minimize and/or retire these technical and programmatic risk areas. Based on the results of the more detailed transition studies and risk reduction efforts, the Navy is in the process of exercising the contract option for one vendor to build the ASW Escort Mission Module EDM (pre-production test article).

Mine Countermeasures (MCM) MP—When augmented with the MCM MP, the LCS is capable of conducting detect-to-engage operations (mine hunting, sweeping, and neutralization) against sea mine threats. LCS outfitted with the MCM MP provides the joint force commander with the capability to conduct organic mine countermeasure operations ranging from intelligence preparation of the environment to first response mine countermeasures enabling joint operations to be conducted ahead of power projection forces. With the MCM MP a broader range of options will be available to the joint force commander, and we will remove the ship and crew from the minefield.

The MCM MP provides these capabilities through the use of sensors and weapons deployed from organic unmanned vehicles and the MH–60S multi-mission helicopter. The unmanned vehicles include the Common Unmanned Surface Vessel (CUSV), unmanned aerial vehicles, and the Knifefish UUV.

TECHEVAL of the initial MCM MP capabilities was completed in August 2015, aboard USS *Independence* (LCS 2). The mission package met the majority of its sustained area coverage rate test requirements, but significant reliability issues were noted with the Remote Multi-Mission Vehicle (RMMV). Based on TECHEVAL results, the Navy delayed MCM IOT&E and initiated an Independent Review Team (IRT) to assess the system.

The IRT submitted their findings and recommendations in February 2016, following which Chief of Naval Operations (CNO) and Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN(RD&A)) directed OPNAV (N9) and PEO LCS to develop an implementation plan to execute the RMS IRT recommendations. The implementation plan was to coordinate experimentation, technology maturation, Concept of Employment development, and industry and Fleet engagement to ensure a supportable MCM capability, tested, and delivered to the Fleet before legacy systems reach the end of their service life, including:

- OPNAV and PEO alignment of responsibility and authority with clear lines of accountability for delivery of MCM capability;
- Concept development and testing for both LCS and non-LCS based systems;
- Employment of expeditionary mine warfare capability from LCS and other Navy platforms;
- Deployment of MCM MP initial increment on *Independence* variant ships using upgraded low rate initial production RMMVs to gain operational experience.
- Cost and recommended budgetary actions.

Subsequently, the Under Secretary of Defense (Acquisition, Technology and Logistics) signed an Acquisition Decision Memorandum cancelling further development of the RMMV and separately establishing the associated towed mine-detection sonar, the AN/AQS–20A, as an independent acquisition program.

The CNO and ASN(RD&A) approved the IRT Implementation Plan on June 28, 2016. Execution of the plan is based on a three-phase approach. The first "deploy" phase of the plan focuses on exercising MCM capability from LCS or other platforms of opportunity in fiscal year 2018 through fiscal year 2019. The second "assess and decide" phase will evaluate data from the fiscal year 2018–2019 deployment with the MCM MP initial increment and Fleet assessments of CUSV minehunting capability and Knifefish UUV, culminating in an MCM minehunting platform decision in fiscal year 2019. The final "re-baselining" phase efforts focus on the long-term plan to deliver MCM capability to support IOC in fiscal year 2021 to address legacy surface and airborne mine countermeasures systems end of service life.

To execute the IRT implementation plan, the Navy submitted an fiscal year 2016 Above Threshold Reprogramming (ATR). This ATR was not supported, resulting in the Navy developing a revised implementation plan which was briefed to professional staff members of the congressional defense committees in September 2016. The revised plan focuses on CUSV as the tow vehicle for the AQS–20A mine hunting sonar. In the interim, two RMMVs will be groomed and one will be overhauled, and these RMMVs will then be used to continue AN/AQS–20 sonar testing, conduct data collection, and support user operational evaluation until the CUSV is available in late fiscal year 2018, at which point the RMMVs will be replaced.

TRANSITION TO FRIGATE

On February 24, 2014, the Secretary of Defense (SECDEF) directed that the Navy limit the number of Flight 0+ LCS ships to no more than 32 and that the Navy submit alternatives for a more capable and lethal Small Surface Combatant (SSC) with capabilities generally consistent with a FF. In response, the Navy formed a Small Surface Combatant Task Force (SSCTF). The SSCTF's efforts informed the Navy's recommendation and SECDEF's decision memorandum of December 10, 2014, approved the Navy's plan to procure a SSC based on an upgraded LCS Flight 0+ hull form.

The SSCTF approach entailed five key activities. First, establish and co-locate a team of operational, technical, and acquisition experts with experience in surface combatant operations, design, and program execution. Second, develop a process that integrates capability concept development, requirements analysis, engineering and design, cost analysis, and program planning to characterize a rich trade space. Third, obtain and consider the Fleet's views and perspectives on SSC capability needs in the 2025+ timeframe. Fourth, seek and consider industry's ideas regarding existing ship designs and ship systems including hull, mechanical, and electrical and combat system components. Fifth, ensure the analysis and findings represent technically feasible and operationally credible SSC alternatives for consideration by Navy leadership.

The SSCTF proposed to Navy leadership that a modified LCS fulfilled the requirement of "a capable and lethal small surface combatant" providing the multi-mission SUW and ASW capability consistent with the Fleet's view on the most valued capabilities delivered by a SSC at the most affordable cost. Further, the study concluded that this approach would provide the shortest timeline to first ship delivery (fiscal year 2023) and last ship delivery (fiscal year 2028) with no gap in production; and could support a subset of capability and survivability upgrades on LCS production ships as early as fiscal year 2017. Navy leadership accepted this recommendation and proposed for SECDEF's decision that the upgraded LCS Flight 0+ hull form be used as the basis for the new SSC (termed a Frigate).

The FF's design continues to mature in preparation for a RFP release to both LCS shipbuilders in 2017, which could support contract award in late fiscal year 2018. The FF will bring multi-mission capability to a modified LCS hull form, incorporating MP components from both the SUW and ASW mission modules. The FF does not change the fundamental LCS mission sets, but rather provides additional lethality and survivability capabilities that support executing independent, integrated, high-value unit escort, and both offensive and defensive SUW and ASW operations.

In December 2015, SECDEF directed that the total LCS/FF procurement be truncated to 40 ships. This programmatic decision, reflected in the President's Budget 2017 submission, is not indicative of a change in the overall 2012 Force Structure Assessment (FSA) interim update conducted in fiscal year 2014. The FSA interim update determined a post-2020 requirement of 308 ships in the battle force, corresponding with a 52 SSC requirement necessary to fulfill the Navy's essential combat missions.

The December 2015 SECDEF memorandum also directed that the LCS program down-select to a single variant and transition to the FF no later than fiscal year 2019. In response to the SECDEF direction, the Navy has outlined a path to downselect to one shipbuilder (one variant) as early as fiscal year 2018, but no later than fiscal year 2019, for the last twelve ships of the program based on the FF design. The Navy intends to make a downselect decision based on best value criteria based on cost and warfighting capability. This acquisition strategy sustains the two shipbuilders competing for the single ship awards in fiscal year 2017 while enabling competitors to align long term options with their vendor base in support of the subsequent down-select, and accelerates delivery of the desired FF capability to the Fleet. Additionally, the plan preserves the viability of the industrial base in the near term in support of potential opportunities for Foreign Military Sales opportunities.

CONCLUSION

The LCS and FF classes close critical warfighting gaps for our fleet commanders. LCS will provide much-needed MCM, ASW, and SUW capability at an affordable cost, freeing up the higher end multi-mission large surface combatants to focus on their primary missions such as area air defense, land strike, and ballistic missile defense.

Looking ahead, the Navy is planning for the next generation Fleet, including SSCs, using the established requirements generation process to determine what

warfighting gaps will be present and what capabilities the future SSC will require in order to fill those gaps. When completed, we look forward to briefing you on the outcome of this analysis and the composition of the future Fleet.

The Navy's role in providing for our national security strategy includes ensuring freedom of navigation for all maritime traffic, providing reassurance to our partner nations, and deterring those who would challenge us. As more LCS ships are deployed forward, these innovative ships will deliver the persistent presence our allies and partners desire and our nation's security demands consistent with this role.

We are committed to working with Congress as we continue to make adjustments to how these ships are employed. We thank you for your past support and urge your continued support. We welcome your oversight, and we look forward to answering your questions.

Chairman MCCAIN. Thank you. Admiral?

STATEMENT OF VICE ADMIRAL THOMAS S. ROWDEN, COMMANDER, NAVAL SURFACE FORCES, AND COMMANDER, NAVAL SURFACE FORCE, U.S. PACIFIC FLEET, UNITED STATES NAVY, WASHINGTON, DC

Admiral ROWDEN. Chairman McCain, Ranking Member Reed, distinguished members of the committee, I am honored for the opportunity to testify about the Littoral Combat Ship.

As the commander of U.S. Surface Forces, I have the privilege of leading the sailors that take our ships to sea. These ships and the sailors that man them are the center of our professional universe, and my frequent visits to the waterfront give me real-time feedback of what we are getting right and on things that we need to address.

This committee's support of the Surface Force has been strong and consistent, and we are moving steadily forward in posturing a more lethal, distributed, and networked force. Small surface combatants have a key role to play in implementing this vision, and the LCS program is a cornerstone of this effort.

The LCS program has had a number of setbacks, something that you, and I, and the Navy leadership team are acutely aware of. We are doggedly pursuing solutions that will improve operational availability of the ships, and you have my assurance that these are never far from my mind.

The CNO testified in his posture statement that for the first time in 25 years there is competition for control of the seas. This statement underpins my entire approach to the LCS fleet introduction.

As the ship begins to join the fleet in numbers, it is my job to examine past assumptions about every aspect of its employment, and implement changes that reflect the operational environment of the future. The Surface Force must be prepared to not only impose sea control over uncontested seas, but it must also be prepared to contest control of the seas by others.

The capabilities of the LCS will bring the fight—the capabilities that the LCS will bring to the fight are in high demand by our fleet commanders, specifically with respect to anti-submarine warfare, mine countermeasures, and over-the-horizon anti-surface warfare. These aspects of sea control from the—form the basis of a more robust, conventional deterrence posture, which in turn frees our cruisers and destroyers to focus on high-end tasking.

We have learned quite a bit from the *Freedom Fort Worth* and *Coronado* deployments and the options provided to our fleet commanders by their presence. The challenges encountered during

these early deployments prompted the recent CNO directed 60-day review, which resulted in a number of straightforward changes that will drive simplicity and stability into the program, even as we increase unit lethality. I am confident we are on the right track to increasing crew ownership and reliability of this ship, while delivering critical warfighting capability to the fleet.

There is work to be done, and I join Secretary Stackley in committing to continuously improving this lethal, necessary, and versatile component of our fleet architecture.

Thank you, sir, and I look forward to your questions.

Chairman MCCAIN. Mr. Francis.

STATEMENT OF PAUL L. FRANCIS, MANAGING DIRECTOR, ACQUISITION AND SOURCING MANAGEMENT, GOVERNMENT ACCOUNTABILITY OFFICE, WASHINGTON, DC

Mr. FRANCIS. Good morning, Mr. Chairman, Mr. Reed, members of the committee. Mr. Chairman, I do not have a real slick statement to read from. I thought I would just talk to you for a few minutes if that was okay.

I think the bottom line on the LCS, as we have talked—the other panelists have talked already, we are 26 ships into the contract, and we still do not know if the LCS can do its job. Over the last 10 years, we have made a number of what I would call trade downs. We have accepted higher costs. We have accepted construction delays, mission module delays, testing delays, reliability and quality problems, and we have accepted the lower capability.

To adjust to this or accommodate the lesser performance of the ship, we have accepted a number of workarounds, higher crew loads, more shore support. We have kind of dialed down the concept of operations, and we have reduced some mission expectations for the ship. Still it will be 2020 by the time we know the ship and all its mission modules will work.

I was doing my own math. I think we did the first contract for the first ship in 2004 or 2005, but it is 16 years from first contract to when the ship will be finally tested with all its mission modules. That is 16 years. To me, that is aircraft carrier territory. The miracle of LCS did not happen.

What did happen? I think when the Navy started off, they had a really good plan. They were going to build two ships, experimental ships, using commercial yards and commercial derivative designs because they had a rough construct of a new mission, the littoral mission, and they wanted to use some ships to see what they could do with it, which I think was a good idea.

About 2005, things really changed, and that is when the Navy decided that they could not just stop with two experimental ships. They had to go forward with construction for the industrial base. In my mind, that is when the program really made a change. It went from an experimental program to a ship construction program. As with any construction or production program, once you get into it and once the money wheel starts to turn, the business imperatives of budgets, and contracts, and ship construction take precedence over acquisition and oversight principles, things like design, development, tests, and cost.

Let me switch now to a little discussion about oversight. On any major weapon system, Milestone B is the most important milestone. That is when you lay down—that is when the legal oversight framework kicks in. Your approved baseline, your Nunn-McCurdy requirements, your cost estimates, your operational test and evaluation, selective acquisition reports all kick in at that time. Usually on ships, you have a Milestone B decision when detailed design and construction is approved for the first ship.

On LCS, the Milestone B decision was made in 2011. That was after we had already approved the block buy of 20 ships and had already constructed and delivered most of the first four ships. The cost growth that occurred on the early ships was grandfathered into the baseline of the LCS program. That is why today if you go to look at the selected acquisition report for LCS, you are not going to see much of a schedule or cost variance because of the grandfathering in.

Mission modules, turning to those, those were actually produced before the Milestone B decision to keep pace with the ship. What we had was, in my view, a highly concurrent buy-before-fly strategy on an all new class of ships. I think the picture for oversight for the frigate program is concerning. It is not going to have milestone decisions. It is not going to be a separate program. There will not be a Milestone B. You are not going to have Nunn-McCurdy protections for the frigate itself. You will not have a selective acquisition report on the frigate itself.

Some of the key performance parameters as they relate to the mission modules have been downgraded to key system attributes, which means the Navy, and not the JROC [Joint Requirements Oversight Council], will make decisions on what is acceptable.

Let me wrap up by saying that the ball is now in your court. In a few months, you will be asked to approve the fiscal year 2018 budget submit, which will, if current plans hold, include approval for a block buy of 12 frigates. In my mind, you are going to be rushed again. You are going to be asked to put in upfront approval for something where the design is not done. We do not have an independent cost estimate. The risks are not well understood. Oh, by the way, the mission module still have not been demonstrated yet.

You will be told that, hey, it is a block buy, we are getting great prices, and the industrial base really needs this. Now, on the prices, you know, in my view the block buy is a pretty loose construct for accountability. You do not have to say how much you are saving. You are not held accountable for what you are saving.

There is an instrument that exists for that, and it is called multiyear procurement. The Navy was able to use multiyear procurement after the fourth *Virginia*-class submarine. You have to ante up what your savings are going to be. You have to test to the stability of the design. It is a real commitment. For the frigate, they are going to use the same contracts that they used for the LCS, and we know how well they have worked in holding down costs.

On the—on the industrial base side, as we have looked past—the past 10 years, we have seen a lot of decisions made to protect the

industrial base. Again, this is an industrial base we did not think we were going to create because we were using commercial firms.

But my question now is, have we not done enough for the industrial base? Is it not time for the industrial base to come through for us? Can we get one ship delivered on time? Can we get one ship delivered without cost growth? Can we get one ship delivered without serious reliability and quality problems? That is my question.

Once the block buy is approved, your oversight is marginalized because what you will be hit with in the future is we got great prices, and we have to protect the industrial base. With these two things, you cannot change the program from then on, and I am saying you can.

I think that your first oversight question is going to be is a program that has doubled in cost and has yet to demonstrate its capabilities worth another $14 billion in investment, and that is the floor. That is assuming everything goes well.

If you do think it is worth it, and that is a big if, I would say—my counsel to you in fiscal year 2018 is do not approve a block buy. Have the Navy do a competition on detailed design, and let them compete the two—the two ship designs and downselect. Make it a major acquisition program with its own baseline, and its own milestones, and its SARs [Selected Acquisitions Reports].

In 2019, then you can consider if you want to authorize more ships, and that should be based on the demonstrated performance of the ships. If you did, you do not have to do a block buy. You can consider what kind of arrangements you want to make at that point.

In wrapping up, my view is you have got one shot left in fiscal year 2018 to preserve your oversight power over this program, and my advice is take it. Take that shot, and I can assure you the Earth is not going to come off its axis if you do. You will be sending an important signal to other programs as to what you are willing to prove and what you are not.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Francis follows:]

United States Government Accountability Office

Testimony

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LITTORAL COMBAT SHIP AND FRIGATE

Congress Faced with Critical Acquisition Decisions

Statement of Paul L. Francis, Managing Director, Acquisition and Sourcing Management

GAO-17-262T

GAO Highlights

Highlights of GAO-17-262T, a testimony before the Committee on Armed Services, U.S. Senate

Why GAO Did This Study

The Navy envisioned a revolutionary approach for the LCS program: dual ship designs with interchangeable mission packages intended to provide mission flexibility at a lower cost. This approach has fallen short, with significant cost increases and reduced expectations about mission flexibility and performance. The Navy has changed acquisition approaches several times. The latest change involves minor upgrades to an LCS design—referred to now as a frigate. Yet, questions persist about both the LCS and the frigate.

GAO has reported on the acquisition struggles facing LCS and now the frigate, particularly in GAO-13-530 and GAO-16-356. This statement discusses: (1) the evolution of the LCS acquisition strategy and business case; (2) key risks in the Navy's plans for the frigate based on the LCS program; and (3) remaining oversight opportunities for the LCS and small surface combatant programs. This statement is largely based on GAO's prior reports and larger work on shipbuilding and acquisition best practices. It incorporates limited updated audit work where appropriate.

What GAO Recommends

GAO is not making any new recommendations in this statement but has made numerous recommendations to the Department of Defense (DOD) in the past on LCS and frigate acquisition, including strengthening the program's business case before proceeding with acquisition decisions. While DOD has, at times, agreed with GAO's recommendations, it has taken limited action to implement them.

View GAO-17-262T. For more information, contact Paul Francis at (202) 512-4841 or francisp@gao.gov.

December 1, 2016

LITTORAL COMBAT SHIP AND FRIGATE

Congress Faced with Critical Acquisition Decisions

What GAO Found

The Navy's vision for Littoral Combat Ship (LCS) program has evolved significantly over the last 15 years, reflecting degradations of the underlying business case. Initial plans to experiment with two different prototype ships adapted from commercial designs were abandoned early in favor of an acquisition approach that committed to numerous ships before proving their capabilities. Ships were not delivered quickly to the fleet at low cost. Rather cost, schedule, and capability expectations degraded over time. In contrast, a sound business case would have balanced needed resources—time, money, and technical knowledge—to transform a concept into the desired product.

Evolution of Expectations for the Littoral Combat Ship (LCS) Program

	Early program	Updated program
Quantity and cost	55 seaframes @ $220 million each	40 seaframes @ $478 million each
Schedule	Ship initial operational capability (IOC) in 2007	Ship IOC with partial capability in 2013
Design	Leverage existing designs for reduced cost, rapid fielding	Considerable design changes, under revision throughout early construction
Seaframe	Sprint speed: 40-50 knots; range: 1,000 nautical miles @ 40 knots	Neither seaframe meets combined original speed and range expectations
Mission Packages	IOC for three mission packages by 2010	Revised IOC – one package in 2015; two more planned by 2020

Source: GAO analysis of prior GAO reports and Navy documentation. | GAO-17-262T

Concerned about the LCS's survivability and lethality, in 2014 the Secretary of Defense directed the Navy to evaluate alternatives. After rejecting more capable ships based partly on cost, schedule, and industrial base considerations, the Navy chose the existing LCS designs with minor modifications and re-designated the ship as a frigate. Much of the LCS's capabilities are yet to be demonstrated and the frigate's design, cost, and capabilities are not well-defined. The Navy proposes to commit quickly to the frigate in what it calls a block buy of 12 ships.

Congress has key decisions for fiscal years 2017 and 2018 that have significant funding and oversight implications. First, the Navy has already requested funding to buy two more baseline LCS ships in fiscal year 2017. Second, early next year, the Navy plans to request authorization for a block buy of all 12 frigates and funding in the fiscal year 2018 budget request for the lead frigate. Making these commitments now could make it more difficult to make decisions in the future to reduce or delay the program should that be warranted. A more basic oversight question today is whether a ship that costs twice as much yet delivers less capability than planned warrants an additional investment of nearly $14 billion. GAO has advised Congress to consider not funding the two LCS requested in 2017 given its now obsolete design and existing construction backlogs. Authorizing the block buy strategy for the frigate appears premature. The decisions Congress makes could have implications for what aspiring programs view as acceptable strategies.

Chairman McCain, Ranking Member Reed, and Members of the Committee:

I am pleased to be here today to discuss the Department of the Navy's Littoral Combat Ship (LCS) and frigate programs. The Navy envisioned a revolutionary approach to the LCS program. Unlike other surface combatant programs, LCS consists of two different ship design variants (called seaframes) with interchangeable mission packages carrying equipment for three mission areas—surface and anti-submarine warfare, and mine countermeasures—intended to give the Navy flexibility to rapidly deploy equipment and incorporate new systems. Coupled with this approach, the LCS would have a smaller crew that would rely on shore-based support for its maintenance needs in an effort to reduce life-cycle costs. To execute the program, the Navy deviated from traditional shipbuilding acquisition in hopes of rapidly delivering ships to the fleet. The consequences of this approach are well known today—costs to construct the ships have more than doubled from initial expectations, with promised levels of capability unfulfilled and deliveries significantly delayed. Acknowledging capability and affordability concerns, the Department of Defense (DOD)—in conjunction with the Navy—changed course in February 2014 to pursue a more capable frigate based on the LCS concept.[1]

Today, with 26 ships delivered or under contract, the LCS program again stands at a crossroads, as Congress will decide on funding the last two planned LCS and will be asked early next year to authorize the Navy's plans to procure the remaining 12 ships, including funding the lead frigate. With that context in mind, I will discuss today: (1) the evolution of the LCS acquisition strategy and business case; (2) key risks in the Navy's plans for the frigate based on the LCS program; and (3) remaining oversight opportunities for the LCS and small surface combatant programs.

[1]The term "frigate" can be applied to ships of different sizes and capability. The now-retired Oliver Hazzard Perry-class frigate (FFG 7) was the last U.S. Navy frigate. Frigates—including the FFG 7—have been identified as typically being open-ocean, multi-role ships capable of performing surface, anti-submarine, and anti-air warfare.

This testimony largely leverages our past reports on the LCS program from 2005 to 2016.[2] We also draw on some conclusions from our broader work on Navy shipbuilding and acquisition reform initiatives. More detailed information on our objectives, scope, and methodology for that work can be found in the issued reports. We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. This statement also includes updates to information, as appropriate, based on program documentation and discussion with DOD officials—work that also was conducted in accordance with generally accepted government auditing standards.

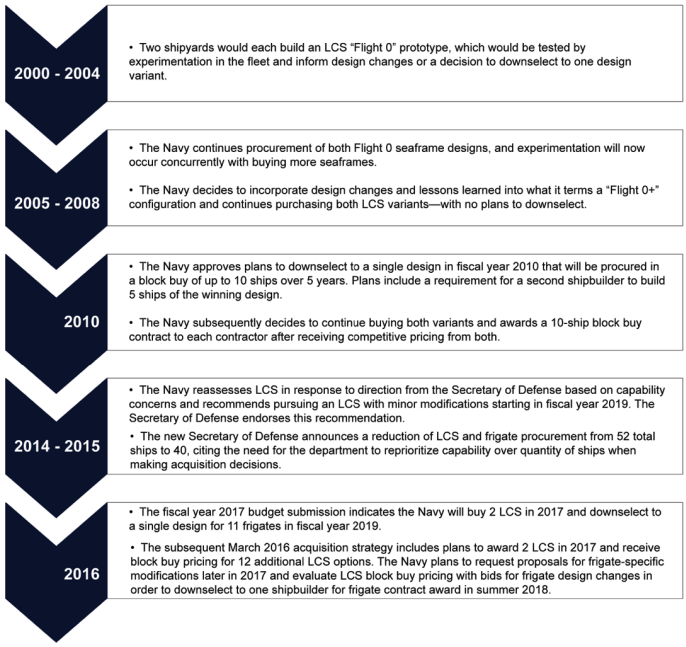
The Course of the LCS Program Has Changed Significantly over Time

When first conceived, the LCS program represented an innovative approach for conducting naval operations, matched with a unique acquisition strategy that included two nontraditional shipbuilders and two different ships based on commercial designs—Lockheed Martin's Freedom variant and Austal USA's Independence variant, respectively.[3] The Navy planned to experiment with these ships to determine its preferred design variant. However, in relatively short order, this experimentation strategy was abandoned in favor of a more traditional acquisition of over 50 ships. More recently, the Secretary of Defense has questioned the appropriate capability and quantity of the LCS. The purpose of the program has evolved from concept experimentation, to LCS, and more recently, to an LCS that will be upgraded to a frigate. The strategy for contracting and competing for ship construction has also changed. This evolution is captured in figure 1.

[2]GAO, *Littoral Combat Ship: Need to Address Fundamental Weaknesses in LCS and Frigate Acquisition Strategies,* GAO-16-356, (Washington, D.C.: June 9, 2016); *Navy Shipbuilding: Significant Investments in the Littoral Combat Ship Continue Amid Substantial Unknowns about Capabilities, Use, and Cost,* GAO-13-530, (Washington, D.C.: July 22, 2013); and *Defense Acquisitions: Plans Need to Allow Enough Time to Demonstrate Capability of First Littoral Combat Ships,* GAO-05-255, (Washington, D.C.: Mar. 1, 2005).

[3]Lockheed Martin is the prime contractor for LCS 1 and the odd numbered seaframes. For LCS 2 and LCS 4, General Dynamics was the prime contractor for the Austal USA built ships. General Dynamics and Austal USA ended their teaming arrangement in 2010. Austal USA is the prime contractor for the remaining even-numbered seaframes.

Figure 1: A Persistent Pattern of Change to the Littoral Combat Ship (LCS) Acquisition Strategy



Source: GAO analysis of Department of Defense data. | GAO-17-262T

While one could argue that a new concept should be expected to evolve over time, the LCS evolution has been complicated by the fact that major commitments have been made to build large numbers of ships before

proving their capabilities. Whereas acquisition best practices embrace a "fly before you buy" approach, the Navy has subscribed to a buy before you fly approach for LCS. Consequently, the business imperatives of budgeting, contracting, and ship construction have outweighed the need to demonstrate knowledge, such as technology maturation, design, and testing, resulting in a program that has delivered 8 ships and has 14 more in some stage of the construction process (includes LCS 21, with a planned December 2016 construction start) despite an unclear understanding of the capability the ships will ultimately be able to provide and with notable performance issues discovered among the few ships that have already been delivered.

LCS Business Case Has Eroded as Cost, Schedule, and Performance Expectations Have Not Been Met

The Navy's vision for the LCS has evolved significantly over time, with questions remaining today about the program's underlying business case. In its simplest form, a business case requires a balance between the concept selected to satisfy warfighter needs and the resources—technologies, design knowledge, funding, and time—needed to transform the concept into a product, in this case a ship. In a number of reports and assessments since 2005, we have raised concerns about the Navy's business case for LCS, noting risks related to cost, schedule, and technical problems, as well as the overall capability of the ships. Business case aside, the LCS program deviated from initial expectations, while continuing to commit to ship and mission package purchases.

The LCS acquisition was challenging from the outset. The Navy hoped to deliver large numbers of ships to the fleet quickly at a low cost. In an effort to achieve its goals, the Navy deviated from sound business practices by concurrently designing and constructing the two lead ship variants while still determining the ship's requirements. The Navy believed it could manage this approach because it considered LCS to be an adaptation of existing commercial ship designs. However, transforming a commercial ship into a capable, survivable warship was an inherently complex undertaking. Elements of the business case further eroded—including initial cost and schedule expectations. Table 1 compares the Navy's initial expectations of the LCS business case with the present version of the program.

Table 1: Evolution of Expectations for the Navy's Littoral Combat Ship (LCS) Program

	Early program	Updated program
Quantity and cost	• 55 seaframes • $220 million per seaframe	• 40 seaframes (includes 12 frigates) • $478 million per seaframe
Schedule	• Ships rapidly fielded, with initial operational capability (IOC) in 2007, 3 years after program initiation	• IOC achieved with partial capability in 2013, 9 years after program initiation
Design	• Leverage existing designs to enable a low-cost, rapidly fielded platform	• Designs required considerable change and were under revision throughout the first several ships built
Seaframe Capability	• Sprint speed: 40-50 knots • Range: 4,300-nautical-mile range when operated at a speed of 16 knots and 1,000-nautical miles at 40 knots	• Speed: Freedom variant (odd-numbered ships, e.g., LCS 1) can meet speed requirements, but Independence variant (even-numbered ships, e.g., LCS 2) did not meet speed requirements; frigate will have reduced speed • Range: In 2009, endurance requirement reduced to 3,500-nautical-mile range at a speed of 14 knots. Freedom variant cannot meet these reduced requirements—with a 2,138-nautical miles range at a speed of 14 knots and 855 nautical miles at 43.6 knots; Independence variant can meet range requirements
Mission Packages Capability	• New capabilities would be rapidly fielded as the Navy would integrate existing technologies on to the three types of mission packages—mine countermeasures, surface warfare, and anti-submarine warfare	• Some technologies were ultimately less mature than envisioned, leading to significant difficulty developing mission capabilities • Only one of three packages (surface warfare) has demonstrated required performance. However, initial operational capability was achieved at a temporarily reduced minimum capability requirement
Crewing and Logistics Constructs	• LCS would be minimally manned (55-60 crew), with many support functions transferred to shore facilities • LCS was initially intended to have a 3-2-1 crewing construct, where 3 crews would support 2 LCS, and 1 LCS would remain forward deployed	• Crew size has increased over time to 70 • The Navy is transitioning to a blue/gold crew concept for LCS, where two crews will rotate on and off the same hull

Source: GAO analysis of prior GAO reports and Navy documentation. | GAO-17-262T

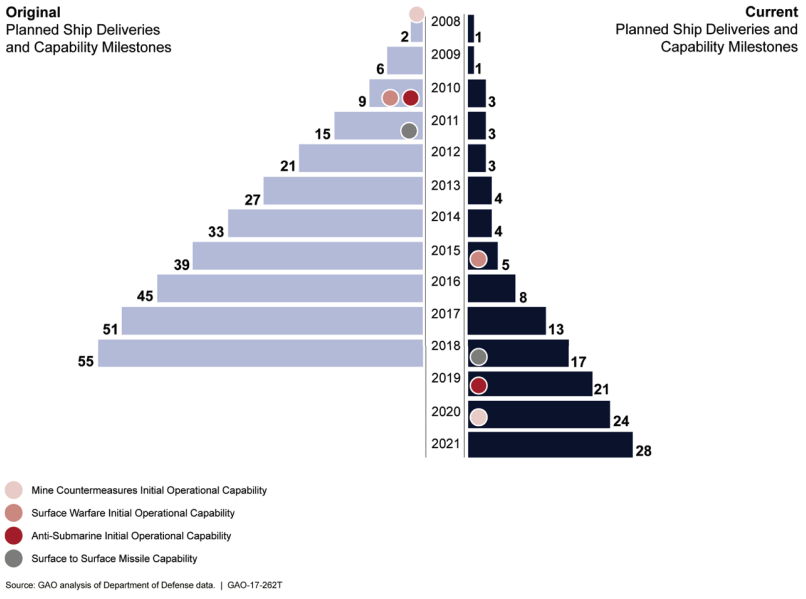
Note: Costs are in fiscal year 2005 dollars.

Our recent work has shown that the LCS business case continues to weaken. LCS ships under construction have exceeded contract cost targets, with the government responsible for paying for a portion of the cost growth. This growth has prompted the Navy to request $246 million in additional funding for fiscal years 2015-2017 largely to address cost overruns on 12 LCS seaframes. Similarly, deliveries of almost all LCS under contract (LCS 5-26) have been delayed by several months, and, in some cases, closer to a year or longer. Navy officials recently reported that, despite having had 5 years of LCS construction to help stabilize ship delivery expectations, the program would not deliver four LCS in fiscal year 2016 as planned. Whereas the program expected to deliver all 55

ships in the class by fiscal year 2018, today that expectation has been reduced to 17 ships.

LCS mission packages, in particular, lag behind expectations. The Navy has fallen short of demonstrating that the LCS with its mission packages can meet the minimum level of capability defined at the beginning of the program. As figure 2 shows, 24 LCS seaframes will be delivered by the time all three mission packages achieve a minimum capability.

Figure 2: Littoral Combat Ship Mission Package Operational Capability Delays Since 2007



Source: GAO analysis of Department of Defense data. | GAO-17-262T

Since 2007, delivery of the total initial mission package operational capability has been delayed by about 9 years (from 2011 to 2020) and the Navy has lowered the level of performance needed to achieve the initial capability for two packages—surface warfare and mine countermeasures. In addition to mission package failures, the Navy has not met several seaframe objectives, including speed and range. For example, Navy testers estimate that the range of one LCS variant is about half of the minimum level identified at the beginning of the program. As the Navy continues to concurrently deliver seaframes and develop mission packages, it has become clear that the seaframes and mission package technologies were not mature and remain largely unproven. In response, the Navy recently designated the first four LCS as test ships to support an aggressive testing schedule between fiscal years 2017 and 2022. Additional deficiencies discovered during these tests could further delay capability and require expensive changes to the seaframes and mission packages that have already been delivered.

As the cost and schedule side of the business case for LCS has grown, performance and capabilities have declined. Changes in the LCS concept of operations are largely the consequence of less than expected lethality and survivability, which remain mostly unproven 7 years after delivery of the lead ships. LCS was designed with reduced requirements as compared to other surface combatants, and over time the Navy has lowered several survivability and lethality requirements further and removed some design features—making the ships less survivable in their expected threat environments and less lethal than initially planned. This has forced the Navy to redefine how it plans to operate the ships. Our previous work highlighted the changes in the LCS's expected capability, as shown in table 2.

Table 2: Evolution of Littoral Combat Ship (LCS) Capability

Concept	Initial	Current
LCS's capability against adversaries	LCS was primarily planned to be used in major combat operations, enter contested spaces, and be employable and sustainable throughout the battlespace regardless of anti-access or area denial environments.	The Navy acknowledges current LCS weapon systems are under-performing and offer little chance of survival in a combat scenario. LCS lacks the ability to operate independently in combat and should not be employed outside a benign, low-threat environment unless escorted by a multi-mission combatant providing credible anti-air, anti-surface, and anti-submarine protection.
How LCS will deploy	LCS will be a self-sufficient combatant designed to fight and win in shallow water and near-land environments without risking larger combatants in constricted areas.	LCS's dependencies in combat require it to be well-protected by multi-mission combatants. Multiple LCS will likely have to operate in a coordinated strike attack group fashion for mutual support.

Concept	Initial	Current
How mission packages swaps will be utilized	Mission packages will be quickly swapped out in an expeditionary theater in a matter of days.	Mission packages can be swapped within 72 hours only if all the equipment and personnel are in theater. An LCS executing a package swap could be unavailable for between 12-29 days. The Navy now expects mission package swaps will be more infrequent than initially envisioned.

Source: GAO analysis of Navy documentation. | GAO-17-262T

Further capability changes may be necessary as the Navy continues to test the seaframes and mission packages, as well as gain greater operational experience. For example, the Navy has not yet demonstrated that LCS will achieve its survivability requirements and does not plan to complete survivability assessments until 2018—after more than 24 ships are either in the fleet or under construction. The Navy has identified unknowns related to the Independence variant's aluminum hull, and conducted underwater explosion testing in 2016 but the Navy has yet to compile and report the results. Both variants also sustained some damage in trials in rough sea conditions, but the Navy has not completed its analytical report of these events. Results from air defense and cybersecurity testing also indicate capability concerns.

Business Case for Frigate Program Remains Uncertain

The Navy elected to pursue a frigate concept based on a minor modified LCS. The frigate, as planned, will provide multi-mission capability that is an improvement over LCS and offers modest improvements to some other capabilities, such as the air search radar. Still, many questions remain to be settled about the frigate's design, cost, schedule, and capabilities—all while the Navy continues to purchase additional LCS. Despite the uncertainties, the Navy's acquisition strategy involves effectively demonstrating a commitment to buy all of the planned frigates—12 in total—before establishing realistic cost, schedule, and technical parameters—because the Navy will ask Congress to authorize the contracting approach for the 12 frigates (what the Navy calls a block buy contract) in 2017.[4] Further, the frigate will inherit many of the

[4]The Navy plans to request authorization in 2017 to use what it calls a block buy contract to purchase the frigate—the same contracting approach used for LCS—and funding in the fiscal year 2018 budget request for the lead frigate. Our past analysis of the LCS contracts found that a block buy approach could affect Congress's funding flexibility. For example, the LCS block buy contracts provide that a failure to fully fund a purchase in a given year would make the contract subject to renegotiation, which could result in the government paying more for ships. If similar terms are included in the frigate contract, the same potential effect may apply.

shortcomings or uncertainties of the LCS, and does not address all the priorities that the Navy had identified for its future frigate.

Frigate Cost Uncertainty and a Compressed Schedule Contribute to Gaps in Program Knowledge

The costs for the frigate are still uncertain. Navy officials have stated that the frigate is expected to cost no more than 20 percent—approximately $100 million—more per ship than the average LCS seaframes. However, the Navy will not establish its cost estimate until May 2017— presumably after the Navy requests authorization from Congress in its fiscal year 2018 budget request for the block buy contracting approach for 12 frigates—raising the likelihood that the budget request will not reflect the most current costs for the program moving forward.

In addition to the continued cost uncertainty, the schedule and approach for the frigate acquisition have undergone substantial changes in the last year, as shown in table 3.

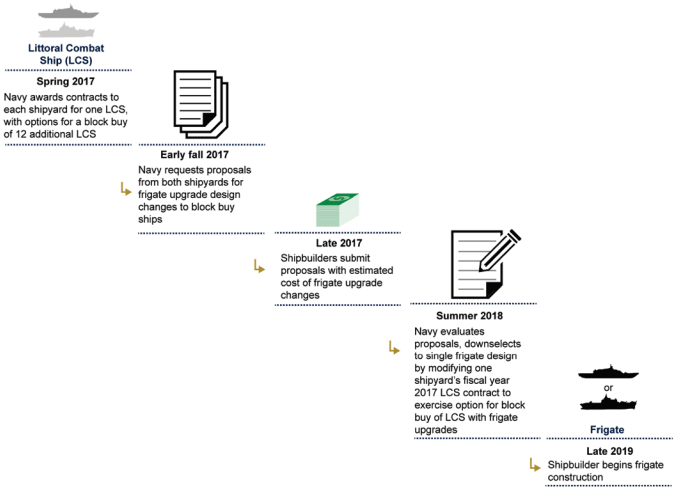
Table 3: Changes in Frigate Acquisition Plan

Previous plan (December 2015)	Current plan (October 2016)
Dual contract award in fiscal year 2019	Downselect award to one shipbuilder in summer 2018
20 frigates (10 per shipbuilder)	12 frigates
Government-led, prescribed design	Contractor-driven design process based on build specifications; increased government furnished equipment
Multiple frigate upgrade packages, with a fiscal year 2019 bid to mature frigate design	Single frigate upgrade package expected from each contractor in fiscal year 2018
Detail design in fiscal year 2018 to increase design knowledge prior to contract award	Detail design begins after downselect award in 2018

Source: GAO analysis of Navy documentation. | GAO-17-262T

According to frigate program officials, under the current acquisition approach the Navy will award contracts in fiscal year 2017 to each of the current LCS contractors to construct one LCS with a block buy option for 12 additional LCS—not frigates. Then, the Navy plans to obtain proposals from both LCS contractors in late 2017 that would upgrade the block buy option of LCS to frigates using frigate-specific design changes and modifications. The Navy will evaluate the frigate upgrade packages and then exercise the option—now for frigates—on the contract that provides the best value based on tradeoffs between price and technical factors. This downselect will occur in summer 2018. Figure 3 illustrates how the Navy plans to modify the fiscal year 2017 LCS contract to convert the ships in the block buy options to frigates.

Figure 3: Navy Block Buy Option Contract Modification Process for Frigate Procurement



Source: GAO analysis of Navy data. | GAO-17-262T

The Navy's current plan, which moves the frigate award forward from fiscal year 2019 to fiscal year 2018, is an acceleration that continues a pattern of committing to buy ships in advance of adequate knowledge. Specifically, the Navy has planned for its downselect award of the frigate to occur before detail design of the ship begins. As we previously reported, awarding a contract before detail design is completed—though common in Navy ship acquisitions—has resulted in increased ship prices.[5] Further, in the absence of a year of frigate detail design, the

[5] GAO-16-356 and GAO, *Defense Acquisitions: Improved Management Practices Could Help Minimize Cost Growth in Navy Shipbuilding Programs*, GAO-05-183 (Washington, D.C.: Feb. 28, 2005).

Navy plans to rely on a contractor-driven design process that is less prescriptive. This approach is similar to that espoused by the original LCS program, whereby the shipyards were given performance specifications and requirements, selecting the design and systems that they determined were best suited to fit their designs in a producible manner. Program officials told us that this new approach should yield efficiencies; however, history from LCS raises concern that this approach for the frigate similarly could lead to the ships having non-standard equipment, with less commonality with the other design and the rest of the Navy.

Frigate Does Not Address All Navy Priorities and Will Likely Carry Forward Some of the Limitations of the LCS Designs

As LCS costs grew and capabilities diluted, the Secretary of Defense directed the Navy to explore alternatives to the LCS to address key deficiencies. In response, the Navy created the Small Surface Combatant Task Force and directed it to consider new and existing frigate design options, including different types of modified LCS designs. The task force concluded that the Navy's desired capability requirements could not be met without major modifications to an LCS design or utilizing other non-LCS designs. When presented with this conclusion, senior Navy leadership directed the task force to explore what capabilities might be more feasible on a minor modified LCS. This led the task force to develop options with diminished capabilities, such as reduced speed or range, resulting in some capabilities becoming equal to or below expected capabilities of the current LCS. Ultimately, the department chose a frigate concept based on a minor modified LCS in lieu of more capable small surface combatant options because of LCS's relatively lower cost and quicker ability to field, as well as the ability to upgrade remaining LCS.

Table 4 presents an analysis from our past work, which found that the Navy's proposed frigate will offer some improvements over LCS. For example, the Navy plans to equip the frigates with the mission systems from both the surface and anti-submarine mission packages simultaneously instead of just one at a time like LCS. However, the Navy's planned frigate upgrades will not result in significant improvements in survivability areas related to vulnerability—the ability to withstand initial damage effects from threat weapons—or recoverability—the ability of the crew to take emergency action to contain and control damage.

Table 4: Proposed Frigate Capability Changes

Proposed change	Description	Significance
Switch from single to multi-mission capability	Frigate will be able to embark surface and anti-submarine warfare mission packages at one time instead of just a single mission package, like LCS.	A multi-mission capability was recognized in Navy analysis as a key characteristic of a frigate. A frigate will be able to engage different types of threats at all times, unlike LCS which depends on the mission package embarked.
Improve air warfare systems	Frigate will be equipped with an improved air search radar and defensive countermeasures.	This reduces susceptibility to attacks from air-based threats (e.g. aircraft or missiles). The Navy also is considering these improvements for LCS.
Add armor to vital spaces and magazines. Improve shock hardening in anti-air missile system	Armor reduces vulnerability; intended to lessen risk of magazine detonation. Shock hardening reduces vulnerability of missile system.	LCS already has some armor in these areas; shock hardening is limited to anti-air missile system. The Navy believes adjusting the concept of operations for the frigate is more cost-effective and feasible than a further increase in armor and shock hardening.

Source: GAO analysis of Navy documentation. | GAO-17-262T

Further, the Navy sacrificed capabilities that were prioritized by fleet operators. For example, fleet operators consistently prioritized a range of 4,000 nautical miles, but the selected frigate concept is as much as 30 percent short of achieving such a range.

The Director, Operational Test and Evaluation has noted that the Navy's proposed frigate design is not substantially different from LCS and does not add much more redundancy or greater separation of critical equipment or additional compartmentation, making the frigate likely to be less survivable than the Navy's previous frigate class. Further, the Navy plans to make some similar capability improvements to existing and future LCS, narrowing the difference between LCS and the frigate. We found that the proposed frigate does not add any new offensive anti-submarine or surface warfare capabilities that are not already part of one of the LCS mission packages, so while the frigate will be able to carry what equates to two mission packages at once, the capabilities in each mission area will be the same as LCS. While specific details are classified, there are only a few areas where there are differences in frigate warfighting capability compared to the LCS.

Since it will be based on the LCS designs, the frigate will likely carry forward some of the limitations of the LCS designs. For example, LCS was designed to carry a minimally-sized crew of approximately 50. The Navy has found in various studies that the crew is undersized and made some modest increases in crew size. A frigate design based on LCS may not be able to support a significant increase in crew size due to limited space for berthing and other facilities. Additionally, barring Navy-directed changes to key mechanical systems, the frigate will carry some of the

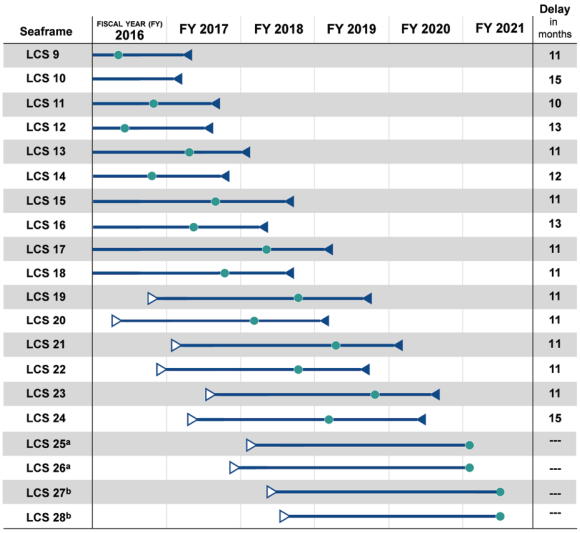
more failure-prone LCS equipment, such as some propulsion equipment, and will likely carry some of the non-fleet-standard, LCS-unique equipment that has challenged the Navy's support and logistics chain. Uncertainties or needs that remain with the surface and anti-submarine warfare mission packages, such as demonstrating operational performance of the surface-to-surface missile and the anti-submarine warfare package, also pose risk for the frigate.

Limited Opportunities Remain to Shape LCS and Frigate Programs

The Navy's plans for fiscal years 2017 and 2018 involve significant decisions for the LCS and the frigate programs, including potential future commitments of approximately $14 billion for seaframes and mission packages. First, the Navy plans to buy the last two LCS in fiscal year 2017, even though DOD and the Navy recognize that the LCS does not meet needs. Second, the Navy is planning to seek congressional authorization for a block buy of all planned frigates and funding for the lead frigate as soon as next year—2017—despite significant unknowns about the cost, schedule, and capability of the vessel. The Navy's acquisition approach for the frigate raises concerns about overcommitting to the future acquisition of ships for which significant cost, schedule, and technical uncertainty remains. Similar to what we previously have advised about LCS block buy contracting, a frigate block buy approach could reduce funding flexibility. For example, the LCS contracts provide that a failure to fully fund the purchase of a ship in a given year would make the contract subject to renegotiation. Following this reasoning, such a failure to fund a ship in a given year could result in the government paying more for remaining ships under the contract, which provides a notable disincentive to take any action that might delay procurement, even when a program is underperforming.

The Navy requested funding for two LCS in its fiscal year 2017 budget request. We previously suggested that Congress consider not funding any requested LCS in fiscal year 2017 because of unresolved concerns with lethality and survivability of the LCS design, the Navy's ability to make needed improvements, and the lagging construction schedule of the shipyards. As figure 4 depicts, even if no ships were funded in fiscal year 2017, delays that have occurred for previously funded ships have resulted in a construction workload that extends into fiscal year 2020.

Figure 4: Construction Demands for Littoral Combat Ship (LCS) Shipyards



Source: GAO analysis of Navy contract data and budget documents. | GAO-17-262T

[a]The delivery dates for LCS 25 and 26—awarded in March 2016—have not been modified.

[b]The Navy has not awarded contracts for construction of LCS 27 or 28.

In all, 8 ships have been delivered (LCS 1-8) and 14 are in various phases of construction (LCS 9-22), with 3 more (LCS 23, 24, and 26) set to begin construction later in fiscal year 2017. Although the Navy has argued that pausing LCS production would result in loss of production work and start-up delays to the frigate program, the schedule suggests

that the shipyards in Marinette, Wisconsin, and Mobile, Alabama, will have sufficient workload remaining from prior LCS contract awards that offsets the need to award additional LCS in fiscal year 2017. The Navy's concern also does not account for any other work that the shipyards may have from other Navy or commercial contracts and the possibility of continued delays in the delivery of LCS.

On the heels of the decision to fund fiscal year 2017 LCS will be the decision on whether to authorize the frigate contracting approach and fund the lead frigate. As I noted above, the current acquisition plans for the frigate have been accelerated during the past year. If these plans hold, Congress will be asked in a few months to consider authorizing a block buy of 12 frigates and funding the lead frigate when the fiscal year 2018 budget is proposed—before detail design has begun and the scope and cost of the design changes needed to turn an LCS into a frigate are well understood. The frigate acquisition strategy also reflects a proclivity by the Navy to use contracting approaches such as block buys and multiyear procurement for acquisition programs, which may have the cumulative effect of inuring the programs against changes—such as in quantities bought.

Summary

To the extent that both the LCS and the frigate successfully demonstrate their ability to conduct their intended missions, it is reasonable to assume they will provide useful capability to the Navy. By the same token, the LCS's weakened business case raises a basic oversight question: does a program that costs twice as much but delivers less capability than planned still warrant an additional investment of nearly $14 billion?

Congress has two key decisions remaining for LCS and the frigate that, once made, will put a set of commitments in place that will make it difficult for Congress to alter in the future. The first decision is whether to fund additional LCS in fiscal year 2017, in light of the backlog of work already in the shipyards and the fact that these ships are baseline LCS, not the frigate. Second—and more importantly—is the decision on whether to authorize a block buy of 12 frigates, which would conclude the entire buy of 40 LCS and frigates. If Congress were to authorize the block buy, those ships would still require annual appropriations. While Congress could still thus conduct oversight of the program through the appropriations process, it could be more difficult to make decisions to reduce or delay the program should that become warranted, as the Navy may point to losses in favorable block buy prices, like it has done previously with LCS. At a minimum, holding the Navy to the plan it set

forth in the fiscal year 2017 budget submission, which provided for detail design activities in advance of a contract award in fiscal year 2019, affords more time to reduce LCS uncertainties that directly affect the frigate and to build design knowledge to reduce technical and cost risks. Additionally, forgoing a frigate award in fiscal year 2018 offers the Navy an opportunity to better demonstrate to Congress whether the frigate's estimated cost and expected capabilities warrant the additional investment.

GAO has reported extensively about what we refer to as the defense acquisition culture, a prevailing set of incentives that encourages decisions to go forward with programs before they are ready and a willingness to accept cost growth and schedule delays as the likely byproduct of such decisions. This Committee has been particularly concerned with repeated acquisition problems and has actively advocated for legislative solutions. As I testified last year on the Ford-class Aircraft Carrier, Congress has a very important role to play in shaping the acquisition culture, particularly in what it sanctions via funding approvals. If programs that propose optimistic or rushed acquisition strategies win funding approval, those strategies are, in effect, sanctioned. The upcoming decisions on the LCS and the frigate represent opportunities for Congress to take a stand on what it is willing to fund and what that means for maintaining—or changing—the defense acquisition culture.

Chairman McCain, Ranking Member Reed, and Members of the Committee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff has any questions about this statement, please contact Paul L. Francis at (202) 512-4841 or francisp@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Michele Mackin (Director), Diana Moldafsky (Assistant Director), Pete Anderson, Jacob Leon Beier, Laurier Fish, Kristine Hassinger, C. James Madar, Sean Merrill, LeAnna Parkey, and Robin Wilson.

Related GAO Products

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Littoral Combat Ship: Knowledge of Survivability and Lethality Capabilities Needed Prior to Making Major Funding Decisions. GAO-16-201. Washington, D.C.: December 18, 2015.

Littoral Combat Ship: Additional Testing and Improved Weight Management Needed Prior to Further Investments. GAO-14-827. Washington, D.C.: September 25, 2014.

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Chairman MCCAIN. Thank you very much.

Secretary Stackley, as Ronald Reagan used to say, "Facts are stubborn things." You painted a rather rosy picture, but the facts are that the LCS was initially expected to cost $220 million per ship. That was the testimony before this committee. The cost has now doubled to $478 million. The first LCS combat capability mine countermeasures was supposed to be delivered in 2008. That capability is still not operational, nor is it expected to be until 2020, 12 years late.

You have served as the Navy's acquisition executive for the past eight years. Who is responsible, and who should be held accountable for a doubling of the cost of the ship, delivery 12 years late,

and obvious difficulties, which I will mention in later questioning. Who is responsible, and who is going to be held accountable?

Mr. STACKLEY. Sir, let me start with the reference to the $220 million ship, that number that dates back to the 2004, 2005 timeframe. Everybody here would absolutely agree that was unrealistic.

Chairman MCCAIN. No, I would not because it was testified before this committee that that would be the cost per ship. In retrospect, we see that it was unrealistic, but at the time this committee and this Congress, which approved it, was on the basis of $220 million per ship. If we had been told it was $478 million and 12 years late for some of the programs, I do not think that this committee and the Congress of the United States would have approved it, Mr. Secretary.

Mr. STACKLEY. Yes, sir. I am telling you that the $220 million number was unrealistic.

Chairman MCCAIN. Well, then why——

Mr. STACKLEY. This Congress—this Congress——

Chairman MCCAIN.—why was it unrealistic to tell the Congress of the United States?

Mr. STACKLEY. I agree. Sir, I agree. This Congress was led to believe that the ship would cost $220 million. That was an unrealistic number that was put before the Congress in terms of a program to authorize and appropriate. The result of the lead ship going to $500 to $700 million dollars each, that was——

Chairman MCCAIN. Who was—who gave that information of $220 million per ship to the—to the Congress and this committee? Do you know?

[The information referred to follows:]

The Navy's cost as an independent variable cap of $220 million (fiscal year 2005 dollars) for the ship platform and basic core systems was first reported in the report to Congress directed by section 218 of Fiscal Year (FY) 2003 National Defense Authorization Act (Public Law 107–314). The report was signed by the Assistant Secretary of the Navy for Research, Development, and Acquisition, John Young, and delivered to the congressional defense committees on February 10, 2003.

Mr. STACKLEY. I would have to go back to the records to see who testified. The number was directed from the top down. I can tell you that the Naval Sea Systems Command's estimate for the program at that point in time was not $220 million. That was the number that was in place as a cost cap for the program, and they pressed down to try to achieve what could not be achieved, and industry followed suit.

We have the experience of the lead ship in terms of things that went wrong that we have been trying to recover from since.

Chairman MCCAIN. Seventeen years, $700 million of taxpayers' money has been sunk into the Remote Multi-Mission Vehicle. The program was canceled earlier this year due to unsatisfactory performance, reliability, and the Navy formulated a new way ahead for the mine countermeasures mission. For nearly a decade, the GAO has reported the Navy was buying this system before they would approve it. Dr. Gilmore reported the RMMVs were not effective.

Why did the Navy recommend to the RMMV in 2010 after a Nunn-McCurdy breach revealed a shoddy business case for the system to continue development?

Mr. STACKLEY. Yes, sir, 2010 timeframe, we went through the Nunn-McCurdy process, and we looked at a couple of key things. One was the performance issues that we were having with the RMMV and whether or not we believed that we could correct the reliability issues through a reliability improvement program.

Chairman MCCAIN. Obviously you could not.

Mr. STACKLEY. Correct, we failed in that assessment. We believed we could. We did a redesign effort. We did not go back and build new vehicles in accordance with the redesign. What we did was took the existing vehicles and back fit what fixes we could, and took that to test.

Chairman MCCAIN. Which obviously did not work since now it has been abandoned, right?

Mr. STACKLEY. Yes, sir.

Chairman MCCAIN. One more question, Admiral. Of the major casualties encountered to date, are these issues of ship design, inferior shipbuilding quality, a lack of procedural compliance, a lack of training, or something else? Who has been accountable? 2013 generator failures. That is on the LCS–1. Hundred and ninety-five days and $1.6 million to fix. Sea water contamination, and combining you have 20 days and $377,000.

2016, contamination of a main engine, 258 days and $12 million dollars to fix. LCS–3, 2016, combined gear bearings, 184 days and $5.6 million to fix. LCS–4 in 2016, water jet failure, 24 days, and we do not know the cost. LCS–5 in 2015, high-speed clutch failure, 355 days and counting. LCS–8 in 2016, water jet failure.

What is going on here, Admiral, and who is held accountable?

Admiral ROWDEN. Yes, sir. Starting specifically back in the early part of this year when—with the *Fort Worth* failure associated with personnel errors on the USS *Fort Worth,* I started to look very hard at the training and the qualification of the men and women that serve on our ships to see if we had short-changed them with respect to the training that they had been provided.

Chairman MCCAIN. Who was held accountable for that? They were not well-trained. Somebody is supposed to train them.

Admiral ROWDEN. Absolutely, sir.

Chairman MCCAIN. Was it you that was in charge of that?

Admiral ROWDEN. I am responsible for training the men and women on these ships.

Chairman MCCAIN. Should you be in your job?

Admiral ROWDEN. Yes, sir, I believe I am capable of fulfilling the responsibilities. What I did find was that the training that we had provided to the young men and women was insufficient in reviewing two casualties specifically, the one on the *Fort Worth* and then one on the *Freedom*.

The men and women, when we—I stepped back and got our Surface Warfare Officer School to conduct an assessment of the engineering knowledge of the men and women on the ships, it was found to be deficient. One of the things that we found was that, and that I directed, was that we start to import much more of the training than we had been relying on for the vendors to provide to our sailors that serve on these ships.

Given the fact that we have pulled that engineering training in, given the fact that we have—are moving to get the curriculum nec-

essary in order to be able to get the right knowledge into their heads in order to operate the propulsion plants, I think we are in a much better place going forward.

Specifically associated with the accountability——

Chairman MCCAIN. I agree. We may be better going forward. But, Admiral, we are going to start holding people accountable. We are talking about millions of dollars here that were failures that you say were a problem with training. Who was responsible for the training? Was not someone? Was it not anticipated that the crew would have to be well trained to avoid these tens of millions of dollars of problems?

Admiral ROWDEN. Absolutely, sir. I feel that as we have operated the ships and as we have learned about these new propulsion plants——

Chairman MCCAIN. I am glad we have learned at the cost to the taxpayers of tens of millions of dollars.

Senator Reed.

Senator REED. Well, thank you, Mr. Chairman. Secretary Stackley, in the letter that the chairman I wrote to the CNO, we talked about the replacement of the LCS. As I understand it, the current plan is to stop building LCS in fiscal year 2025. Mr. Francis' assessment was interesting. He suggested that LCS is simply going to morph into something called a frigate, and we are going to buy frigates, but we are not going to have a real opportunity to review, nor are you going to have the opportunity given the compressed timeframe, to do all the requirements, to validate the requirements, to do the testing, to do the proving, if you will.

Can you give us an indication of where this program is headed? Is it going to morph into frigates? Is it going to be a new design for a surface combatant? If it is, does that have to be up and running by fiscal year 2026 because we stop buying LCSs in 2025?

Mr. STACKLEY. Sir, in 2014 we were directed by then Secretary Hagel to take a review of our small surface combatants and to come back with a proposal for what was referred to as capabilities consistent with a frigate. We did that review in the 2015 timeframe. In fact, we briefed the defense committees and invited them to participate in some of the out briefs.

The plan going forward that we then presented in our subsequent budget was to take the ASW Mission Package capabilities, plus the Surface Warfare Mission Package capabilities that are currently planned for the LCS, and combine them and permanently install them on the LCS platform to give it the multi-mission capabilities, trade away modularity, but to give it multi-mission capabilities. Add to that over-the-horizon missile, and add to that upgrades to electronic warfare and decoys, specifically, our Nulka decoy, in effect, using existing capabilities or capabilities that we already have in development and that the ship is already designed to accommodate, permanently install them on the platform to give them multi-mission capability I have referred to as a frigate.

That work was done—was chartered in 2014, done in 2015, shared with the defense committees at least at the staff level, included in our budget. The capabilities development document has gone through the JROC [Joint Requirements Oversight Council] for validation of the requirements. The shipyards have been turned on

to do the design associated with permanently integrating those existing capabilities into their platforms. That design effort is going on today.

The competitive downselect for that future frigate design, that RFP [request for proposals] is planned to go out next summer. We will be doing those design reviews, and, as I described in my opening statement, we will invite your staffs to look at the process, look at the products, look at the criteria, and provide basically your oversight. We will ensure that you have the insight before we go further forward.

Senator REED. Okay. Will that plan include a block buy of the frigates or a block buy of another group of LCSs?

Mr. STACKLEY. Today, that is the plan. We do not have—we do not have a formalized—we have not finalized the acquisition strategy with the 2018 budget. We will be bringing that formal acquisition strategy over to present to the Congress for your review and ultimately for your approval.

I want to—I do think it is important, though, to make a comment. First, I fully appreciate all of Paul Francis' comments in his opening statement, and we work closely together. I do need to point out when we talk about a block buy versus talking about a multiyear, effectively what we are—what we are describing with the competitive downselect is the competitive downselect will be based on best value associated with the detailed design by the shipbuilders.

What we are telling them is somebody is going to win this, one is going to win this, and they will get 12 ships of this frigate design. The details in terms of whether that is one-plus options, whether that is 12 options, or whether we convert that to a multiyear in the future, that is not decided today. But we do want to get—to ensure we procure those ships as affordably as possible when we go through that competitive downselect.

Senator REED. Again, just to get my perspective, it appears that the LCS Program is morphing into the frigate program. Is that fair?

Mr. STACKLEY. Yes, sir. We went from 52 LCSs. We determined—yes, sir.

Senator REED. Yeah, thank you. Dr. Gilmore points out that one of the things we have to consider is this ship gets heavier literally with these systems placed on it, that it will be lower maximum sprint speed, as he describes, with less fuel endurance. The loss of sprint speed will, therefore, affect the success of small boat swarm defenses and the ability to keep up with the carrier strike group. In fact, anecdotally, I have heard that the present ships have a difficult time keeping up with the carrier strike groups, and, therefore, are not available when needed.

Now, let me ask——

Mr. STACKLEY. Yes, sir.

Senator REED. My time is limited, so if you have a quick response.

Mr. STACKLEY. Yes, sir. First, we will be adding capability which will add weight to the ship. However, the impact on speed is marginal. Today, the requirement is 40 plus knots. These ships will

still be faster than any other combatant or warship that we have today with the added weight.

Second, a part of our—in this requirement cycle—requirement and design cycle, we are not trading off endurance. In fact, as we look at our—the competitive strategy that we are going to put out there in our best value criteria, we are—we are not just going to not trade off endurance. We are going to place a premium on being able to increase endurance. Endurance is not going to go down, and speed is only going to be affected at the margins.

Senator REED. Thank you very much, and I will—I might have some written questions for the other panelists. Thank you.

Chairman MCCAIN. Senator Inhofe.

Senator INHOFE. Thank you, Mr. Chairman.

You know, we have heard this before in the eight years I spent on the House Armed Services Committee and the 22 years on this committee. We are always talking about cost overruns. We are talking about increased—you know, the costs and delays.

I actually sat next to B–1 Bob [Former Represenatative Robert Dornan], and some you may remember the B–1 Bob, and all the problems we went through there, and then the B–2 came along, and we went through FCS, Future Combat System. Just about had everything. Same problems. It worked out Gates canceled it. Then the F–35, we have actually had tested. It is not just the Navy. This is a problem, Mr. Francis, and it is all over.

But just in terms of the Navy, Mr. Secretary, the—how does this compare to the other problems, like the DDG *Zumwalt,* in terms of delays and the things we have been talking about in this committee hearing?

Mr. STACKLEY. Yes, sir. I think all the previous discussion and testimony regarding delays in the program, the LCS delays have been unacceptable. Frankly, when we think about going forward and what we are doing different, LCS, DDG–1000, I would add CVN–78 to the mix. There is a period of time where the Navy went forward with all clean sheet designs, high risk, a lot of new development wrapped up in the lead ships. That is in our—we are still working through those lead ships, but that approach is in our rearview mirror. We are not going forward with that approach today and in the future

When we talk about LCS transitioning to a frigate, we are leveraging mature designs, mature systems, and that gives us the ability to compete this ship, this future ship, under a fixed price contract. LCS and DDG–1000 are on a cost plus——

Senator INHOFE. Well, but there—yeah. You do not need to elaborate on that because the fact that in 2013, five of the eight LCSs delivered to the Navy have experienced significant engineering casualties, and then it just gets worse and worse, USS *Montgomery.* We have talked about all of this.

But, Mr. Francis, you have been at the GAO for quite a while. How long?

Mr. FRANCIS. Forty-two years.

Senator INHOFE. Forty-two years, and you have been doing the same types of things, evaluating military systems and so forth?

Mr. FRANCIS. I have to keep doing it until I get it right, Senator.

[Laughter.]

Senator INHOFE. No, I am serious about this because you have watched all this, and one of your recommendations was—there are a lot of good recommendations in your—the final part of your statement that says, "Congress should consider not funding finding any requested LCS in fiscal year 2017, and should consider requiring the Navy to revise its acquisition strategy for the frigate." Is this one of your recommendations?

Mr. FRANCIS. Yes, sir.

Senator INHOFE. What do you think about that recommendation, Mr. Secretary?

Mr. STACKLEY. I do not propose to halt production of the LCS in 2017. As it relates to the frigate, I listened carefully to Mr. Francis' comments, and I am taking notes.

What I welcome is the committee, the GAO to sit down and look at the Navy's plan and whether or not it can be improved upon. We will take recommendations to improve upon it, but in terms of the fundamentals of locking down the requirements, stable design, ensuring that we have a competitive fixed price approach to a frigate, I think all those fundamentals that you all would want us to do, we have got in place.

Senator INHOFE. Admiral Rowden, what do you think about that specific recommendation?

Admiral ROWDEN. Sir, I agree with Secretary Stackley. It is——

Senator INHOFE. You do not agree with that recommendation and carrying out that recommendation as a partial solution to the problem that we are discussing.

Admiral ROWDEN. I am sorry, sir?

Senator INHOFE. I will read it again. "Congress should consider not funding any requested LCS in the fiscal year 2017, and should consider requiring the Navy to revise its acquisition strategy of the frigate.

Admiral ROWDEN. No, sir, I would disagree with that recommendation.

[The information referred to follows:]

The fiscal year 2017 Consolidated Appropriations Act (Public Law 115–31) provided $1,563.7 million for three LCS in fiscal year 2017. The President's 2018 submission programs the first year of FFG(X) procurement in fiscal year 2020 to define FFG(X) requirements, thoroughly evaluate design alternatives, and mature the design. To ensure we maintain the small surface combatant industrial base to support the FFG(X) procurement and leverage the efficiencies from the facilitization investments made in LCS shipyards, the Navy plans to continue LCS production in fiscal year 2018 and fiscal year 2019.

Senator INHOFE. Well, for the record, I would—I would kind of like to have you—both of you elaborate on what is wrong with that, and what is a better solution. I know we have got a long hearing here, and we have heard a lot of things. But, you know, I read these things, and particularly when it comes from someone who has been doing this for such a long period of time.

I would also say, Mr. Francis, I would like some time to sit down with you, not just on this stuff we are talking about in this committee, but on some of the others that I mentioned that we have had to suffer through, FCS and all that.

Mr. FRANCIS. I would like to do that.

Senator INHOFE. Thank you, Mr. Chairman. Thank you.

Chairman MCCAIN. Senator Hirono.

Senator HIRONO. Thank you, Mr. Chairman. I would like to follow up on some of Mr. Francis' suggestions to this committee. This is probably a question that can be responded to by either the Secretary or the admiral.

One of Mr. Francis' suggestions is that we not okay the block buy strategy for the frigates. I would like to know what would that kind of strategy or are not okaying this block buy due to the industrial base, and what kind of message would that decision by this committee give to the Navy's acquisition strategy in other programs.

Mr. STACKLEY. Well, let me—let me start by trying to describe a little bit about what the block buy itself is. We are going to go out and downselect the frigate to a single shipbuilder. We plan to procure 12. We want that shipbuilder to go out to its vendor base and secure long-term agreements with its vendors as best as possible so that pricing and stability across the industrial base will support the program.

Senator HIRONO. Mr. Secretary, if I can get a clarification then. The concern with the block buy is that it does not really interject the kind of competition that Mr. Francis thinks would be warranted. Was that your point, Mr. Francis?

Mr. FRANCIS. Well, actually, Senator, I think the competition could be done under the detail design phase. My concern is oversight for this committee once you approve the block buy. Now, the Navy will execute, and I would believe they would do a good job of trying to lay it out in a program. But your opportunity to influence what gets done is going to be largely compromised once you approve the block buy. Your ability in the future to make changes is going to be limited.

Senator HIRONO. Mr. Secretary, you—your explanation seems to go to the competition aspect of the suggestion, but apparently it has much more to do with our ability to provide oversight. When we okay a block buy, then we are letting go of the oversight responsibilities that this Congress has. Can you respond to that aspect?

Mr. STACKLEY. I disagree that you are relinquishing any of your oversight responsibilities. A block buy is still annual procurement of each ship in the block buy. There is termination liability or cancellation ceiling that the Congress is taking on responsibility for, and you will have absolute insight and oversight of the program each step of the way.

Senator HIRONO. Well, I'm sorry. You know, that is all well and good, but the entire history of this program has been that, yes, we have always had that decision-making capability. But, you know, you can go down a path, and next thing you know a ship is costing twice what it originally started because we have gone down a particular path.

I think we are at the point where listening to all of this testimony that we want to have reassurances that going forward, that we are not going to just throw more money into a program that is going to continue to haunt us with a lack of capability, and unreliability, and all the other factors that have been brought to light.

I realize you sit here and you reassure us. That has been the case at every hearing with regard to this program. But I am looking for something very concrete that we can do that enables us to

get the kind of product that the taxpayers are paying for. Aside from your reassurances, is there something very specific that you are going to do that is going to result in the kind of product that we are paying for?

Mr. STACKLEY. Well, let me just start to go down the list. Unlike the start of this program, we are not going to suffer through requirements, churn, and instability. We are not going to introduce new design late in production that are going to cause costs to go through the roof. We are not going to put these ships under contract in a cost-plus environment where the government owns responsibility for the cost itself.

I think Mr. Francis' concerns about a Milestone B, I would be happy to sit down with the committee staff and walk through what you need to ensure that you do, in fact, have confidence that all the statutory requirements in terms of cost estimates, in terms of acquisition program baselines, in terms of requirements, documentations, just like a Milestone B.

We will prepare that for you. We will prepare that for you, and we will—we will walk through it with you. If we need to establish a pseudo-Milestone B or a Milestone B, I do not hesitate to do that, ma'am.

Senator HIRONO. Thank you. I think it is really important that we have those kinds of very specific items that you are going to follow, just as the initial testimony was that this—these ships would cost some $200 million, and we are—you have been asked to justify the kind of changes. Yes, it would be good for us to have some very specific items that we can check off as we go forward if we go forward with this.

Mr. STACKLEY. I recommend——

Senator HIRONO. Thank you very much.

Mr. STACKLEY. I recommend that we work with committee staff and we come up with the agreed plan in that regard going forward.

Senator HIRONO. Thank you.

Mr. FRANCIS. Ma'am, if I—if I may, I would say while these are modifications, they are rather significant, at least the $100 million dollars per ship, and that cost has not independently validated yet. My thinking is if we are that close to being able to have everything ready for Milestone B, let us have the Milestone B.

Although there are not legal requirements for you to approve ships under a block buy, if past history is any indication, if you try to alter the plan, try to reduce the number of ships, you will be told you are going to jeopardize our prices, and you are going to affect the industrial base. Pressure will be brought to bear to keep things the way they are.

Senator HIRONO. I understand. Thank you, Mr. Chairman.

Chairman MCCAIN. Mr. Francis, I totally agree, and I have seen that movie before. This idea of a block buy before it is a mature system is absolutely insane. Again, $220 million per ship.

Mr. Stackley—Secretary Stackley to say that was really bogus. We can only go by the—by the numbers that we are given. Again, who gave us that? Do you know? Do you know who gave us the $220 million per ship instead of the $478 it will cost today? Do you know who that unknown bureaucrat was?

Mr. STACKLEY. Sir, I believe it was uniform leadership in the Navy at that time.

Chairman MCCAIN. It was all the uniform Navy that was responsible for it. I did not know that the uniform Navy was responsible for this kind of acquisition. I thought it was the civilian side.

Senator Ayotte.

Senator AYOTTE. Thank you, Chairman. I just want to thank the chairman for his very important focus on the issues with the LCS. I want to also thank Mr. Francis for his very good insight as to how we could try to really bring back some real oversight over this and the cost overruns. I thank you for that.

Dr. Gilmore, I want to on a different topic wanted to ask you, right now OT&E is currently planning an F–35 versus A–10 comparison test. I also want to thank the chairman for the work that we have done together to make sure that there is not a premature retirement of the A–10 because of its important capacity to provide close air support for our troops on the ground, and the importance of that close air support.

I have been getting some mixed signals between what has been happening with the Air Force. The Chief of Staff of the Air Force testified before this committee that the A–10—that, in fact, the F–35 will not replace the A–10. This comparison testing for what happened in terms of close air support is very, very important. In fact, I want to thank the chairman as well for working, and it was an honor to work with him to make sure that there are provisions in the NDAA [National Defense Authorization Act], which we are going to consider shortly, hopefully next week, that will make sure that this comparison test is done before there is any retirement of the A–10.

I want to ask you where the comparison test process is, and also how that process will be conducted in a thorough way.

Dr. GILMORE. I, in conjunction with the commander of the Navy's Operational Test and Evaluation Force and the commander of the Air Force Operational Test and Evaluation Center, the three of us approved a detailed plan for all of the testing in F–35 operational tests this past summer, including, in particular, a comparison test. There is a detailed design that is on the record that the three of us have approved. It does not mean that my successor might not change that, but it is a good plan, and I hope that that will not occur.

The test design includes comparison testing with the A–10 and the F–35 conducting close air support, combat search and rescue, and forward air controller airborne missions. It is a rigorous test, and if it is conducted it will provide excellent information on how well the F–35 can conduct those kinds of missions in comparison with what the A–10 can do. We are also going to be doing other comparison testing, suppression of air—enemy air defenses with the F–16 and surface attack with the F–18.

Again, the justification for all of these tests, these comparison tests, comes back to the requirements that the Air Force chief of staff has approved. Those include specifically, as I think I said the last time that I appeared before the committee where I read them from the requirements document, that the A–10 is meant to take—or excuse me, the F–35 is meant to take on the role of the A–10.

I mean, that is just unambiguously stated in the requirements document.

I understand there has been debate and testimony that is confusing about it, but you can refer to that document, and it is there in very plain English.

Senator AYOTTE. Well, that is excellent because we are going to find out whether that measures up——

Dr. GILMORE. Now, with regard to conducting that test, my projection is that the operational test for the F–35, which will include this comparison test, will not begin in all likelihood until late Calendar Year 2018 or early Calendar Year 2019, because my estimate is that mission systems testing is not going to end until July of 2018.

At that point, you could get a fleet release of the mission system's capability software together with the mission data file, which enables the aircraft to actually deal with the threat environment. The Joint Program Office's own projections are that that mission data file will not be ready until the summer of 2018. You cannot do meaningful testing until that time.

Chairman MCCAIN. Does that mean that the F–35 is not ready to engage in combat?

Dr. GILMORE. Until it has a mission data file that is verified and accredited, it would not have the capability to deal with the threats that we are spending $400 billion to have it deal with.

Chairman MCCAIN. We are dealing—we are dealing with ISIS [Islamic State of Iraq and Syria] in Syria and Iraq as we speak using the A–10.

Dr. GILMORE. Correct. That is not why we are buying the F–35.

Chairman MCCAIN. Is the F–35 ready to assume that role?

Dr. GILMORE. There are people who argue it could. I kind of wonder about that argument because right now the capability that the F–35 has is two air-to-air missiles and two bombs, with limitations in close air support that actually are discussed—that are significant and discussed in detail in the Air Force's own IOC readiness assessment, which states clearly that the current F–35 with the Block 3i software does not provide the close air support capability that our existing fourth generation aircraft provide. That is a quote from an Air Force report. I have written evaluations that are consistent with that quote.

Then there are the problems with the 35 availability. The fleetwide availability is at best 50 percent, sometimes bottoming out around 20 or 30 percent. Why it is that a commander would choose to send an aircraft that has two bombs, limited endurance, low availability to fight ISIS is, I think——

Chairman MCCAIN. The cost——

Dr. GILMORE.—a question.

Chairman MCCAIN. The cost of an F–35 is per copy roughly?

Dr. GILMORE. You know, I hesitate to give a number. It is well over the initial cost estimates. I think it is up around—it is up around—it is between $80 and $100 million. It is coming down.

Chairman MCCAIN. The cost of an A–10?

Dr. GILMORE. Mr. Chairman, I do not know.

Senator AYOTTE. Except that the——

Dr. GILMORE. A lot less.

[Laughter.]

Senator AYOTTE.—the A–10 has the lowest cost per flying hour.

Dr. GILMORE. Oh, yes.

Senator AYOTTE. I do not think we are going to have the low cost per flying hour with the F–35.

Chairman MCCAIN. I believe it is—I believe it is—I believe the A–10 is $15 million per——

Senator AYOTTE. Yeah.

Dr. GILMORE. I——

Chairman MCCAIN. Your time has——

Senator AYOTTE. May I follow up briefly, Chairman, on one other issue with regard to the A–10? Given the timing that we are hearing this comparison testing, one of the provisions that is also—that if the NDAA is passed, which we hope it is, that has been publicly released is that the Secretary—one of the issues that I have been going back and forth with the Air Force on has been the actually removal—of not ensuring that the A–10 continues to be viable.

The 2018 budget requests make sure that the Air Force cannot remove any active inventory of A–10 from flyable status due to unserviceable wings or other components. I think this is really important given the timing that you have just talked about about this comparison test and what the A–10 is doing right now against the fight against ISIS.

Dr. GILMORE. Let me just be as clear as I can be about the timing. If I am correct, we would not start training for the operational test until mid-2018, which takes about six months. Then the test would be conducted beginning in very late 2018 or early 2019. By the time the test is over and the reporting gets done, another year has gone by. The report that is mandated in the—in the bill would not be available until the end of 2019 or early 2020.

Senator AYOTTE. Thank you.

Chairman MCCAIN. Senator King.

Senator King. Thank you, Mr. Chairman. As I listen to this discussion, it strikes me that it would profit us—profit us to talk about a broader issue. Mr. Stackley, first I start with the premise that nobody involved in this process was malicious or meant to do harm. I want to say that you are one of the most capable officials that I have met in this—in this business.

However, we could have had this same hearing today and you cross out "LCS" and put in "F–35." You cross out "F–35" and put in the "new class of carrier." You cross out the "new class of carrier" and put in the "future combat systems." It seems to me there is a more—a deeper issue going on here, and it strikes me that it is our desire to have the latest and greatest new technology as soon as possible, and at the same time control costs and do it on time. We are trying to invent things while we are building them.

Could you comment on this larger question?

Mr. STACKLEY. Senator, I think—I think you nailed it right there. We have spent a lot of time reviewing programs that either have failed or have just gone out of bounds in terms of cost and schedule, and almost invariably there are common themes. One of them is a lot of concurrency in terms of developing multiple technologies and trying to integrate them at the same time on a major

weapons platform or major system. There is—and GAO has written a number of reports.

There is an inclination to underestimate the cost——

Senator KING. Particularly of something that has never been built before.

Mr. STACKLEY. Yes, sir. Yes, sir. Then, when you get into that contract environment and you get started, it is difficult to stop. You press forward. Now——

Senator KING. On the other hand, if you stop and say we are going to fully test—build a prototype and fully test, then that is going to lengthen your——

Mr. STACKLEY. Yes, sir.

Senator KING.—your deployment window, and that conflicts with the need of the Navy, or the Air Force, or the Army to have these weapons to meet current threats.

Mr. STACKLEY. Yes, sir. What we are doing is, and this is the CNO and myself. We are co-chairing requirements reviews, design reviews, production readiness reviews, program reviews. We are—we are challenging every requirement, every specification in terms of do we absolutely have to have that, or is there another way, a less—a lower risk way to deliver the ultimate capability that we have got to have.

I would point out a couple of examples. The decision to, frankly, to truncate the DDG–1000 and to revert back to the DDG–51 was a recognition in the 2009 timeframe that we had overreached in terms of technology versus what we really needed in terms of warfighting capability. We go back to the tried and true DDG–51——

Senator KING. But that—but that decision made it likely that only building three ships——

Mr. STACKLEY. Yes, sir.

Senator KING.—in one class was going to make them more expensive and all that.

Mr. STACKLEY. It is going to drive cost into those three ships, but——

Senator KING. The first DDG back in the 80s was very expensive.

Mr. STACKLEY. Yes, sir, but what it avoided was the recognition—it recognized the cost that was coming——

Senator KING. Right.

Mr. STACKLEY.—in terms of completing that ship program. Then going back to the 51 and incrementally introducing the capabilities that we need to keep pace with the threat, particularly in the 51's mission areas.

Senator KING. The key word is "incrementally," not trying——

Mr. STACKLEY. Absolutely.

Senator KING. We had a hearing on carriers, and as I recall, what we learned was we were trying to do too much in the—in the new carrier.

Mr. STACKLEY. That is exactly right. The original carrier concept was incremental over three ships. It was collapsed onto a single hull ole called CVN–78, and we are paying the price in terms that concurrent development and integration on that ship.

Senator KING. Okay. How do we avoid this in the future?

Mr. STACKLEY. Well, we——

Senator KING. We have got the B–21 coming down the road.

Mr. STACKLEY. I gave you the 51 example. On the next amphib, the LXR, we threw away the notion of a clean ship sheet design. We took the proven LPD–17 hull form, and what we are doing is tailoring that ship to meet the requirements associated with replacing the LSD–41. That was a year-long effort with myself, the commandant, and the CNO co-chairing those design reviews to get down to a design that we are confident that it is mature enough. We are not introducing unnecessary risk. We understand the cost, and now we are ready to put it into the——

Senator KING. It seems to me, though, that one of the—one of the things, and I know I am running out of time. But one of the things we need to think about is how to design these weapon systems in a—a way, and I hesitate to use the word—the word "modular" because that is not a good word in today's hearing, but in a modular way so that they can be upgraded as technology improves instead of having to rebuild the whole—the whole thing.

Mr. STACKLEY. We are getting there. It is open architecture, that general term. If you take a look at the vertical launching system on the DDG–51, that is an open system design. It started off with the SM–2. It now handles the SM–3. It handles the SM–6. It handles the Tomahawk. It handles the evolved cease-fire missile. Now we can develop the missiles in their environment and bring them to the ship, and then we will deal with the upgrades to the software and the land-based system.

Senator KING. The whole system is not—is not built from scratch.

Mr. STACKLEY. Yes, sir.

Senator KING. Mr. Chairman, thank you very much for holding this hearing, and I look forward to future hearings. I hope we can continue this broader discussion of why does this keep happening. Thank you.

Mr. FRANCIS. Mr. Chairman, could I follow up for a moment with Mr. King? Mr. King, I think you are right on about the broader problem, and we have done quite a bit of work. I think what we have is an age-old acquisition culture problem where there are really strong incentives when a program is getting started to over promise on its abilities to perform and underestimate cost and schedule.

Senator KING. To load requirements on.

Mr. FRANCIS. To load requirements on, especially if you are only going to have platforms once a generation, you had better get everything on that platform you can.

We have to look at what those incentives are and why they occur, some as competition for funding in the—in the Pentagon. If you show any weakness, your lunch is going to get eaten. Your program is not going to go forward. You have to be a strident supporter of those programs going through.

We have to learn where to take risk and how to take risk, and I would say it is before that Milestone B decision. That is where we really need to make investments, and try things out, and be willing to put money there.

You're right, there is—there is an aversion to if we take time to do that, that is going to delay the capability of the warfighter, and

we find that to be unacceptable. But when we have approved the program and then it runs into delays, we find that is acceptable. I think we can get it right.

I empathize with Secretary Stackley. He is in a very difficult position, and I think he is one of the best service acquisition executives I have—I have had the pleasure to work with. But he is charged dually with executing these programs and defending the programs, and that is a very tough position to put somebody in, but our acquisition process demands it.

Dr. GILMORE. Mr. Chairman, I know—I would just like to say one thing on this topic based on my experience over 26 years. What we have to do is quit denying the facts. There are plenty of facts that were available about what was happening with LCS all along. Yet as recently as 2013 when it comes to the Mine Countermeasures System on LCS, that Navy testified, and I will quote here, "Most of the systems in the first few increments consist of off the shelf products. The risk in these early increments is very low and very well managed." That turned out not to be the case. Again, in 2013 the Navy testified, "The linchpin of the MCM package, the remote—the RMMV, now has over 850 hours of reliability growth over the span of 47 missions in five months, which has shown the mean time between operational mission failure substantially exceeding requirements."

That statement was absolutely incorrect. I have been reporting for several years that those claims were incorrect, and the program office and the Navy could not bring themselves to deal with what the facts were. Ultimately, they did to their credit with the independent review team.

But what I have seen repeatedly is an inability, a refusal to deal with what the facts are of how well the systems are or are not performing, and it is because of these incentives and other the other things that have been discussed. But it keeps happening, and it is a real problem.

Chairman MCCAIN. Doctor, that is why some of us express such extreme frustration because we are only as good as the information we receive as that the LCS would cost $220 million dollars per ship, which now Secretary Stackley says, well, that was absolutely wrong. Nobody said it was wrong at the time. Everybody said it was right.

I do not want to take the senator's time, but there are two stories here that I could relate to. One was the MRAP [Mine Resistant Ambush Protected Vehicle], which we needed very badly in Iraq, and then the Secretary of Defense had to preside over a weekly meeting in order to get the MRAP to the battlefield to save lives from the IED [improvised explosive devices]. Then we had the other extreme, an RFP for a new pistol that is 200 hundred pages long, for a pistol because it has gone through layer, after layer, after layer, after layer.

The reason why I am frustrated and other members are, we are only—we can only make decisions on the information we get. If that information is incorrect or false, as Secretary Stackley just said about the LCS, then how can we function effectively for the people we represent? That is why you sense this frustration here

amongst members of the committee, including this chairman, because we see it time after time.

We have not even talked about the aircraft carrier, and the arresting gear, and the catapults, but—and I do not want to take more time of the committee. But I hope that our witnesses understand that we have to bring this to a halt. Fooling around on the fringes is not—has proven to be unsuccessful.

Senator Ernst.

Senator ERNST. Thank you, Mr. Chair. I agree with the chair that we have to have honest brokers, and we have to have people that will be held accountable. I do not know that we have seen that so far. But I do want to thank all of you for coming in today.

As you may be aware, improving acquisition program management is a priority for me, and I have passed legislation to improve program management government wide. Not just in the DOD [Department of Defense], but government wide, with an emphasis on areas that are designated by GAO as high risk. This especially includes DOD acquisition program management.

I know we can all agree that this LCS has become really an example of one of those DOD challenges. We mentioned the aircraft carrier. We will not go there today, but that is another one that we need to take a look at.

But during times of defense spending caps, we know how difficult it is, and we have looming entitlement spending which will further squeeze our military budgets. We cannot have repeats of acquisition failures like we have seen with the LCS. Acquisition success is bottom line a matter of national security.

This is a question for all of you, if you could just briefly respond, please. The LCS program changed its acquisition approach several times, something cited by the GAO as a reason for the increase in costs, and it also created performance issues. In your opinion, would the LCS program and others throughout DOD benefit from a standardized approach to managing the portfolio based on the best practices, not only of the industry, but also the government, before fully moving forward? If you could briefly respond, please, starting with you, Mr. Stackley.

Mr. STACKLEY. Let me just describe that, you know, the experience of LCS, it broke the Navy, and we retooled the entire way that we do business when it comes to acquisition programs, and I think we are trying to pull best practices in. I described CNO [the Assistant Secretary of Navy] and RDA [Research, Development, and Acquisitions] sitting side by side reviewing requirements, reviewing specifications that lead to design, that lead to production.

We have our program managers pretty much under a microscope right now, and we have taken things like cost, and we have put cost into our requirements so that you do not get to—you do not get to ignore cost while you are chasing a requirement. Just like speed, range, power, and payload, if you start to infringe on the cost requirement that we put—we put into our documents, then you have to report to RDA and CNO just like you do if you infringe on one of the other requirements. You have to identify what are you going to do to revert that, either trading away or otherwise. We would look at either canceling or, if necessary, padding costs to the program.

Senator ERNST. Would that have been good to have had before the process was started?

Mr. STACKLEY. Absolutely. Mr. Chairman's reference to the $220 million ship, the witnesses that informed the Congress, I do not think they knew. I do not think they knew or understand what this ship would cost. The system led to information that was provided.

Chairman MCCAIN. If they did not know, why did they tell the Congress that it would be—that the cost would be——

Senator ERNST. Absolutely.

Mr. STACKLEY. Because I think they believed or they desired it strongly enough that they believed that it would cost $220 million, but the underpinnings below that was broken. That is why I am sitting side by side with the CNO reviewing our programs, holding program managers accountable, understanding the details of the cost element by element, time phase by time phase. If we need to make trades, we will make trades.

Senator ERNST. Very good. Thank you very much. Vice Admiral?

Admiral ROWDEN. Yes, ma'am. With respect to the application of lessons learned, feeding back into the acquisition system and from my perspective as a—as the commander of the Surface Forces, clearly one of the things I think that the review that we recently conducted, the 60-day review, showed that we needed to take a—take a step back, take a pause, and apply, and look at what lessons we had learned associated with the program, and make the appropriate adjustments in order—in order to get the value down to the combatant commanders, in order to get the operational availability of the ships up.

I think that the—it is a constant process, and I know that we will be continuing to look at the ships as we continue to deploy more of them, applying those appropriate lessons as we—as we learn them, and then feeding them back into the system. As it applies to the acquisition system, if we can apply those lessons back, then certainly we are going to do that.

Senator ERNST. Dr. Gilmore, if you could respond as well. It is well and good. I am amazed that we are only now just discovering that we should be reviewing these processes and having a finished product in mind before we start the process. Could you respond, please?

Dr. GILMORE. We should use best practices, and if you read the Department's acquisition—the documents that describe its acquisition process, they incorporate most of these best practices that people talk about, except they are often waived.

What I have watched over 26 years is what I call a constant search for process solutions to what I think are fundamentally leadership problems. When leadership is presented with a cost estimate that a number of people, and I was working at CBO [Congressional Budget Office] at the time when the original cost estimates were put out, and we were warning that they were probably quite low. When leadership does not make itself aware, does not critically question the information that it is being given, and lets it go forward, that is a big problem. A process can help give them that information, but if they do not do their jobs as real leaders and critically question the information that they are being given

and that it is being recommended that they send to the Congress and elsewhere, then they are failing.

I have watched those kinds of failures occur for 26 years, and it—I am certainly for process improvements. If you have a bad process that stops information from getting forward from the, you know—does not enable the reviews to peruse that information to occur, then that is all bad. But if you have leadership that does not do its job, those process solutions will not fix things.

Senator ERNST. That is very well put, Dr. Gilmore. Thank you. Mr. Francis?

Chairman MCCAIN. Senator Blumenthal.

Senator ERNST. Thank you.

Senator BLUMENTHAL. Thank you, Mr. Chairman, and thank you for having this hearing. Thank you to each of you for being here today, realizing that this topic is a challenging one for you. But as the chairman said at the very beginning quoting Ronald Reagan, "Facts are stubborn things," and leadership is important.

Dr. Gilmore, I find your testimony probably the most damning document concerning any government program I have ever read, not just as to what has happened in the past, and my colleagues have amply and ably focused on the procurement process, but the decision what should we do going forward. Not only is the survivability of this ship in question, but is very ability to accomplish the essential missions and endure the testing that has been reduced, in effect, because the ships are not sufficiently shock hardened, and, in fact, its cybersecurity defenses are not amply developed.

In this approach that Mr. Francis has outlined of a procurement process rather than a block purchase, what is the case now for going forward with this program at all?

Dr. GILMORE. Well, sir, it is not my purview to say what ships the Navy should buy or what capabilities the Navy should have in those ships. That is—that is the Navy's decision. What we have seen is that the ships thus far are not meeting the Navy's own performance requirements, and we are well into the program.

I cannot predict what the future will hold. I know it sounds parochial, but I will say it again. I said it in my opening comments. Whatever the Navy decides to do with regard to going forward, the history here in this program, as well as in many other programs, is clear, and that is that the only way you are going to discover the problems with performance that are significant that you will have to deal with, you have to deal with before you send sailors into harm's way in combat. You do not want to discover these problems for the first time when you are in combat.

Senator BLUMENTHAL. Well, that——

Dr. GILMORE. The only way you're going to discover those problems is by doing realistic testing along the way.

Senator BLUMENTHAL. I agree completely that you want to fly before you buy, which apparently has not been done here, and obviously test before you use the ship in combat. But what is—what assurance can any of the witnesses give us that the ship is actually going to be capable of accomplishing its mission and protecting the sailors who are going to be on board?

Dr. GILMORE. Well, the—again, we can give you information along the way about how well the ships and the crews are doing

with regard to what the Navy expects the ships and crews to do. Of course, the Navy's views of what the Navy—the ships and crews are going to do is changing along the way as they learn more, which is appropriate. Which is appropriate. It is late in the process, but it is appropriate.

You are never going to get from me or anyone else an honest, ironclad guarantee that the ships are going to perform the way people now say they hope they will. Those hopes are sincere, but, again, and I know it sounds parochial. What you have to continue to do is to do the testing that will tell you along the way whether your hopes are actually going to be realized, not deny the results of that testing, and adjust accordingly along the way. Now, finally, the Navy is doing some of that adjusting, and I actually commend them for it, but it took a while for all that to occur.

Senator BLUMENTHAL. Admiral, did you have a comment?

Admiral ROWDEN. Yes, sir, if I could just add. There are a number of things that we are doing to ensure the value of the ships to the combatant commanders as they go forward. In my discussions with forward commanders, both in the Mediterranean and the Western Pacific, one of the things that they constantly tell me is we cannot get enough of these ships here to provide the presence and to provide the operational availability forward.

I am excited about the direction that we are taking the ships. I am excited about the capabilities that we are bringing to the fleet. I am excited by the conversations that I have with the sailors on the ships as they look forward to innovating with the capabilities that we are delivering forward.

There is no doubt that we have a lot of work to do, but as recently as 18 months ago, one of the things that we did was we stood up the Surface and Mine War Fighting Development Center, an organization that we are building, which mirrors a similar organization that the aviation community has had for a long time and the submarine community, where we can take those good ideas, take the equipment and the—and the—and the capability that the acquisition system is delivering, and put that in the hands of the sailors and get it forward.

I think that what we are finding and what I am finding as I talk to these young men and women that take these ships to sea, yes, there are problems, and they are—and they are not shy about telling me what needs to be fixed about the Littoral combat ships. But they are also very excited not only about the potential or the capabilities that they do deliver, but also that the potential that are built into these particular ships.

Senator BLUMENTHAL. Thank you.

Mr. FRANCIS. Mr. Blumenthal, may I make a comment? As regards to the ships, once you do produce a hull, then the Navy is going to have to support it. For the ones that we have already committed to and are under contract, the Navy will have to do whatever is required through mission equipment and so forth to make them viable. As we know, there is no guarantee it is going to work out the way we thought. It is hard to—hard to say, as Mike Gilmore said.

The Navy is committed to the full buy of LCS and the frigate, and they are obviously entitled to that decision. But you have to

make your own decision. It is at least a $14 billion commitment, and there are opportunity costs. Really the question for the committee is, is that the next best use of $14 billion.

Senator BLUMENTHAL. Thank you very much. Thank you, Mr. Chairman.

Senator MCCAIN. Senator Tillis.

Senator TILLIS. Thank you, Mr. Chair. Mr. Chair, I hate to take exception to something you said earlier. You said that the handgun RFP was 200 pages. It is actually almost 680 pages, and it has been in the works for 10 years. It is a shining example of a, to me, disastrous procurement process.

Chairman MCCAIN. Thank you for that correction.

Senator TILLIS. But the acquisition people did tell me that there are only 39 nine pages of specifications, so I asked them are the other pages just blank pages for notetaking, or are they relevant to the acquisition.

Mr. Francis, look, first off, I believe everyone here is trying to do the very best to put warfighting capabilities out there to protect our men and women and to let them accomplish their mission. I think everybody's intention is to do that. Mr.—or Secretary Stackley, I think you have inherited a problem. There is a great joke that I will not use my time on now that talks about the difference between a bear skinner and a bear hunter, and you are trying to skin a bear that somebody took down. They did not quite wrestle it to the ground. I appreciate the fact that you are dealing with something and expectations that were set back over a decade ago. I do think that there are things even in this Administration that we have to face up to in going forward.

Mr. Francis, I worked in complex consulting environments in research and development. When we would go about estimating large projects, we would use past history as a basis for going out and creating an estimate for what we are doing now. Once we did that, we would still handicap it with examples of other projects that we did not hit our—did not hit our mark.

It seems to me until we come up with an acquisition process that actually comes close to its original mark, we have got to start handicapping any estimates here. In my—if I go through the LCS, the F–35, the carrier, the future combat systems, it would seem to me anytime someone comes in here—either you or your successors come in here, I should multiply somewhere on the order by two or two and a half times the amount of money and the length of time that is going to be necessary to deliver this platform, because past history has proven that to be the case most of the time. Would you agree with that?

Mr. FRANCIS. I would, sir.

Senator TILLIS. I have to ask you just as a point of interest on my part, I do not know how on earth anybody who has worked in your—in your position for 42 years could possibly have the amount of hair that you do——

[Laughter.]

Senator TILLIS.—because I have got to believe you are tearing it out. I mean, why can we not front end load—the insights that you are providing here, why can that not be instructive to the estimating process to begin with? In other words, in the same way that

we would handicap these large, complex projects, not anywhere approaching the complexity of what we are talking about here in the IT world, why do we not have a function that says, you know, you guys, you think you have got it, an ideal circumstance, $200 million, it is going to be great, time horizon. But then have somebody come in and say, but because all of you have been consistently and habitually wrong, we are going to require handicapping of some multiplier.

Why should we not have that sort of methodology until we actually get our act together and deliver something on time and on budget?

Mr. FRANCIS. It is a really interesting discussion. Then, if you look at the private sector and I think this is the point the chairman is getting to, accountability is pretty clear. I mean, if you blow the estimate and you cannot sell your product at a profit, then the company loses money, and you know who is accountable.

Senator TILLIS. Mr. Francis, I want to keep to my time. I know that the committee has gone long. But that is another point that the chair has made and a source of frustration for many of us that I think we also have to change in the procurement process. I used to call them memorable moments.

When I would have a team who would come out and do these sorts of estimates, and then we do the handicapping, I would put a tag on every single one of them. Who was ultimately responsible for this, whether the supplier—whether inputs or, in my case, subcontractors, staff on board. I would create a memorable moment so if that person still worked for the government at a point in time that we were two and a half times over a cost or two and a half times over time budget, they lost their job.

I think that in this process we have to start looking that way, we are going to continue these poor results, and we are going to continue to be frustrated at the expense of having more money to put to more warfighting systems that make our men and women safer and more—and the probability of our completing our missions more likely. I think we have to start doing this.

I am going to reach out to your office and speak with you about maybe how we can front end load some of this handicapping. It is clear to me it has not happened. If it has happened, we have got incompetent people doing it. Thank you, Mr. Chairman, and I yield back my time.

Dr. GILMORE. Senator, could I just——

Senator TILLIS. All two seconds.

Dr. GILMORE. Senator, could I just add something because in my previous life I actually worked as a career person in what is called cost assessment, is now called Cost Assessment and Program Evaluation [CAPE] in OSD [The Office of the Secretary of Defense]. There is a group there that does cost estimates. There are independent cost estimates, independent of the services and the program offices, cost estimates of programs.

They do it on the basis that you just described, historical experience. There is a very rigorous process that exists and good literature that exists about how to do that, and they do it very well. They present their estimates, and then the acquisition leadership starts rationalizing why the next time this time things will be dif-

ferent, things will be better. They go through the handicapping that you talked, but in exactly the opposite way that you just described.

Mr. STACKLEY. Sir, if I may, Dr. Gilmore's description of the role of the CAPE cost estimating is correct. His description of what happens between the acquisition community and the CAPE regarding that estimate is not correct.

Senator TILLIS. But the bottom line—the bottom line, Secretary Stackley, with all due respect——

Mr. STACKLEY. Oh, yes, it is.

Senator TILLIS.—and I have gone over—with all due respect, they have been wrong. The LCS, the F–35, the carrier. If I had more time, I would ask Mr. Francis in his 42 years many—this is a bipartisan failure. It has transcended Administrations. But at some point you have to look at history and recognize history for what it is. It is the only way you will not repeat the mistakes.

The fact of the matter, if somebody wants to come up to me and say, you know, Senator Tillis, look at all these programs in DOD that we have gotten right, it is just unfair for you to say that we are off almost every single time, I do not believe that the data would be very compelling to support that argument. Let us figure out a way to handicap it so that we can have discussions and set realistic expectations so that we can help the warfighter.

I am sorry, Mr. Chair. I have gone over. Thank you.

Chairman MCCAIN. Secretary Stackley, you wanted to comment.

Mr. STACKLEY. No, sir. What I was going to—well, two things. One, I think we owe you the data. I think we—as a task here we should be providing the data in terms of cost growth on programs, and it is not a pretty picture cost growth programs over history.

My comment with regards to the CAPE's estimate, I cannot point to many programs in the Navy, I cannot think of any off hand, where we are not, in fact, budgeted to the CAPE's estimate, with the exclusion of programs where we have a fixed price contract in hand, and so we do not budget above the fixed price. I think we actually try to work very collaboratively with the CAPE to arrive at the best estimate for our programs going forward.

I would go back Mr. Francis' discussion regarding the importance of Milestone B and getting—that is the critical point where we have got to get it right, lock in the program baseline, get the independent cost estimate as best as possible, budgeting the risks and everything else accounted for. That is—that is the critical point. In fact, LCS went forward without a Milestone B. That rigor was not there.

Chairman MCCAIN. On, again, wonders why and who did it. Senator Graham.

Senator GRAHAM. Thank you, Mr. Chairman. Admiral, we have gone from 52 ships to 40. Why? Why are we going to just buy 40 of these things?

Admiral ROWDEN. The requirement for the Small Surface Combatant remains 52. So——

Senator GRAHAM. But Secretary Carter said we are going to build 40. Is it because of budgets?

Admiral ROWDEN. That was a budget driven decision, yes, sir.

Senator GRAHAM. Okay. One, the committee needs to know sequestration probably. Is that right? Is that right, Mr. Secretary?

Mr. STACKLEY. Let me weigh in. The Budget Control Act, yes, sir. Secretary Carter's decision was we have to take risk due to the budget and where we are going to take risk——

Senator GRAHAM. Okay, I got you. He said I got to do something because I just do not have enough money, so I am going to, like, go from 52 to 40. Admiral, you said that people out in the field out on the—you know, fighting the wars and preventing wars, they like this. They want more of these ships. Is that right?

Admiral ROWDEN. That is correct, sir.

Senator GRAHAM. Okay. What does this ship do that is so important? What can it do that is different than the ships we have today? Very briefly.

Admiral ROWDEN. Well, certainly, sir, as we—as we move forward, the building of the—of the—of the——

Senator GRAHAM. Is it more stealthy? What makes it different?

Admiral ROWDEN. It gives us—it will deliver higher operational availability forward. I think it will give—deliver more capacity forward I think as we bring in the minesweeping capabilities, as we bring in the anti-submarine capabilities, which I think will significantly improve our ability to hunt and track——

Senator GRAHAM. Is this a modernization program? Are we trying to modernize ships? Is that what this is about?

Admiral ROWDEN. Well, certainly the advanced technologies will be—that we will deliver will be—will be of much use to the—to the—to the sailors as we move them forward, yes, sir.

Senator GRAHAM. Okay. All right. Modernization of the existing fleet is one of the goals to be achieved if this ship comes online, right, and operates. It would be more effective.

Admiral ROWDEN. Yes.

Senator GRAHAM. That is why we are doing this, right?

Admiral ROWDEN. Yes, sir.

Senator GRAHAM. The reason we are not building 52 is because of money, not because demand. The world is not safer to justify 40 versus 52. Is that correct?

Admiral ROWDEN. That is correct, sir.

Senator GRAHAM. Okay. When it comes to estimating ships, who actually said $220 or mean whatever the number was?

Mr. STACKLEY. Sir, we are going to have to go back to the record——

Senator GRAHAM. All right. Let us do that.

[The information referred to follows:]

OPNAV memo regarding "Objectives for Family of Ships Concept Studies" dated July 8, 2002, stated that $220 million (fiscal year 2005 dollars) was the targeted goal for ship construction cost of one LCS.

Mr. STACKLEY.—the leadership.

Senator GRAHAM. Right. Well, that is a lot of people. Let us find the guy or gal or the groups of guys and gals that said it is $220 million, and see who they are, and figure out what we should do about that. I think we should, like, call him in Mr. Chairman, and talk to them.

This $448, why did it go up so much? Was it because we asked for things additional to what was originally required? Was it sort of add on capability?

Mr. STACKLEY. Sir, the one major change that was done to the program early on after contract award or commensurate with contract award, was we changed the specifications to go to what is referred to as naval vessel rules to give it the degree of design details associated with——

Senator GRAHAM. How much did that add to the cost?

Mr. STACKLEY. It is hard to pin a number on it, but it created extraordinary disruption at the front end of the program.

Senator GRAHAM. You cannot blame the original people who gave the cost estimate because they were not confronted with that requirement.

Mr. STACKLEY. That is a good point that that requirement was added after the $220.

Senator GRAHAM. Who put that requirement on?

Mr. STACKLEY. I would have to go back to the record to find out.

[The information referred to follows:]

Many factors contributed to the rise in cost per ship of the LCS compared to that originally bid by industry, some of those due to specification changes.

The January 2004 LCS Final Design Request for Proposals (RFP) included the Navy's intent to classify LCS to the new American Bureau of Shipbuilding (ABS) Naval Vessel Rules (NVR). This occurred prior to the final ABS NVR rules which were not available until May 2004 (Note: the NVR development was primarily tied to DDG 1000 need dates). The ABS NVR were developed to create a less prescriptive means to specify ship requirements than Military Specifications (MILSPECS), and also represented a shift away from design specifications to performance specifications. The Navy stated its intent to develop and impose these requirements, but industry bids developed and submitted in March 2004 did not completely capture the impact of the final ABS NVR. The LCS industry bids were based on commercial designs to contain cost. However, the commercial design did not meet many key LCS requirements and the cost to modify the designs was underestimated. After contract award, industry and the Navy worked to change the design specifications to one which would meet Capabilities Development Document requirements and could be approved and certified by the Navy. In addition, complete details of mission package interfaces were not available at RFP release for industry to adequately bid, and industry underestimated the cost of mission package integration. These and all other changes were contractually settled with each industry team through the LCS Engineering Change process.

In addition to the above specification changes, there were documented requirements for rapid delivery of LCS to the Fleet. These requirements resulted in initiation of ship construction prior to design completion, resulting in rework, schedule impacts and cost increases.

Senator GRAHAM. I want to find out who did the 220. I want to find out who said it needs to do this, not that so we can talk to them as to why they decided that. Mr. Francis, do you have any idea who did that?

Mr. FRANCIS. I do not remember at this point, Senator. But I think what happened with the ship is it was thought to be a relatively simple derivation of high-speed ferries of commercial vessels when they got in, and they made that estimate before they entered the detail design. When they got into detailed design and they got naval vessel rules, then they found out it was way more complicated than they thought. That was——

Senator GRAHAM. They found that out after they started building the thing.

Mr. FRANCIS. Yes.

Senator GRAHAM. Okay. I want to end with this. If we do not modernize our force, we will pay a price. The A–10 works today, but it is not going to work forever because we will not be fighting ISIL forever. There will be an environment where the F–35 makes more sense. It makes no sense to me to retire the A–10 because it actually works. But all of us need to know what you are trying to do is modernize the force so that the next war we are in or the next war we need to prevent that we are capable of doing both, right?

Modernization is not an exact science. Part of the problem is when you modernize your force, it is not like just duplicating something. It is not a commodity. But what have I learned, that in the effort to modernize the force, our estimates of what it cost and the capabilities we need are ever changing. The process is completely broken, and it goes back to what you said, Doctor, about leadership.

If you want this to stop, somebody needs to get fired. One of the reforms we did in this committee is to make every Service Secretary and Service Chief responsible for the big programs under their control. Hopefully in the future someone will be held accountable and get fired if this happens again. If nobody ever gets fired, nothing is going to change. Thank you.

Chairman MCCAIN. Senator Sullivan.

Senator SULLIVAN. Thank you, Mr. Chairman.

Dr. Gilmore, I wanted to follow up on some of the questions you received from Senator Blumenthal. You were talking about kind of the hopes that you had. Matter of fact, I think you use the word "hopes" three or four times just in answering the questions on the capability of the ship. But in your written testimony—your written testimony is not full of hope at all, so let me—let me read a little bit of what you said with regard to the written testimony.

"With respect to survivability, neither of the LCS variant is expected to be survivable in high intensity combat. Neither of the LCS designs include survivability features necessary to conduct sustained operations in a combat environment. The LCS' limited lethality makes these ships a shadow of the abilities of modern Navy frigates.

With regard to combat capability, you seem very concerned, so let me ask him more operationally focused question, Admiral. Given what Dr. Gilmore said, do you think—are you confident that these ships could, say, for example, go into the South China Sea, conduct a FONOP [Freedom of Navigation Operation] near Mischief Reef or other places, and be able to survive if Chinese frigates responded with force, or could an LCS in the fleet today survive attacks from small boats and other patrol craft like the ones that were used in the recent capture of American sailors by Iran? Are you confident of that given what Dr. Gilmore clearly states is a ship that is not combat survivable?

Admiral ROWDEN. Yes, sir, I am. I——

Senator SULLIVAN. Are you, Dr. Gilmore?

Dr. GILMORE. No, for the reasons that are stated in detail and all the reporting that I have done at the classified level and other levels.

Senator SULLIVAN. Admiral——

Dr. GILMORE. These ships—the original vision for these ships was that they could use unmanned systems that would go in and conduct combat operations, and they could stand off away from threats. But those unmanned systems that can reach out and conduct combat operations we do not have, and it is not clear when we ever will.

The ship was built to not be nearly as survivable, as, for example, the Frig 7s [*Perry*-class Frigates] that we used to have. It was built according to high-speed naval vessel rules, which fundamentally limits the amount of compartmentalization and redundancy you can put on the ship. It is not nearly as survivable as other ships, and, frankly, it was not meant to be in that regard.

The original CONOPs [concept of operations], if it could be—ever be realized, that might have been fine. But as I understand the CONOPs and the way it has been written, and the Navy is continually revising it based on what it learns, the CONOPs still says that the ship would be out there preparing the way for the battle fleet. If that is true, then it will be subject to attack by anti-ship cruise missiles, torpedoes, and mines. The Navy's own requirements show that the only the—only thing the Navy expects if it is hit by one of those kinds of threats is for it to be able to exit the battle area and/or provide for an orderly abandon ship.

Against those kinds of threats, which ASCMs [anti-ship cruise missiles], for example, the Chinese are fueling thousands of them, and they are supersonic, and they are very threatening. Those are going to be a challenge for any ship, but a particular challenge for this kind of ship.

Senator SULLIVAN. Admiral, how do you respond to that, and, you know, are you—are you confident, you know, in putting our marines and sailors on these ships to conduct those kind of operations, say, again, in the South China Sea or a standoff or a confrontation with Iranian small boats?

Admiral ROWDEN. Yes, sir. There are a number of variables that go into the equation associated with the survivability of the ships. Certainly, the manufacturer of the ship, the watertight integrity of the ship, the way the ship is manufactured. That is part of the survivability. Part of it is the damage control systems that we put on the ship in order to ensure the survivability. Part of it is the defensive systems that we put on——

Senator SULLIVAN. You do not—you do not agree with Dr. Gilmore's written testimony.

Admiral ROWDEN. I think there are a number of—there are a number of variables that have to be looked at when you look at the survivability of the ship. For example, one of the variables that you have to look at is the intensive training that we provide to all of our sailors, not only to fight the ships, but also to fight battle damage.

I go back to the example of the USS *Samuel B. Roberts* that hit the mine in the Arabian Gulf. Every analysis said that ship should have gone to the bottom of the Arabian Gulf. It did not. Those sailors fought, and they saved that ship. That is—and that is one aspect that I think is sometimes lost in talking about the survivability of a ship.

Clearly, we do not want to have any of our ships get hit, and we—and we—and we rely on operations, we rely on intelligence, we rely on operating those ships to hopefully not have to lean into a punch.

Senator SULLIVAN. Despite Dr. Gilmore's written testimony, you are comfortable putting marines and sailors on these ships in combat situations against Chinese frigates or Iranian naval ships.

Admiral ROWDEN. Yes, sir, but I think you have to take it in the proper context in that I do not think that necessarily we would find these ships operating alone and unafraid in the middle of an adversary's fleet.

Senator SULLIVAN. If they were?

Admiral ROWDEN. If they were, then I think that we would do our best to fight the ship, and we would do our best to defend the ship. If the ship took a hit, the crew would fight to save the ship and exit the area as the ship is designed.

Dr. GILMORE. Can I add something, Senator?

Senator SULLIVAN. Sure.

Dr. GILMORE. We do something called a total ship survivability trial, and it gets at exactly the issues that the Admiral was just raising. Now, of course, we do not actually let an ASCM, an anti-ship cruise missile, hit a ship. Obviously not. But we do have the crew there. They are trained in all the damage control measures that they are supposed to take. We do then go through a simulation of one of these threat systems, like an anti-ship cruise missile—we have done this—hitting the ship—we have done this for the LCS. We then have the crew fight to save the ship.

In the total ship survivability trials that we did, the crews did their best, but in almost every instance there was major damage to the ship, and the combat capability was fully lost. In some instances, the ship would have been lost.

Again, an anti-ship cruise missile hit on any ship is going to be a problem, no doubt about it. But a hit on one of these ships with their lack of redundancy, their lack of compartmentalization, which is driven by, you know, their small size and the speed requirement, and their construction according to high-speed naval vessel rules. A hit on one of these ships is going to be a real problem, and we have analyzed that, and we have done the kind of testing that enables the crew to fight—try to fight to save the ship. There are definitely problems with these ships.

If you can keep them out of harm's way, okay, but the current CONOPs says that they will be out ahead of the battle fleet preparing the way. Again, they will—if they are going to do that, they will be subject to being hit and attacked by these threats.

Chairman MCCAIN. Senator Cruz.

Senator CRUZ. Thank you, Mr. Chairman. Good morning, gentlemen. Thank you for your testimony this morning, and thank you for your dedicated service to our men and women in uniform.

The near peer threat we are facing is increasing across the globe, with our Nation's adversaries bolstering their defense capabilities and focusing on new technology in the hopes that they can deny access to the United States Navy or, if necessary, compete militarily with the United States in a more limited scenario.

Recent acts of aggressions by our adversaries prove that the men and women in the United States Navy operate in an incredibly difficult environment every single day. Whether facing threatening shows of force from Iran, Russian belligerents, and unsafe practices, or China's egregious claims and illegal expansions into the South China Sea, our Navy sailors are to be commended for their professionalism and steadfast service. However, these actions should remind us that there is simply too much at stake if we willfully choose to ignore the ambitions of our foes.

There is undoubtedly room for improvement in the LCS program, and I appreciate your candid testimony regarding several of the reviews and efforts that are already underway. But instead of looking back, I am most concerned that future problems might plague the program, and that it could have a crippling impact on the Navy's entire modernization efforts. Between the *Ford*-class carrier, F–35 procurement, the LCS, and an *Ohio*-class replacement ballistic submarine, the Navy simply must make the most effective and efficient use of every single dollar it receives if we are to have any hope of rebuilding the fleet.

Now, Secretary Stackley, there have been many studies that have attempted to determine the appropriate size and mix of Navy forces, including the 1993 Bottom-Up Review in the 2010 Quadrennial Defense Review, to name a couple. Most of the studies indicate that we need more than the Navy's current plan to build 308 ships in order to defend our global interests.

In the time since those reports, our Navy has now shrunk to around 275 ships, while commitments and the number of deployments have remained relatively constant. This has resulted in a larger percentage of the force being at sea on any given day, often for longer deployments than their predecessors, and add an—at the expense of other mission requirements. The incoming Administration has set a goal to increase the Navy to 350 ships and to reverse this damaging trend. That is a goal with which I strongly agree.

My question to you is can you provide your professional opinion to this committee on how we can accomplish a 350-ship fleet, what an appropriate high/low mix of platforms might look like, and where you believe the LCS and its successor will fit into that construct?

Mr. STACKLEY. Yes, sir. Let me—let me describe that right now the CNO and his staff is conducting an update to the force structure assessment that was last updated in 2014. He has been very clear and testimony in the public describing that the threat vector has only—has only increased. The 308-ship Navy that is currently on the books, all pressure says that number has got to go up.

The force structure assessment taking place right now is identifying what number and mix of ships we need for the future, mid 2020s and beyond. He has been clear, the number is going to go—the number in terms of requirements will go north. That going to put more pressure on the budget. What we have to determine is in that mix of ships, what the specific modernized capabilities that we will need platform by platform, and then how to procure those as affordably as possible so we do not add more pressure to the budget than absolutely necessary.

Inside of that construct, high-low mix, LCS is the small service combatant today, and we have talked about the frigate modification to the LCS platform going forward. The today 52 in the force structure assessment, 40 in terms of a budget determination. If we fail to deliver the small surface combatant in those numbers, then what that means is we are going to put more pressure on the high end of our—of our force structure. That is going to add costs, and that is going to take those ships off of the—where they need to be, tax them in terms of operational demand compared to where they need to be, and that is going to put more pressure in terms of turnaround time and the entire operations and maintenance cycle.

Senator CRUZ. What do you see as the biggest challenges facing growing to a 350-ship fleet, and what do you see as a realistic timeframe for that?

Mr. STACKLEY. Yes, sir. Let me—let me first say the first big challenge that is already in the program of record is the High Replacement Program due to its uniqueness, its imperative in terms of schedule and the capability that we have to provide, and then its cost. It is a—it is a high-cost program.

We are, and when I say "we," it is CNO and myself are on top of that program in terms of the design process, in terms of the planning to ensure that it does not grow. In fact, we are looking to find ways to make it more affordable than it is today. That already stands as a challenge going forward.

The next—the next thing we need to do is leverage existing designs. What we do not want to do is bring a whole bunch of new design to the table, add the technical risk that that brings, the startup costs that that adds, and the uncertainty that that introduces, and add the amount of time that that will take to go through the design and production cycle. Let us leverage the existing production lines that we have and introduce capability to those platforms as best as possible looking at that future threat. That is the path that we are on.

Then the next is raising the rate at which we produce those ships. I will tell you the first part of it is going to be looking at our attack submarines. When you look at our force structure going forward, we have a very serious shortfall in attack submarines in the late 2020s. We have got to stem that as best as possible. That would be the first place that we go in terms of increasing our production rates.

Surface combatants. Right now, we are building surface combatants at a rate that in the long-term results in dropping off in terms of total number of large surface combatants, because we built at such a high rate during the Reagan buildup years. Well, if we—if we stay at two per year, we are going to start settling down to a 60 to 70 number of large surface combatants, which will not meet our operational requirements.

Then amphibs. Today, we are—we are below what the CNO and the commandant agreed to in 2009 in terms of the amphibs force structure. We have got to get up to that number, and we are on that path. But the reality is that these are high utility platforms. They are high demand, high utility, very flexible. Wherever we have operations going, amphibs find a way to support that oper-

ation. There is—that will be the next leg in terms of increasing our production rates.

Senator GRAHAM. Thank you.

Chairman MCCAIN. I am sure that you will get support from this committee on that. You will not get support if we have double—redouble the cost of these systems. We owe the taxpayers a lot more than that.

This has been a very helpful hearing, and I thank the witnesses. We are adjourned.

[Whereupon, at 11:48 a.m., the hearing was adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR SESSIONS

LITTORAL COMBAT SHIP PROGRAM

1. Senator SESSIONS. When is the next Force Structure Analysis (FSA) due for completion and dissemination?

Secretary STACKLEY. Navy's Fiscal Year 2016 Force Structure Assessment was released on December 16, 2016.

2. Senator SESSIONS. If the next FSA shows the Navy's force-level needs to be higher—for example 325 or 350 ships—shouldn't we anticipate the Navy's current requirement for 52 small surface combatants to increase?

Secretary STACKLEY. Navy's Fiscal Year 2016 Force Structure Assessment, released on December 16, 2016, reaffirmed the requirement for 52 Small Surface Combatants.

3. Senator SESSIONS. Given the need for 52 small surface combatants, what is the rationale for truncating the LCS program and how does the Navy intend to start a new program to get to the required small surface combatant force-level?

Secretary STACKLEY. The Navy's requirement for 52 Small Surface Combatants was validated through the 2014 Force Structure Assessment (FSA) and revalidated with the Navy's 2016 FSA. The truncation to 40 Small Surface Combatants reflects a consequence of the hard choices that had to be made to deliver the fiscal year 2017 budget in compliance with the Bipartisan Budget Act. At that point in time, Secretary of Defense Carter concluded that the Navy could accept risk associated with slowing the rate of ship construction in the near term in order to rebalance its investments towards other warfare systems and advanced capabilities. The Navy plans to continue LCS procurements in fiscal year 2018 and fiscal year 2019 while transitioning to the more capable Frigate in fiscal year 2020 to meet the full Small Surface Combatant requirement.

4. Senator SESSIONS. Are there benefits of keeping the LCS program on its original course of two shipyards building to 52 units and if so, what are they?

Secretary STACKLEY. By maintaining the two LCS shipyards, the Navy maintains a competitive environment for not only the shipbuilders, but also for the supporting vendor industrial base, resulting in highly competitive pricing throughout the supply chain. Additionally, maintaining two construction yards provides the Navy capacity and flexibility to address changes to the LCS acquisition plan and preserves industrial base necessary to meet changing Force Structure Assessment (FSA) requirements. The Navy's requirement for a minimum of 52 Small Surface Combatants (SSC) was validated through the 2012, 2014, and the 2016 FSA and no subsequent analysis has revised this requirement. The truncation to 40 SSCs reflected the consequence of the hard choices that were made to deliver the fiscal year 2017 budget in compliance with the Bipartisan Budget Act. Secretary Carter (former Secretary of Defense) concluded that the Navy could accept risk associated with slowing the rate of ship construction in the near term in order to rebalance its investments towards other warfare systems and advanced capabilities. The two LCS shipbuilders currently utilize facilities optimized for LCS serial production, resulting in stable production planning and improved cost and schedule performance. The benefit of keeping the two shipyards constructing LCS viable throughout the procurement of the 52 SSCs allows the Navy to meet the FSA requirements within a highly competitive framework.

5. Senator SESSIONS. What is the current cost per unit of LCS?

Secretary STACKLEY. The current budget estimate for two fiscal year 2017 LCS is $1,125.6 million, $562.8 million per ship end cost in then year (TY$) dollars. Based on the previous year's procurement profiles of up to four ships per year, the current Program Managers estimate for the average end cost of the block buy ships (LCS 5, 6, 7, 8 and LCS 10 delivered, and LCS 9, 11—LCS 26 under construction) is $486.9 million in TY$ dollars. End cost includes the basic cost of construction, government furnished equipment, and budget for change orders, plans and other.

6. Senator SESSIONS. Will the cost of the remaining units in the LCS program be increased by down-selecting the LCS before reaching the currently planned 40 vessels?

Secretary STACKLEY. Increasingly complex operating environments, emphasis on distributed maritime operations, and the need for combat logistics force escort-capable ships to free up large surface combatants for high-end missions has prompted the Navy to reevaluate frigate requirements and pursue a Guided Missile Frigate (FFG(X)) having local air defense capability and increased survivability characteristics. To allow adequate time to mature the design and thoroughly evaluate design alternatives, the PB18 budget defers the FFG(X) contract award to fiscal year 2020. A revised acquisition strategy will be developed to conduct a full and open competition using existing designs in fiscal year 2020, vice doing a down-select of the existing LCS variants.

If the existing LCS shipbuilders do not secure additional workload, the Navy will experience cost growth and schedule delays for the ships currently under contract with the affected shipbuilder(s). Additional schedule and cost risk will be introduced through reductions in the industrial base as each stage of construction concludes, with corresponding manpower reductions. Each shipyard is managed by stage of construction for which trades and skills are not transferable from one stage to another. Due to this, lack of follow on work will begin to impact the industrial base much earlier than delivery of the last LCS from the affected shipyard(s). In addition, the ability of the affected shipyard(s) to compete for future Navy and commercial work will be jeopardized, exposing the Government to costs related to shipyard closure should the affected shipyard(s) not remain viable. The Government's exposure to cost growth resulting from these risks is limited by the contract price ceiling and related fixed price incentive terms and conditions.

7. Senator SESSIONS. What is the projected cost per unit for the LCS replacement—the Future Frigate?

Secretary STACKLEY. To allow adequate time to mature the design and thoroughly evaluate design alternatives, the first year of Frigate procurement is now planned for fiscal year 2020. The Navy is finalizing the requirements for the Frigate and will begin seeking Industry design solutions for review in the summer of 2017. In conjunction with finalizing requirements and design solutions, the Navy will develop a cost estimate for the program, ensuring a balance of both capability and affordability.

8. Senator SESSIONS. What would be the benefits and costs of accelerating the LCS replacement, or Future Frigate, to ensure the Navy continues building to its current 52 ship requirement as quickly and as efficiently as possible?

Secretary STACKLEY. The Navy's 2016 Force Structure Assessment revalidated the warfighting requirement for a total of 52 small surface combatants (SSCs). While LCS provides valuable capability, the Navy needs to transition to the more capable Frigate. This improved capability will provide the remaining ships needed in order to meet the full Small Surface Combatant requirement and allow for an expanded mission to address the emerging threat environment.

QUESTIONS SUBMITTED BY SENATOR AYOTTE

BUILDING ENOUGH *VIRGINIA*-CLASS SUBMARINES

9. Senator AYOTTE. In the April Seapower Subcommittee hearing, I asked you, Secretary Stackley, as well as Admiral Mulloy, about the requirement for attack submarines. I also raised the issue with Admiral Richardson in March in the Navy posture hearing. Admiral Mulloy and Admiral Richardson confirmed that the current requirement for 48 attack submarines was established around 2006. Admiral Richardson stated in May what we all understand: "The security environment [has] changed a great deal since then." As a result, he said the Navy is only able to meet

about 50 to 60 percent of combatant commander demands right now for attack submarines. The Chief of Naval Operations said that he had commissioned a study to reassess the attack submarine requirement. Secretary Stackley, can you provide an update on that study? When do you expect it to be complete and delivered to Congress? Do you expect that the attack submarine fleet requirement will likely increase?

Secretary STACKLEY. The Navy's current Force Structure Assessment (FSA) was released on December 16, 2016. The FSA concluded 66 attack submarines (increased from 48) would be needed to provide the global presence required to support national tasking and prompt warfighting response.

10. Senator AYOTTE. In light of this projected decline in the size of our attack submarine fleet at a time when the demand for them is increasing, you and I have discussed the issue of building two—instead of only one—*Virginia*-class submarines in 2021. In April, you mentioned to me in the Seapower Subcommittee hearing that the Navy is working with industry to see if in 2021 we could simultaneously execute the planned Ohio Replacement program and also build two (not just one) *Virginia*-class submarines that year. I included language in the NDAA Committee Report on this issue. I understand that there are at least two elements to consider: funding and capacity of the industrial base. You said this is a top priority. Secretary Stackley, can you provide an update?

Secretary STACKLEY. Additional funding will be needed in fiscal year (FY) 2019 for advance procurement and economic order quantity (EOQ) funding in order to commence long lead time material activities and optimize savings from EOQ material procurements to add a second *Virginia*-class Submarine (VCS) in fiscal year 2021. No industrial base investments are required. A thorough study to determine the impact of a steady state two VCS build rate concurrent with the *Columbia*-class is in development and will be provided in the report to Congress that was requested in House Report 114–537, accompanying H.R. 4909, the National Defense Authorization Act for fiscal year 2017.

QUESTIONS SUBMITTED BY SENATOR REED

LCS SPEED AND ENDURANCE

11. Senator REED. Director Gilmore, Secretary Stackley responded to a question where I repeated information from Director Gilmore's testimony that said:

"Finally, while the Navy is examining methods to reduce weight, it is anticipated the LCS-frigate, because of the simultaneous employment of ASW and SUW (surface warfare) equipment, will be significantly heavier than the existing LCS resulting in a lower maximum sprint speed and less fuel endurance. The loss of sprint speed will therefore affect its success in small boat swarm defense, and its ability to keep up with a carrier strike group."

Secretary Stackley replied that the Navy was not going to be trading off endurance, but would be placing a premium on being able to increase endurance. As far as lower speed, Secretary Stackley said that speed is only going to be affected at the margins. Director Gilmore, do you believe that the Navy will be able to increase endurance for the frigate variant of LCS while avoiding anything more than marginal reductions in speed capability? Mr. Francis, does GAO have a position on these differing positions?

Dr. GILMORE. My fiscal year 2015 review of draft Navy requirements for the LCS Flight 0+ Frigate Increment informed my testimony statement. From these Navy requirements I concluded a Frigate, utilizing the same seaframe design as the existing LCSs, would be significantly heavier resulting in a lower maximum sprint speed and less fuel endurance compared to the current LCS ships. Since then, the Navy issued its final requirements for the Frigate that are different than those of the fiscal year 2015 draft. The Navy acknowledged the predicted weight increase for both Freedom and Independence variant Frigates would be approximately 200 metric tons. This is approximately a 6 percent increase in weight. The Navy also said it would permit the vendors to alter the ship designs. The Navy draft "Request for Proposal," intended for procurement of the Frigate, incentivized the vendors to alter ship designs to enhance endurance up to 4200 nautical miles and to maximize the number of surface-to-surface missiles. The Navy also designated all but one of the relevant LCS warfighting requirements as Key System Attributes that may be traded off. The lone exception is the range of the over-the horizon surface-to-surface missile, which is a Key Performance Parameter. The Navy's Frigate requirements document indicated Navy fleet operators recommended trading short duration maximum

speed, known in the LCS Flight 0+ requirements as "Sprint Speed," for enhanced lethality and survivability features. Navy leadership accepted this feedback and excluded the legacy requirement for "Sprint Speed" from the LCS Frigate requirements, replacing it with a new Key System Attribute requirement for sustained high speed referred to as "Sustained Speed." Considering the potential for altering the ship designs to accommodate increased weight and trading Sprint Speed for Sustained Speed, it may now be possible for the Navy to increase endurance and achieve sufficient "Sustained Speed" to be comparable with other combatant ships. The proposed Frigate design is preliminary, with details known only to the Navy and its vendors. Until the Navy makes the final design for the ship available, DOT&E will not be able to characterize quantitatively the effect of the design changes on the Frigate variant of LCS.

QUESTIONS SUBMITTED BY SENATOR MAZIE K. HIRONO

READINESS

12. Senator HIRONO. The Littoral Combat Ship (LCS) program was scheduled to produce 52 ships. However, in December of 2015, the Secretary of Defense directed the Navy to reduce the LCS buy from 52 ships to 40. What is the Navy's requirement for this class of ship and how would a reduction to 40 ships impact our capabilities and readiness, particularly with respect to our presence in the Asia-Pacific?

Secretary STACKLEY. Navy's Fiscal Year 2016 Force Structure Assessment, released on December 16, 2016, reaffirmed the 52 Small Surface Combatant (SSC) requirement. A reduction to 40 ships, employed under the same operating constructs, would result in about six fewer ships deployed globally conducting steady state theater security operations. Should conflict arise, the reduced SSC inventory would result in delays for the arrival of required forces and/or risk to other missions should other forces be diverted from currently planned missions to mitigate the delays.

LCS DOWN-SELECT

13. Senator HIRONO. The Secretary of Defense also directed that the Navy down-select the 2 LCS designs to a single variant by fiscal year 2019. What are the Navy's plans in determining how to down-select from the two versions? Moving to a single production line would likely eliminate competition as well as the benefits that can be derived from it. How would this change impact overall cost and schedule performance on the program? Finally, what would be the impact to the industrial base at the prime, sub, material and component supplier levels?

Secretary STACKLEY. Increasingly complex operating environments, emphasis on distributed maritime operations, and the need for combat logistics force escort-capable ships to free up large surface combatants for high-end missions has prompted the Navy to reevaluate frigate requirements and pursue a Guided Missile Frigate (FFG(X)) having local air defense capability and increased survivability characteristics. To allow adequate time to mature the design and thoroughly evaluate design alternatives, the PB18 budget defers the FFG(X) contract award to fiscal year 2020. A revised acquisition strategy will be developed to conduct a full and open competition using existing designs in fiscal year 2020, vice doing a down-select of the existing LCS variants. If the existing LCS shipbuilders do not secure additional workload, the Navy will experience cost growth and schedule delays for the ships currently under contract with the affected shipbuilder(s). Additional schedule and cost risk will be introduced through reductions in the industrial base as each stage of construction concludes, with corresponding manpower reductions. Each shipyard is managed by stage of construction for which trades and skills are not transferable from one stage to another. Due to this, lack of follow on work will begin to impact the industrial base much earlier than delivery of the last LCS from the affected shipyard(s). In addition, the ability of the affected shipyard(s) to compete for future Navy and commercial work will be jeopardized, exposing the Government to costs related to shipyard closure should the affected shipyard(s) not remain viable. The Government's exposure to cost growth resulting from these risks is limited by the contract price ceiling and related fixed price incentive terms and conditions.

LCS BLOCK BUY

14. Senator HIRONO. I am concerned about the issue raised in the testimony of Paul Francis of the Government Accountability Office stating that committing to the block buy of the frigate variant of Littoral Combat Ship (LCS) at this point in time would be premature. He points out that the process that the Navy plans on using

in this procurement is almost identical to the original procurement of the LCS variant, which resulted in large cost overruns and unmet mission capability in past.

Secretary STACKLEY. Increasingly complex operating environments, emphasis on distributed maritime operations, and the need for combat logistics force escort-capable ships to free up large surface combatants for high-end missions has prompted the Navy to reevaluate Frigate requirements and pursue a Guided Missile Frigate (FFG) having local air defense capability and increased survivability characteristics. To allow adequate time to mature the design and thoroughly evaluate design alternatives, the PB18 budget defers the FFG contract award to fiscal year 2020. A revised acquisition strategy will be developed to conduct a full and open competition using existing designs in fiscal year 2020, vice pursuing a block buy strategy using one of the existing LCS variant designs.

15. Senator HIRONO. During the hearing, you committed to working with the Armed Services Committee to come up with a set of benchmarks against which we could measure LCS cost, schedule, and testing performance before approving any block buy for the last 12 ships in program. I would like the Navy to provide: a) A detailed cost and schedule baseline for any ships proposed in an LCS block buy that establishes cost per ship and savings that would result from utilizing block buy contracting and; b) A detailed assessment of how the testing requirements will need to be changed for a frigate variant of the LCS.

Secretary STACKLEY. a) Increasingly complex operating environments, emphasis on distributed maritime operations, and the need for combat logistics force escort-capable ships to free up large surface combatants for high-end missions has prompted the Navy to reevaluate Frigate requirements and pursue a Guided Missile Frigate (FFG) having local air defense capability and increased survivability characteristics. To allow adequate time to mature the design and thoroughly evaluate design alternatives, the PB18 budget defers the FFG contract award to fiscal year 2020. A revised acquisition strategy will be developed to conduct a full and open competition using existing designs in fiscal year 2020, vice pursuing a block buy strategy using one of the existing LCS variant designs; b) The FFG Test and Evaluation Master Plan (TEMP) is currently in development to support the FFG Request For Proposal release in the fall of 2018. This FFG TEMP will leverage LCS testing where applicable, however for systems that are new for improved warfighting and multi-mission capabilities, additional testing may be required. The Navy will work with the appropriate testing organizations to finalize requirements for the FFG TEMP. It is anticipated that the TEMP will be complete in 2021 with final approval from Director, Operational Test & Evaluation in 2023. The conduct of Frigate Developmental Testing, Technical Evaluation, and Operational Testing is projected to occur in late 2025 through early 2027. Once the FFG TEMP is approved, specific details can be provided for an updated baseline.

LCS INFLUENCE IN THE ASIA-PACIFIC

16. Senator HIRONO. Our rebalance to the Asia-Pacific appears to gain in importance, given recent actions of North Korea and China. It is also important to show our support to our allies and partners in the region. How has the deployment of the LCS to the Asia-Pacific helped to increase our influence and deterrence in the region?

Admiral ROWDEN. LCS has proven to be an excellent platform for our engagements in the region. Its use in the popular and enduring CARAT series of exercises in Southeast Asia is particularly noteworthy. The LCS well-fits in our engagement program with other Navies in the Indo-Asia-Pacific, and offers substantial options for tailoring Navy-to-Navy activities with like-minded maritime forces, fielding similarly-sized platforms. As LCS force structure in the SCS region increases, so too will our access to friends and allies. The deterrent effect on more-belligerent regional actors will increase as well, due to the increased operational availability and additional engagement and interoperability opportunities in the region, vital to our national security interests.

17. Senator HIRONO. During this past year's Rim of the Pacific exercise, the LCS Coronado was able to successfully launch a Harpoon surface-to-surface missile. While the missile did not hit its target, this is a good step towards increased capability of the LCS. How would this capability aid in our presence and capabilities in the Asia-Pacific region?

Admiral ROWDEN. The Navy has invested in live fire testing of two different anti-ship cruise missiles from USS *Coronado* (LCS 4): the Kongsberg Naval Strike Missile (NSM), fired in 2014 from a temporary launcher as a demonstration of a

100NM+ precise aimpoint capability; and the 2016 structural test fire of a Harpoon missile fire to complete launcher certifications in preparation for an extended operational demonstration during her 2016–2018 deployment. Live fire events have and will continue to develop our understanding of LCS structural engineering, reducing risk for procurement and installation of installed missile systems on the LCS and Frigate (FF).

By 2030, LCS and FF will be more than half of the surface combatants on deployment at any given time. When implemented, a missile capability will give LCS the surface warfare capability of a larger combatant, changing the risk calculus of potential adversaries and making LCS a key enabler for warfighting capability and capacity increases for the combatant commanders in support U.S. interests in the region.