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[H.A.S.C. No. 114–145]

# OVERSIGHT REVIEW OF THE U.S. NAVY'S LITTORAL COMBAT SHIP PROGRAM

HEARING

BEFORE THE

SUBCOMMITTEE ON OVERSIGHT
AND INVESTIGATIONS

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

HEARING HELD
DECEMBER 8, 2016

U.S. GOVERNMENT PUBLISHING OFFICE
23–763 WASHINGTON : 2017

For sale by the Superintendent of Documents, U.S. Government Publishing Office
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# CONTENTS

# OVERSIGHT REVIEW OF THE U.S. NAVY'S LITTORAL COMBAT SHIP PROGRAM

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HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS,
*Washington, DC, Thursday, December 8, 2016.*

The subcommittee met, pursuant to call, at 9:05 a.m., in room 2118, Rayburn House Office Building, Hon. Vicky Hartzler (chairwoman of the subcommittee) presiding.

## OPENING STATEMENT OF HON. VICKY HARTZLER, A REPRESENTATIVE FROM MISSOURI, CHAIRWOMAN, SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

Mrs. HARTZLER. Good morning. I would like to extend a warm thank you to our witnesses testifying before us today and welcome them to our subcommittee's last hearing event for the 114th Congress.

I thank the subcommittee members for your contributions and dedication during this Congress. I wanted to especially express gratitude to those members who are not going to be returning next year.

Certainly, Representative Graham, you have been a wonderful member on this committee and on Armed Services and just here in Congress as well. I have enjoyed getting to know you and appreciate your work, your dedication. Representative Graham is—comes to the hearings. I don't think she missed hardly any, so responsible and cares so deeply about the military, so we are going to miss you, but thank you. Thank you.

And we also have subcommittee member Representative Heck and Representative Miller who may be joining us, but we appreciate their service as well.

So in connection with today's hearing, I welcome the members also of the full committee who are not permanent members of the subcommittee, who are or who will be attending. And I ask unanimous consent that these committee members be permitted to participate in this hearing, with the understanding that all sitting subcommittee members will be recognized for questions prior to those not assigned to the subcommittee.

Without objection, so ordered.

So today, we take testimony of the littoral combat ship [LCS] program. We seek to gain a deeper understanding of the challenges that this program has presented us in the past and the opportunities that exist as the program moves forward. We need to grow the size of this Navy's surface fleet. The LCS could have an important role in increasing our capabilities and our flexibility. I know that

there is a critical need to replace our less capable and decommissioned mine countermeasure ships, patrol craft, and all of our *Hazard Perry*-class frigates.

I believe the littoral combat ship and the eventual upgrade to the frigate design has great potential to fulfill the roles for the platforms it replaces. This is why the LCS has garnered bipartisan support in the Seapower Subcommittee. The concept of the LCS and the decision to begin the program came at a time in the Department of Defense's acquisition history in which senior leaders of the Department thought it was necessary and possible to disregard the natural evolution of technology by skipping a generation of development. It was good theory but proved costly and cumbersome to implement.

We have learned many lessons from this period. For example, introducing immature technologies into acquisition programs will lead to cost and schedule growth. Awarding contracts without a stable design and directing prescriptive government specifications also increases cost and schedule. It is only with unleashing the power of best buying practices that we can realize acquisition efficiencies. These lessons have been hard learned in a multitude of acquisition contracts.

For example, stable government funding is essential to providing material ordering and labor efficiencies. Additionally, innovative multiyear procurements or block buys save money because long-term agreements with subcontractors and vendors provides contracting stability. Dangerous reductions below minimum order quantities only serve to exacerbate our industrial base and increase the cost of the taxpayer. That is why the House has advocated adding a third LCS in fiscal year 2017, and has expressed reservations about the Navy's acquisition strategy, which involves procuring one LCS frigate every year during fiscal year 2018, 2019, and 2020.

I also want to discuss the Navy's force structure requirements of 52 small surface combatants. The Navy's force structure is based on their ability to meet combatant commander requirements both in peace and in war. That is why I am perplexed with Secretary Carter's determination that we only need 40 LCS frigates. I believe the Secretary's decision lacks analytical rigor. I am hoping that the next administration will review this issue.

We must absolutely integrate the program's acquisition lessons learned as we evaluate, with prudent scrutiny, the opportunity to invest an additional $14 billion to complete the purchase of LCS and transition its hull form into a frigate design. We must also ensure that the mission modules which are integral to the first LCS designs are successfully completed, tested, and fielded at the lowest possible price.

So I look forward to discussing this program with our distinguished panel of witnesses we have here before us. But before I introduce the witnesses, I turn to the Oversight Investigation Subcommittee ranking member for any opening remarks that she would like to make.

[The prepared statement of Mrs. Hartzler can be found in the Appendix on page 45.]

**STATEMENT OF HON. JACKIE SPEIER, A REPRESENTATIVE FROM CALIFORNIA, RANKING MEMBER, SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS**

Ms. SPEIER. Thank you, Madam Chair.

We are here today to examine a case study in gross mismanagement on the part of the Navy. At virtually every decision point—from conceiving the initial flawed concept, to the concurrent acquisition process, to the huge cost overruns, to the huge fundamental flaws in the ships themselves, and to the feeble attempts by the Navy and DOD [Department of Defense] to correct course—the Navy has wasted billions in taxpayer dollars and failed to produce a ship that meets its objectives.

What we examine today is: Has the Navy learned its lesson, have they corrected course, and are they moving forward with a stable ship design based on a sound analytical foundation? From the testimony of witnesses today, I fear the answer is a resounding no.

I would especially like to know who certified that LCS would cost $220 million each. We know it now costs more than double per ship, at $478 million. Who briefed this to Congress, and who signed off on this gross escalation in cost?

While cost overruns are by no means acceptable, perhaps they can be explained if they resulted in a functional ship. But the LCS isn't just outrageously expensive, it is also outrageously bad at doing its job. In simple terms, it is a dud.

Just look at how many issues six out of eight ships in service have had, and I point to this chart, which you can see. Every one of these six ships, and there have only been eight that have been in the water, six out of the eight ships have had serious problems in which the engines have flooded, the couplings cracked, and the ships broke down in transit.

[The chart displayed can be found in the Appendix on page 159.]

Ms. SPEIER. Now, the USS *Montgomery* was commissioned in September of this year, and it has already had two engine failures and two collisions that resulted in major damage. What is even worse is that because of the way the Navy structured the contracts, taxpayers are still responsible for most of the repair costs, even when the shipbuilders are at fault. These contracts mean that, in some cases, the shipbuilders aren't responsible for even one cent of potential defects.

In other words, you take delivery of an LCS, it immediately breaks down, and there is no warranty, there is no lemon law. So there is no compunction on the part of the shipbuilder to make sure that this product is indeed worthy to be afloat, because if it breaks down, it is the taxpayers that will pick up the tab. Why is it that the Coast Guard can hold its shipbuilders responsible for defects, but the Navy puts the burden on the taxpayers?

If that is not enough, there is more bad news. The Secretary of Defense has admitted that continuing to produce two versions of the ship makes no sense, and he has ordered a down-select. The Navy has admitted that its transformative interchangeable mission module will likely never be interchanged as originally envisioned. The Navy has also admitted that its transformative crewing concept won't work and has essentially scrapped it.

Look at how much the program has changed from the Navy's early pie-in-the-sky promises. Cost overruns, delayed schedule, design changes, cannot survive combat. In part, the reason why we are changing the name of LCS is because the word "combat" is in its name and we now know it is not survivable in a combat setting. Poor mission capabilities.

[The chart displayed can be found in the Appendix on page 160.]

Ms. SPEIER. Now, in all of the Navy's wisdom, they have decided to change the name of the LCS to a frigate, and plan to purchase more of what is essentially still an LCS but whose modifications are unproven, lack critical capabilities, and can't pass original survivability tests. Why? Because they have determined it will meet their multi-mission requirements. Yet once again, we don't have a ship design, we don't know what it will cost, or whether the ship can survive in combat. Instead, as I have joked many times, we have a ship that even the Chinese don't want to copy.

You would think all this uncertainty would prompt calls for a pause to get the LCS conceptual house in order before the Navy does a binge buy for more. But if you think that, you don't know the LCS program. Instead, in an act of astonishing arrogance and disregard of taxpayers' money, reports indicate that the Department of Navy is gearing up to ask Congress for a block buy of 12 of these ships. This would give us all leverage—this would give us all our leverage away with a contractor to ensure the ships are tested and fixed.

What are they thinking? Does anyone honestly believe that the taxpayers, the Tea Party, or President-elect Donald Trump would approve this buy if they were in charge of doing so?

From the beginning, the Navy has regularly submitted LCS budget requests that are not consistent with shipbuilding programs, making it nearly impossible for Congress to exercise oversight. It did this in 2003 when it funded the first ships with research and development funding and in 2010 when it wanted to switch to a plan of buying two parallel LCS designs inside of a 20-ship block buy.

When issues continued to occur throughout construction and fielding, the block buy was always cited as the reason why Congress shouldn't slow the program down. Yet again, as the Navy moves towards a different design that they claim will address many of the LCS shortcomings, they are looking for a block buy authority before the design is even completed. This is a strategy that even the shipyards criticized, since it doesn't give them time to complete the frigate design before beginning construction. The single greatest contributor to cost inflation on the LCS was an incomplete design when construction began. The Navy still hasn't learned their lesson.

I am glad that the Navy has acknowledged reality and changed some of its operational concepts, but in many respects, I am concerned they are still hiding the ball. The next time LCS flaws become apparent, it could be in the heat of battle and, frankly, get our sailors killed.

Furthermore, if the Navy's plan for a block buy moves forward, Congress and the Navy's hands will be tied. I realize what this is really about. We know the LCS is the Ford Edsel of the sea, and

yet certain of my colleagues say we can't afford to pause production and get it right because of, quote, "industrial base concerns," unquote, even though, and I want to emphasize this, even though the shipyards will be building the existing buy until 2021 even if we canceled funding for the program today.

Let's be real. This is about getting pork back to their districts. The LCS is a $120 billion pork ship, and they are putting pork barrel politics above the safety of our service members.

The Navy has shown a callous disregard for the taxpayer, and frankly, the Congress has been derelict in doing its job. We think no one will notice. We think our obligation is to the shipbuilders to keep building a defective ship just because we want to retain jobs.

Today, we need the guts to say that the LCS was a mistake. To protect the United States interests and to do what is best for our service men and women, we need a ship that is capable of fulfilling its intended mission. The taxpayers deserve to know if what they are paying for is actually effective. That is why Congress needs to find out if the most recent changes will really make the LCS better or if we are just trying to make a silk purse out of a sow's ear.

I look forward to your insights and about how we got here and how we should go forward and who is to blame.

And with that, I yield back.

[The prepared statement of Ms. Speier can be found in the Appendix on page 47.]

Mrs. HARTZLER. Thank you.

I am pleased today to recognize our witnesses. I want to thank them for taking the time to be with us. We have the Honorable Sean Stackley, Assistant Secretary of the Navy for Research, Development, and Acquisition. We have Dr. J. Michael Gilmore, director of tests—Operational Test and Evaluation for the Department of Defense. We have Vice Admiral Thomas Rowden, commander of the Naval Surface Forces for the United States Navy. We have Ms. Michele Mackin, director of Acquisition and Sourcing Management for the Government Accountability Office; and Mr. Ron O'Rourke, specialist in naval affairs at the Congressional Research Service.

So thank you all for being here today. Really, really appreciate it, and we look forward to hearing your comments. And now we turn to Mr. Stackley.

## STATEMENT OF HON. SEAN J. STACKLEY, ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION, DEPARTMENT OF THE NAVY

Secretary STACKLEY. Chairwoman Hartzler, Ranking Member Speier, members of the subcommittee, 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.

Mrs. HARTZLER. Without objection.

Secretary STACKLEY. The littoral combat ship, or LCS, is designed to fill critical warfighting gaps in anti-surface, anti-submarine, and mine countermeasures warfare mission areas. And as a replacement for three legacy small surface combatant ships, she

is about one-third the size of a DDG–51-class destroyer, is designed to perform missions the DDG [guided-missile destroyer] is not equipped to do or that could otherwise be better performed, at least well performed by a small surface combatant, and thus freeing the destroyer for missions tailored for its higher end capabilities.

LCS's reduced size results in greatly reduced procurement and operating and support cost. In fact, the procurement unit cost for LCS is about one-third of 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 its 57-millimeter gun, surface-to-air missiles, and an over-the-horizon missile that the Navy is currently adding for offensive firepower against long-range threats.

In addition to this core capability, the ship carries modular mission packages tailored for the mission's planned deployments. The surface warfare mission package adds 30-millimeter guns, an armed helicopter, an unmanned aerial vehicle for extended surveillance, and surface-to-surface missiles. The anti-submarine warfare, 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 airdrop torpedoes and a towed decoy.

The mine countermeasure mission package has air unmanned surface and unmanned underwater vehicles with associated sensors and systems to detect and neutralize mines.

And there are four cornerstones of the program 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 schedule growth. The program was subsequently restructured in 2009. Production was placed on hold pending the insertion of production readiness reviews to verify design quality and completeness; authorization to approve design and requirements changes was raised to the four-star level, specifically the CNO [Chief of Naval Operations] 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. And in response to this strategy, industry made significant investments in terms of skilled labor and facilities to improve productivity and quality.

As a result, cost, 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 and Survey. Bottom line, the block buy strategy approved by Congress in 2010 has delivered on its promise. LCS construction is stable, and performance continues to improve on a healthy learning curve.

Second, mission packages. The program's acquisition strategy is that we will incrementally introduce weapons systems as a part of a mission package when they are mature and ready for deploy-

ment. The strategy provides tremendous flexibility, affordability, and speed for introducing new capabilities to the ship when those capabilities are ready to deploy.

Consistent with this approach, the LCS has been highly successful integrating mature weapons systems. The MH–60 helicopter, the Fire Scout unmanned aerial vehicle, the 11-meter rigid hull inflatable boat, the Mark 50 30-millimeter gun system, and most recently, the Harpoon Block II over-the-horizon missile, the Airborne Laser Mine Detection System, the Airborne Mine Neutralization System, and 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. They are deployed today 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. And 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 mission packages are late to their original schedules in part due to technical challenges and in part due to budget challenges. They do, however, demonstrate the benefit provided by the LCS modular design. And as the Navy develops or acquires new systems appropriate to the LCS mission, we will leverage the ship's design and flow these new weapons to the ship in rapid fashion once they are mature.

We have run headlong, however, into challenges with developing those capabilities that are central to filling one of the critical shortfalls in terms of warfighting, and that is the mine countermeasures, or MCM, mission package.

The Navy's requirements for the LCS MCM mission package 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 crew into the minefield.

The MCM mission package airborne capability and MH–60 helicopter carrying the Airborne Laser Mine Detection System and the Airborne Mine Neutralization System has completed testing and is ready to deploy. Additionally, an unmanned aerial vehicle carrying a sensor capable of detecting mines close to shore is on track to complete testing in 2017.

The workhorse of the mission package is the high-endurance unmanned vehicle that tows a sonar for mine detection. The Navy is satisfied with the performance of the towed sonar system and its ability to detect mines, but we are halting development of the unmanned vehicle—we refer to it as the Remote Multi-Mission Vehicle [RMMV]—due to poor reliability. And we are revising the MCM mission package to employ an alternative unmanned surface vessel, specifically one that is currently being built to tow the minesweeping system to likewise tow the mine detection system.

Testing with this vehicle is to commence in 2019. This puts the MCM mission package back to 2021 timeframe, a significant delay to that capability. The likely long-term solution will be to eliminate the tow vehicle altogether and operate with an unmanned under-

water vehicle with an embedded sonar when technology can support it.

The third cornerstone is performance of in-service ships. In total, LCS material readiness, as reflected in operational availability and casualty report metrics, is consistent with other combatant ship classes and meets the Navy's threshold requirements. However, I would like to address five engineering casualties of concern that have occurred over the past year. The Navy has conducted formal engineering reviews and command investigations to assess the root causes, and corrective action for each of these casualties are in action.

One was design related. A deficiency with a new propulsion gear on the *Freedom* variant resulted in the gear's clutch failure. The shipbuilder has been responsive with the manufacturer to correct the design, and we are currently testing this correction. The shipbuilder and manufacturer are being held accountable for these corrective actions.

Two of the five engineering casualties were due to Navy crews departing from established operating procedures. The type commander, Vice Admiral Rowden, has taken appropriate corrective action, including revising the LCS training program and conducting an engineering standdown for all LCS class crews to review, evaluate, and renew their commitment to safe ship operation and good engineering practices.

The remaining two engineering casualties trace to deficiencies in ship construction and repair procedures. One involves the waterborne alignment of the propulsion train, which is being addressed by the Naval Sea Systems Command with industry, equipment manufacturers, shipbuilders, and ship repair yards.

The second involves contamination of a hydraulic system on a newly delivered ship, requiring the ship to reflush the system and the shipyard to make corrections to its flushing procedures. This was corrected under warranty provisions by the shipbuilder in accordance with the contract.

Across the board, we are raising the level of engineering and design discipline on this 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 of LCS propulsion systems and will make their findings available to the subcommittee upon their completion.

The fourth cornerstone is transition to the frigate. Following an intense period reviewing alternative designs, which was ultimately approved by the Secretary of Defense, we are proceeding with modifications to the design of the LCS to incorporate the combined features of the LCS core capabilities, surface warfare mission package, anti-submarine warfare mission package, plus enhancements to the ship's combat systems and survivability features.

Industry is currently working on this new design, which trades the modularity of the LCS for a highly capable multi-mission frigate, and is on track to award in late 2018. The estimated cost for the 12 frigates outlined in the Navy's budget and report to Congress is approximately $8.1 billion.

I want to make clear to the subcommittee that unlike the experience at the outset of the LCS program, we will not proceed with

frigate construction before design is complete and of high quality and that cost estimates are validated. And to enable this committee to conduct its new oversight, we will provide your staff with full insight to our design review process, products, and criteria.

Madam Chairwoman, thank you for the opportunity to discuss this important program, and I look forward to answering your questions.

[The joint prepared statement of Secretary Stackley and Admiral Rowden can be found in the Appendix on page 50.]

Mrs. HARTZLER. Thank you.

Ms. Mackin.

**STATEMENT OF MICHELE MACKIN, DIRECTOR, ACQUISITION AND SOURCING MANAGEMENT, GOVERNMENT ACCOUNTABILITY OFFICE**

Ms. MACKIN. Thank you, Madam Chairwoman.

Good morning, Ranking Member Speier and members of the subcommittee and committee. Thank you for having me here today to discuss the littoral combat ship and frigate programs.

We have been reporting to Congress on LCS for over 10 years now. Our concerns have been and continue to be the Navy's decisions to prioritize seaframe and mission package procurements ahead of needed testing.

Testing is critical to ensure that expected capabilities and operational concepts can be proven out. Over the past few years, we have recommended the LCS program be halted or slowed down while important knowledge was gained through testing. But DOD has generally not taken any actions that would impact the production piece of the program, even in light of some serious concerns. Instead, it has warned that the prices under the two LCS block buy contracts would increase if the program were disrupted.

Almost 3 years ago, the Secretary of Defense directed the Navy to assess options for its small surface combatant that would be more survivable and have more combat capability than the LCS. The resulting study found that a minor modified LCS, which is now the frigate program, was the least capable option considered. Nevertheless, that option was ultimately chosen. In addition to affordability, which was a very important consideration, a key factor was the determination not to have a gap in production at the two LCS shipyards.

We all know that the initial promises of LCS have not come to fruition in terms of cost, schedule, or capabilities. As the Navy pivots now from the LCS to the frigate, there are key questions yet to be answered.

First, what will the frigate cost? This is unknown. A rough estimate is about $9 billion for 12 ships, but the Navy won't develop a more robust estimate until the middle of next year, and not until fiscal year 2018 will DOD prepare an independent cost assessment—cost estimate. Independent cost estimates are very important because they provide an unbiased assessment as to whether the program's cost estimate is reasonable.

Second, what will the frigate design look like? This is also unknown. While the frigate design will be based on the same LCS

seaframes we have today, those seaframes have significant weight issues that will need to be addressed, among other considerations.

The Navy plans to award a frigate contract to one of the shipyards in 2018 and start construction as early as 2019, but specific contractor design proposals won't be received until a year from now. Until the detailed design is understood, exactly what the Navy is buying isn't known.

I want to stop here and address the industrial base issue. Our work has shown that both LCS shipyards are running quite a bit behind in delivering the ships already under contract. Backlogs are many months long and up to a year or more in some cases. So the bottom line here is that both shipyards will be building LCSes for years to come, at least into 2021 at this point. So there is no schedule imperative to add frigates to the pipeline right now.

And finally, what is Congress being asked to do? With its fiscal year 2018 budget request, the Navy plans to ask Congress to approve a 12-ship frigate block buy strategy and also to approve procurement of the lead ship based only on a rough cost estimate. From a contracting standpoint, the initial block buy prices will be for 12 LCS, that is 12 regular LCS. If past is prologue, the Navy might get great pricing for those ships, but only later will the price of adding the frigate capabilities be known.

At that point, under a block buy contract, there is a risk that the program will be considered locked in, as has been the case with LCS, and any inclination to make needed changes may be foregone.

There is an opportunity here to not repeat the mistakes of the past. Continued concerns about the capabilities of LCS, testing that is years away from being completed, unknowns about the frigate, and the production backlog at the shipyards are all factors that need to be taken into account. This potentially $9 billion investment can wait until more is known about what the taxpayers are being asked to fund. Thank you.

[The prepared statement of Ms. Mackin can be found in the Appendix on page 74.]

Mrs. HARTZLER. Thank you.

Admiral Rowden.

**STATEMENT OF VADM THOMAS S. ROWDEN, USN, COMMANDER, NAVAL SURFACE FORCES**

Admiral ROWDEN. Good morning, Chairwoman Hartzler, Ranking Member Speier, distinguished members of the subcommittee. I am honored for the opportunity to testify about the littoral combat ship.

As the commander of our Naval Surface Forces, I am responsible for leading the 58,000 sailors that man and support our surface ships, and I am responsible for manning, training, and equipping those same ships. To execute these responsibilities, I rely on a staff of dedicated officers, enlisted, and civilian professionals. I rely on the experience I have gained over my 34 years of service to our Nation. I rely on almost 14 years to over 40 percent of my professional life serving on ships at sea, ships that range from our Coast Guard cutters all the way to tours on our aircraft carriers. I rely on the experiences I have operating on every ocean and sea from the Gulf of Guinea to the Sea of Japan. I rely on experiences I have gained

through port calls in 52 different cities in 36 different countries around the world.

When it comes to driving, fighting, and steaming our ships, I have experienced firsthand what our Nation can produce, both in terms of sailors with magnificent talent, determination, professionalism, and sheer grit, and in terms of the superb technical capability our phenomenal military industrial complex can produce. Time and again, in real-world situations I have seen our talent, training, tools, and tactics come together to produce a maritime fighting force that, on the whole, is significantly greater than the sum of its parts.

Time and again, the value of our Navy to our Nation manifests itself through engagement and through partnership building on a gray ship with a white number and Old Glory flying atop the mast, tied to the pier or at anchor in the harbor. I have experienced the palpable sense of relief when by our very presence the level of angst in a potentially volatile situation is erased.

To execute our missions, we rely on our ships and aircraft and the sailors who man them. The ships and aircraft are the tools we use. Our sailors round out our fleet's capability by providing the talent, the training, and tactics we need to win and win decisively.

One of the tools we have coming online is the littoral combat ship. So far, eight of these tools have been delivered. Many more are on the way, and to be quite honest, I cannot wait to have them in the fleet and cannot get them there fast enough. This tool, this ship will be—will soon be deployed in numbers to our forward fleet commanders and will provide them with a highly valued and absolutely necessary capability. For in addition to the anti-mine, anti-submarine, and anti-ship capabilities it will carry, it brings the ability to enter ports we have rarely or never been able to visit because of draft limitations. It brings the ability to build partnerships and partnership capacity that we have been able to—that we have only been able to execute in very limited ways. In the day-to-day shaping and stabilizing operations our Navy executes daily, these ships will be invaluable and are needed right now.

Beyond the shaping and stabilizing operations that dominate our operations today, I see a vital role for our littoral combat ships should our adversaries take an aggressive stand towards our maritime forces. And this is where the talent, tactics, and training really come into play.

We understand well the requirements these ships are built to, and we understand the testing and evaluation has proven they are built to the approved requirement. In short, we understand the tool. We understand the ship. We also understand well our talent, tactics, and our training. We can and must take all of these into account when planning for combat operations. As such, we will employ all of our ships and our talent, training, and tactics to maximize their value to the combatant commander while continually assessing the risk to the force.

All risk can never be eliminated, not to our littoral combat ships or any other ship in the inventory, for that matter. However, in planning for any mission, we are constantly evaluating our ability to achieve the objective while limiting the risk to the fleet. In other words, we will never lean into a punch if it can be avoided.

While all this is well and good, there have been challenges in fielding these ships, which is why earlier this year I was tasked to lead, along with Vice Admiral Dave Johnson, the principal military assistant to Secretary Stackley, and Mr. Brian Persons from the CNO staff, a review of the LCS program and to come up with recommendations on how to address and overcome the challenges to providing robust operational capability for our littoral combat ships.

In truth, I was thrilled with the opportunity. Our team looked at the ships and their challenges through three lenses, these lenses being simplicity, stability, and ownership. We looked at all aspects of LCS through these three lenses and came up with what I know to be reasonable, prudent, and appropriate recommendations to start to accelerate the value of these ships to the forward fleet commanders. We are moving out on these recommendations, and I am already seeing the benefits of our new approach on the waterfront. And we will continue to evaluate, assess, and adjust as we move forward.

Beyond this, we have already deployed twice and are in the leading edge of a third LCS deployment. In addition to learning a heck of a lot about how to support these ships forward, I believe the facts speak for themselves: Over 500 days at sea; helicopter landing qualifications with eight nations; boarding operations with seven nations; fleet operations with diverse ships ranging from aircraft carriers down to coastal patrol ships; special operations force operations with the Republic of Korea; humanitarian assistance and disaster response during Typhoon Haiyan, relief operations in the Philippines, and the search for AirAsia Flight 8501 in the Java Sea; regional partners who welcome and want LCS with a high demand signal, having visited 15 cities in 8 countries around the Western Pacific.

There is still much work to be done to fully unlock the significant potential of these ships. I am 100 percent confident that with the talent, training, and tactics our U.S. Navy sailors possess, the promise of our littoral combat ships will be fully realized, and I look forward to being part of this valuable effort.

Thank you very much, ma'am, and I look forward to your questions.

[The joint prepared statement of Admiral Rowden and Secretary Stackley can be found in the Appendix on page 50.]

Mrs. HARTZLER. Thank you.

Dr. Gilmore.

**STATEMENT OF DR. J. MICHAEL GILMORE, DIRECTOR, OPERATIONAL TEST AND EVALUATION, DEPARTMENT OF DEFENSE**

Dr. GILMORE. Chairwoman Hartzler, Ranking Member Speier, members of the committee and subcommittee, I will try to briefly summarize my written testimony.

The Increment 2 surface warfare mission package is the only fielded system on LCS seaframes, and it has demonstrated a 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 secu-

rity operations such as launching and recovering boats and conducting pirate interdiction operations. When the Hellfire missile is fielded in the next increment, the surface warfare package capability has the potential to improve significantly, provided targeting and other challenges can be surmounted.

In a June 2016 report, based on this testing conducted before 2016, I concluded that an LCS employing the current mine countermeasures package would not be operationally effective or suitable if called upon to conduct mine countermeasure missions. The testing that was done demonstrates the LCS mine countermeasure mission package did not achieve the sustained area mine clearance rate of the Navy's legacy systems, nor can the package be used even under ideal benign conditions to meet the Navy's reduced Increment 1 mine countermeasures requirements for mine area clearance rate, achieving, at best, one-half those requirements, which are a fraction of the Navy's full requirements. And by the way, my assessment is the same as the Navy's commander of operational test force.

The ships as well as many of the mine countermeasure systems are not reliable, and all the MCM systems, not just the Remote Minehunting System and the Remote Multi-Mission Vehicle, had significant shortfalls or limitations in performance. For example, limitations in the Airborne Mine Neutralization System depth for neutralizing mines means that it cannot be used to neutralize the majority of the mines in the Navy's own scenarios.

Based on those results, after more than 15 years of development, the Navy decided this past year to cancel the Remote Minehunting System, which is a hard decision for the Navy, halted further procurement of the Remote Multi-Mission Vehicle, abandoned plans to conduct operational testing of individual MCM mission package increments, and delayed the start of full integrated LCS mine countermeasure 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 canceled and restructured elements of the mine countermeasures package, it is likely operational testing of either LCS variant equipped with the final fully capable mine countermeasures, MCM, package will not be completed until at least 2023, more than a decade after the schedule set in the Navy's original requirements.

All of the LCSes have suffered from significant repeated reliability problems with both seaframe and mission package equipment. No matter what mission equipment is loaded on either of the LCS variants, the low reliability and availability of seaframe components, coupled with the small crew size, imposed significant constraints on mission capability.

When averaged over time, LCS 4, which was used in the testing last year, 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, the Navy's requirement, without a critical failure of one or more seaframe subsystems essential for wartime operations.

The Navy's most recent reliability reports show upward trends for a few LCS systems, so that is good news, but the majority of the ship's systems demonstrate flat or declining reliability well below the Navy's objectives, and that is the Navy's data.

It was only through testing of the full mission packages at sea and aboard the ship with sailors from the fleet that the significant problems and shortfalls I have described, both in system performance and sailor training, were clearly revealed. In fact, the Navy's independent mine countermeasures review team emphasized that a reliance on unrealistic, segmented, shore-based testing, quote, "provided a false sense of maturity," unquote.

As in all operational testing, we interacted extensively with the ships' sailors and surveyed them to capture their views of the ships' capabilities. These sailors are proud of their ships and determined to make the best use of them. The sailors are also straightforward in identifying the many problems they have encountered. We—I have a long list of the comments from the surveys that were done during the testing, and I am going to read just a couple, but there is a long list that are consistent with these, so I am not just cherry-picking.

"Well, 130 duty days to complete technical evaluation, which should have only taken 45 days. That should tell you something about the reliability of the RMMVs."

"The tasking would be easier to complete if the equipment didn't constantly break."

"As equipment breaks, we are required to fix it without any training."

Those are not my words. Those are the words of the sailors who were doing the best they could to try and accomplish the missions we gave them in the testing.

So to provide the sailors with what they need to accomplish their missions, it is my hope that the Navy will be provided the resources, meaning the time and money it needs to fix these problems, which we should acknowledge, because if we don't acknowledge them, we can't fix them. And the Congress, obviously, has a key role to play in providing those resources. Thank you very much.

[The prepared statement of Dr. Gilmore can be found in the Appendix on page 101.]

Mrs. HARTZLER. Thank you, Dr. Gilmore.

Mr. O'Rourke.

**STATEMENT OF RONALD O'ROURKE, SPECIALIST IN NAVAL AFFAIRS, CONGRESSIONAL RESEARCH SERVICE**

Mr. O'ROURKE. Chairwoman Hartzler, Ranking Member Speier, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss oversight issues relating to the LCS program. With your permission, I would like to submit my written statement for the record and summarize it here briefly.

Mrs. HARTZLER. Without objection.

Mr. O'ROURKE. I have been tracking the LCS program since its inception 15 years ago. In my 32 years as a naval issues analyst for CRS, no program has been more complex to track or has posed

more potential oversight issues for Congress than this program. The LCS program is at a crossroads not only because of the Navy's proposal to shift to production of the frigate variant, but also because of three additional factors. These are the rapidly shifting international security environment, the possibility that the incoming Trump administration might make significant changes in U.S. foreign and security policy, and the Trump campaign organization's announced objective of building the Navy toward a goal of 350 ships.

A key oversight issue for the Navy's proposal for procuring the frigate variant concerns its analytical foundation as a result of how the program was restructured twice in less than 2 years at the direction of two Secretaries of Defense. The Navy's proposal for procuring the frigate variant of the LCS appears to have three potential weaknesses in its analytical foundation. These potential weaknesses are now compounded by the shifting international security environment and the possibility that the incoming Trump administration might make significant changes in U.S. foreign and security policy.

This situation doesn't prove that the Navy's proposal for procuring the frigate variant of the LCS isn't the most cost-effective approach for meeting the Navy's future needs. It might very well be the most cost-effective approach. But as a result of this situation, the Navy now has less of a basis for being certain of that and less ability to demonstrate this compellingly to others.

This situation also, however, creates a fresh opportunity for the Navy to create a new analytical foundation for the effort that is both rigorous and fully up to date. Doing that would take some time, but it wouldn't prevent some variant of the LCS from being procured in fiscal year 2017 or 2018.

Another oversight question concerns the plan to total quantity of 40 ships. This is 12 less than the 52 small surface combatants called for in the Navy's current 308-ship force structure objective, and the 52 number itself could change again as a result of a decision to build the Navy toward a fleet of about 350 ships.

Building up to a force of 52 or more small surface combatants over the next several years could involve increasing the small surface combatant procurement rate to 3 or 4 ships per year. In terms of industrial base capacity, it might be easier to execute such a procurement rate with two LCS builders rather than one. If the ships are acquired with annual contracting, then depending on the annual procurement rate, maintaining two LCS builders might enhance the Navy's ability to use competition effectively in procurement of these ships.

Another oversight question concerns whether to use annual contracting or block buy contracting for procuring the frigate variant. Annual contracting preserves flexibility for Congress regarding whether and when to procure follow-on units in an ongoing procurement program, while multiyear contracting in the form of block buy contracting or multiyear procurement reduces that flexibility in return for reducing the cost of the units being procured.

My written statement discusses some of the considerations that come into play in considering annual versus block buy contracting. My statement also discusses two other oversight issues, the surviv-

ability of the frigate variant and the mine countermeasures module. It then presents some potential oversight questions for Congress relating to two additional oversight matters, the recent propulsion equipment casualties and the Navy's new plan for crewing and operating the ships.

Now that we are 15 years into the program and with the Navy's proposal to shift to procurement of the frigate variant now being considered, there is a question about the acquisition lessons learned from the LCS program. My written statement concludes with some comments on that question, particularly in terms of the rapid acquisition strategy that the Navy originally pursued for the LCS program which aimed at reducing acquisition cycle time.

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

[The prepared statement of Mr. O'Rourke can be found in the Appendix on page 133.]

Mrs. HARTZLER. Thank you very much. Very good comments. I think very clearly laid out some of the challenges and the opportunities. I would like to start with Admiral Rowden.

What specific combatant commanders' requirements have changed over the past 10 years that necessitates converting the LCS platform into a more capable and survivable frigate?

Admiral ROWDEN. The requirement for the littoral combat ships and the frigates, the 52 number, is a number that provides them with the capability to address not only the day-to-day operations that we are executing during the shaping and stabilizing operations that we are executing now, but also as we transition to the high end.

Clearly, as we look at—reflect on the last 10 years and we see a potential adversary's growing numbers of ships and aircraft and submarines that are being fielded, in order to be able to address those threats, those potential threats, we need a Navy that can do that. And they—and the littoral combat ships and the frigates with either the ASW package installed or the ASUW [anti-surface warfare] package installed, and the frigates with both of those capabilities installed will certainly give capability to the combatant commanders that they need as they look at the ever-changing threat and to be able to address that.

Mrs. HARTZLER. So you would say that the need to change to the frigate is because of the threats and the increased capabilities that the frigate would have over the LCS? Because that was what the question was. Why—what are the changes that would necessitate moving to a frigate from an LCS?

Admiral ROWDEN. Yes, ma'am. Given the wider range of operations that the frigate will be able to execute against the growing threat, that certainly would drive us towards building the frigate over the littoral combat ship.

Mrs. HARTZLER. So bottom line is because they have more mission capability.

Admiral ROWDEN. Yes, ma'am.

Mrs. HARTZLER. Multiple rather than just singular, correct?

Admiral ROWDEN. Yes, ma'am.

Mrs. HARTZLER. Okay. Secretary of Defense's December 2014, 2015 memorandum that directed the Secretary of Navy to reduce the total procurement quantity of littoral combat ships and frigates from 52 to 40 states, and I quote, "40 littoral combat ships and frigates, the number that the Navy's own warfighting analysis says it is sufficient to need," end quote.

So it appears to be the rationale as to why the Secretary of Defense reduced the program's quantity. So does the Navy have warfighting analysis that demonstrates that 40 littoral combat ships and frigates are sufficient to meet warfighting requirements? And if so, what is the Navy's number of 52 total small surface combatants based on?

Admiral ROWDEN. Yes ma'am. I think that is a good question to be addressed by Secretary Stackley, but what I can tell you about the conversations that I have with our forward deployed fleet commanders now, the commander of the 6th Fleet in the Mediterranean and the commander of the 7th Fleet in the Western Pacific and the commander of the 5th Fleet in the Arabian Gulf and even the commander of the 4th Fleet down in Southern Command is, in my conversations with them, that one of the questions that always comes up is how many LCS can I get and how fast can you get them to me. So the demand is there. With respect to the—and the requirement remains 50.

With respect to the reduction from 52 to 40, Secretary Stackley.

Secretary STACKLEY. Yes, ma'am. Let me start by the document of requirement which goes to the Force Structure Assessment that the CNO has conducted. 2012 Force Structure Assessment updated in 2014 continues to emphasize the need for no less than 52 small surface combatants to address the full mission requirements across the balanced fleet. And the CNO, since then, has been clear about a couple of things.

One, all pressure on our fleet points towards the need for a larger fleet to continue to perform the missions at the level that the Nation requires. And so there is not a requirement that is going to come through, and this—the 2014 update is going to be updated again this year, will be delivered with the budget. But I can tell you that that requirement will not go down in terms of the number of small surface combatants.

The decision to go from 52 to 40, that was a decision that did not come from the requirements community. It, frankly, didn't come from the Navy. This was driven in a budget environment where the determination was made that we have to take risk somewhere. This is a place where we will take risk in terms of the size of our force.

Mrs. HARTZLER. Okay. And I know a lot of our members want to ask questions, so I will come back to some others. But I do want to ask—something you said, Secretary Stackley, caught my attention. Where you said the shipbuilders are being held accountable. I know that as contracting goes forward, there is a warranty type of a provision added. But is there—how are they being held accountable now?

Secretary STACKLEY. Yes, ma'am. Let me start by describing that I have been doing shipbuilding for over 30 years.

Mrs. HARTZLER. Right.

Secretary STACKLEY. In our contracts, we do have explicit warranty provisions. When the ship is delivered, we first bring the Board of Inspection—well, first, our supervisors of shipbuilding are monitoring the construction of the ship as it goes to ensure compliance with process and procedures. And in terms of the delivered ship, the Board of Inspection and Survey comes on board and conducts a pretty extensive full-week inspection of the ship, including underway periods. Deficiencies are documented.

When the ship is delivered, it is still within a warranty period so that if other deficiencies emerge during the warranty period, then we first—we evaluate who is responsible for the deficiency. If it is a government responsibility, if it is a government system, then we own it. But if it is a contractor responsibility, we take it back to the contractor to fulfill his requirements under the contract within that warranty provision. And then at the end of this period, we have what is referred to as a final contract trial to shake out any last remnants before we go into a post-shakedown availability, at which point in time the government and the contractor are both on board the ship correcting our response—our respective deficiencies.

Mrs. HARTZLER. Sure. What is the time period for these—has been for the warranty period?

Secretary STACKLEY. Notionally, it is 12 months.

Mrs. HARTZLER. So of the—you outlined in your testimony five engineering—five concerns, and a couple of them dealt with crews, dealt with training. That is why you are changing, Vice Admiral——

Secretary STACKLEY. Yes, ma'am.

Mrs. HARTZLER [continuing]. The training, which makes perfect sense. So you are saying that those were—those costs were incurred by the Navy because it was basically the crew's fault that the structural problem occurred.

Secretary STACKLEY. Yes, ma'am.

Mrs. HARTZLER. But with the design, like on the propulsion and those others, who ate those costs——

Secretary STACKLEY. Let me walk through that.

Mrs. HARTZLER [continuing]. To fix that?

Secretary STACKLEY. First the gear. This was a new gear manufacturer brought to the ship. The prior gear manufacturer ceased its business. And specifications went out to the gear manufacturer. When that gear was coupled with the rest of the propulsion plant, there was a, I will call it a mistiming in terms of software controlling the system. That was not discovered until the USS *Milwaukee* was en route to her home port, and we tripped over this failure and the clutch—the clutch burnt out.

That—the shipbuilder in this case and the gear manufacturer are paying for the correction of the design, and we are withholding payments on subsequent ships until that is corrected on the subsequent ships. And then the USS *Milwaukee* itself, that final correction is waiting for the design, verification, and validation. And prior ships, the LCS 1 and LCS 3, are not affected because they are under a different gear design. So that is being covered today with withholdings, with fee——

Mrs. HARTZLER. Very good.

Secretary STACKLEY [continuing]. And cost under the contract.

Mrs. HARTZLER. Good. That makes sense.

Secretary STACKLEY. Can I hit the other one, because the other one is important?

Mrs. HARTZLER. Well, I think we need to—we are going to have votes coming up.

Secretary STACKLEY. Yes, ma'am.

Mrs. HARTZLER. And we want to get to some other questions, but thank you for that.

Ranking Member Speier.

Ms. SPEIER. Thank you, Madam Chair. Before beginning my questioning, I just want to compliment Congresswoman Graham for an outstanding service to this committee and to Congress, and I am really very disappointed that you are leaving because you really are the kind of member we need that is always going to be responsive to the needs of their constituents and to their responsibilities as members of the committee. So thank you very much for your leadership.

Mr. Stackley, I am so disappointed in your testimony I can't begin to tell you. You just answered a question for the chair that I thought was very deceptive. Let me just read from a GAO [Government Accountability Office] report: "Our past work has found that by virtue of using guaranty provisions as opposed to warranties (such as the U.S. Coast Guard generally uses), the Navy is responsible for paying the vast majority of defects.

"Specifically regarding the LCS, we found that for LCS 4, the Navy's guaranty provisions were structured such that the Navy paid all of the costs to correct the defects. For LCS 3, the shipbuilder was responsible for 30 percent of the costs of the first $100,000 of defects, a number the Navy surpassed just days after delivery. Thus, the Navy was 100 percent responsible for the costs of all remaining defects, for LCS 5–8, the shipbuilder is responsible for some portion of the first $1 million in defects for each ship."

Now, I don't think you were very responsive. I am not going to ask you to respond. I am going to ask Ms. Mackin to clarify what the warranty versus guaranty provisions, how the Coast Guard is so different, and how for the vast majority of defects, it is the taxpayer picking up the tab.

Ms. MACKIN. Yes. We looked into this issue for Coast Guard and Navy ships. It was a pretty comprehensive review. Not just LCS, but other Navy ships as well, and what we found is the Navy does not use warranty provisions as outlined in the Federal Acquisition Regulation warranty the way we would think of a warranty. They use a guaranty clause in the contract, and it is subject to a limitation of liability. Those are the numbers you were citing. So it is negotiated in the contract. The limitation was zero on LCS 4. The more recent ships it is a million dollars. The way these contracts are structured, however, the government and shipbuilder, even for shipbuilder-responsible defects, would split the cost in essence of paying for the fixes, up to a million dollars. After a million dollars, it is all on the government.

The Coast Guard, on the other hand, for their more recent cutters has a pretty stringent warranty provision, kind of the way we

would think of it, that they negotiate at the outset and hold their shipbuilders more accountable to fix problems.

Ms. SPEIER. Thank you. So, Mr. Stackley, why is it the Coast Guard can get it right and the Navy can't?

Secretary STACKLEY. I will review the Coast Guard warranty provisions, but our contract——

Ms. SPEIER. You have been doing this for 30 years. Why haven't you looked at it before——

Secretary STACKLEY. I don't look at the Coast Guard contracts unless it comes under my purview. The provisions that we have on our contract, they hold the contractor responsible, for what he—he is responsible regarding specifications, regarding performance of the systems that they deliver. And if, in fact, there is a deficiency, the costs go back to that contractor during the warranty period.

Ms. SPEIER. I think that we are talking around some realities. The reality is the Coast Guard has figured out a way to do it appropriately. The Navy has basically taken the position that we will pay for most of the costs. And that was reflected in the GAO report.

Secretary Stackley, let me ask you a question. Last week a similar hearing was held by our colleagues in the Senate. You were asked who was responsible for briefing Congress that the ship would cost $220 million. As we see from the chart, it is now costing $470 million per frame. You said you had to check your records. So you have had about a week. Who was responsible for that?

Secretary STACKLEY. Yes, ma'am. Let me go back to, that was the 2003, 2004 timeframe. I have got to be careful about the term briefing because that number was briefed by everybody from the Chief of Naval Operations to the Assistant Secretary of the Navy to the program executive officer to the program manager.

Ms. SPEIER. So who is it? Who was it?

Secretary STACKLEY. I would start at the top of the chain of command.

Ms. SPEIER. Well, evidently, I have a tweet from a reporter that suggests that it was Vern Clark.

Secretary STACKLEY. I said I would start at the top of the chain of command, and Vern Clark was the Chief of Naval Operations at the time. His counterpart in terms of acquisition was Assistant Secretary Young. They carried forward the program based on what they had for affordability targets at the time.

Ms. SPEIER. Okay. But I guess my point is, in your statement you made the case that, you know, we are really moving along appropriately. They are costing about the right amount. We are saving money. We are not saving money. They are costing over twice as much as they were originally intended to cost.

Now, Dr. Gilmore, do you think the LCS is survivable?

Dr. GILMORE. The admiral noted that the ship meets its requirements for survivability, which it does. The testing that we have done and that we will continue to do is indicating that is true. And here are what its requirements are. Its requirements against very modest threats, and the details are classified, are to exit the area, not to continue in combat, but to exit the area if they are attacked by modest threats. If they are attacked by, and hit by, more stressing threats, and unfortunately these threats are proliferating

throughout the world and they are quite stressing—they are stressing for any ship to deal with—but if the ships are hit by these more stressing threats, the requirement is for an orderly abandon ship. And the testing that we have done and will continue to do is probably going to indicate that those requirements have been met.

That means that the ship is not going to be able to stay in the battle area and conduct operations. Now, it is a challenge for any ship to do that, if hit by some of these threats, but all the other surface combatants that we have are built with compartmentalization, redundancy, and other features that at least give them much more of a chance to survive hits by some of these stressing threats. So that is the basis of my evaluation.

The requirements were set when the vision for using these ships actually as articulated first by Admiral Clark—I have looked at his testimony before the Congress in March of 2004—the requirements were set consistent with the vision that the ship would have many off-board systems that could go potentially over the horizon, attack targets, which would mean the ship could stay out of harm's way, and I am paraphrasing what Admiral Clark said. Unfortunately, those capabilities have not materialized. They may in the future. The Navy is getting ready to deploy with some unmanned aerial vehicles that will have reconnaissance capabilities. But in terms of long-range attack, those systems are probably a number of years away.

In fact, many of the upgrades that the Navy has talked about in the past as being available either in the last decade or this decade are probably slipping into the middle of the next decade at best.

So that is the basis of my assessment. If in the future the Navy is able to develop and deploy systems that enable the ship to stay out of the range of some of these threats, then the survivability assessment would change.

Ms. SPEIER. So if an LCS is hit by a torpedo, what is survivability, that the sailors can get overboard or that they can exit the area?

Dr. GILMORE. Actually I am going to have to not answer that directly because the details are classified. Talking about specific threats makes the discussion classified, so I would be happy to discuss that with you in the——

Secretary STACKLEY. I would like to answer that. I would like to answer that, ma'am.

Ms. SPEIER. Well, if it is classified, why should you be discussing it?

Secretary STACKLEY. I can get into some generic discussion regarding survivability that might be helpful.

Ms. SPEIER. All right.

Secretary STACKLEY. Okay. First, Dr. Gilmore's assessment regarding the ship's meeting its survivability requirements is correct. The ship was not designed for what you call fight-through survivability. If it takes a devastating blow, the key is to exit the area and ensure the crew survives. But since the mission is built around these mission packages that work off-board, then it is not envisioned that the ship's ability to continue to operate the off-board mission packages is critical at that point.

In the case of a torpedo striking the ship, the comment regarding compartmentalization of the ship, this ship is designed to the same compartmentalization standards as the rest of the United States Navy, and that is to be able to survive a blow that covers 15 percent of what is referred to as floodable length of the ship to provide three-compartment flooding. So whether it is an LCS, or whether it is a DDG–51, or whether it is a carrier, that compartmentalization standard is the same. The fact that it is smaller, it has a bigger impact on a smaller ship. But a compartmentation requirement in the event that a torpedo, if it breaches more than three compartments, then that crew is going to have to abandon that ship.

Ms. SPEIER. When I was on the——

Dr. GILMORE. Could I say something——

Ms. SPEIER. Yes, Dr. Gilmore.

Dr. GILMORE. The ship still doesn't have all of the redundancy——

Mrs. HARTZLER. Excuse me, Dr. Gilmore. I just want to let everyone know we are voting. There is 9 minutes to go. So if we could wrap up this question, then what I would like to do is just to pause our hearing, let us go vote. It should be about a half hour in voting, and then reconvene, because we have a second vote series later on. So if that would be good. So if you would finish the question.

Dr. GILMORE. I will just very briefly say——

Mrs. HARTZLER. Sure.

Dr. GILMORE. The ship doesn't have the redundancy of the other combatants. That is because it is a small ship. It also has a very small crew, which is very important to recoverability. So the other ships have a larger crew and more redundancy, and if they are hit, that means they have a better opportunity to survive. There is no guarantee of survival when hit by any of these threats. So there is in my view, as I have explained in multiple reports in detail, a significant difference in survivability between these ships and all the other surface combatants.

Mrs. HARTZLER. Great. Thank you very much. So, we will stand in recess and reconvene as soon as possible.

[Recess.]

Mrs. HARTZLER. This hearing will now reconvene. Thank you for your patience while we voted. I appreciate that very much. I would like to go to Mr. Scott.

Mr. SCOTT. Thank you, Madam Chair. One of the questions I had has already been answered, and that was for Mr. Stackley, and that is if the Coast Guard is doing a better job or has better provisions in their contracts, we should at least look at that and see if that is something that we can incorporate. I know you have said that you all would do that, and I appreciate that.

I guess as I listen to this, I think back to the quote that nothing will ever be attempted if all possible objections must first be overcome. And regardless of the weapons system or the branch, if we are talking about the Army, there is a reason we have Strykers, and there is a reason we have M1 Abrams, and the Stryker cannot handle the same type of strike from another weapons system that the Abrams can. But the Abrams can't do all of the things that the Stryker can. And if we are looking for a light, nimble craft, then we have just got to accept the fact that you can't build it as thick

as you are going to build some of our other weapons systems. It is just part of the tradeoff. We have this tradeoff with every weapons system that we have. And so I just, nimble and fast, in and of itself, and quantity in and of itself, I believe are important in winning the battle.

I do have a question, Ms. Mackin. As you talk about the cost per ship, do you consider the development cost a variable cost or a fixed cost?

Ms. MACKIN. When we look at the cost per ship, there is several different ways to look at it. So there is a cost cap for this program, which is somewhat generous. We usually look at the selected acquisition report, the unit cost as reported by DOD——

Mr. SCOTT. But do you consider the research and development [R&D] of the system a fixed cost or a variable cost?

Ms. MACKIN. I think that would depend on the system. Maybe somebody else can weigh in with more detail on that.

Mr. SCOTT. Well, research and development is a fixed cost. It doesn't matter if you build 1 or 50——

Ms. MACKIN. I think one issue for this program and other programs is that some of the systems on this ship may be R&D funded but not by the Navy. Maybe another part of the Navy that is funding the system that will eventually go on the ship. So it is hard sometimes to totally capture the entire cost of the ship. But, again, we go with what is reported to Congress.

Mr. SCOTT. But the same type of analysis is what led to the cancellation of the F–22, when the per unit cost of the F–22, when the project was cancelled, was significantly lower than the cost per unit that was being reported in reports like this. Because the research and development costs are already sunk. It doesn't matter if you build 1 or if you build 1,001.

Ms. MACKIN. Quite frankly, cost is not our main concern with this program right now. After the rebaseline, I do think they have gotten costs more or less under control. The key concern we have is the testing, the lack of completed testing, while they have continued to buy the seaframes and the mission packages. There are still significant concerns. And, again, the frigate is going to be based on these same seaframes that have reliability issues. So I would characterize that as our main concern at this point.

Mr. SCOTT. Well, a lot is said about cost from the people who want to cancel the program. So you are telling me the cost is not the primary concern——

Ms. MACKIN. The cost has doubled since the initial estimate, as was discussed earlier. But let's look at what is happening right now. After the restructuring, I think they have gotten costs more or less under control. That is not our main concern. Schedules are late, and the capabilities aren't there, and the testing hasn't been completed, would be how I would characterize our main concerns at this point.

Mr. SCOTT. Admiral, what are we giving up? What are we accepting in additional risk, as a nation, when we move from 52 ships to 40 ships? And what is your understanding of any studies that were done with OSD [Office of the Secretary of Defense] to form any type of analysis foundation for the quantity reduction to the LCS program?

Admiral ROWDEN. Thank you, sir. I will let Secretary Stackley discuss the analysis. But, I mean, clearly when we reduce the number of ships from 52 to 40, we are taking risk in the capacity that we want to have forward. And so that will result in more water under the keels of the ships that we have. It will result in more wear and tear on those ships. It will result in more wear and tear on the crew and a greater time deployed for the same amount of availability forward. And so that is risk that has to be weighed and has to be accepted as we attempt to fulfill the requirements of the combatant commanders.

Mr. SCOTT. My time is expired, but as I understand it there was no analytical foundation for the reduction. That this was simply a budget-driven decision. Is that correct?

Admiral ROWDEN. That is my understanding.

Mr. SCOTT. Thank you.

Mrs. HARTZLER. Thank you. Ms. Graham.

Ms. GRAHAM. Thank you, Madam Chairwoman, and I really appreciate your kind remarks earlier, thank you so much, and Jackie, thank you as well.

As a representative of a State with nearly 100 vendors that undergird the LCS program, I am very grateful to have an opportunity to talk with you all today. This is my actual last day here on the Hill, so it is very special to be able to be with you all. I would first like to thank the House Armed Services Committee for fighting for the Graham amendment in this year's NDAA [National Defense Authorization Act], which would express the sense of Congress on the role of Panama City, Florida, to the Armed Forces of the United States.

I would also like to thank the conferees who noted that Panama City has played a long role and an important role in the development and support of the United States Armed Forces. This, I hope, is just the first step in recognizing Panama City with the ultimate hope, and I have talked to the Secretary of the Navy about this—that the Navy will name a future LCS after Panama City, a much deserving community.

So now I would like to direct a question to Secretary Stackley. As you know, the United States shipbuilding capacity had been in steady decline for years. As many have noted, shipbuilding is not a faucet that can be turned on and off. Indeed, once lost, it can take years to recapitalize a vendor base and labor force necessary to build our Navy's warships. So, Secretary Stackley, you have suggested that a block buy strategy enables a shipbuilder to go out to its vendor base and secure long-term agreements to achieve the best pricing. Can you please expand on this and comment on how such a strategy may contribute to maximum efficiency and capacity in our industrial base as well as best price for the taxpayers?

Secretary STACKLEY. Yes, ma'am. Thanks for the question. First, you described the level of ship production that we have going on in the country, and it is below capacity, and it is, frankly, below where we need it to be in the long-term in terms of being able to sustain the force structure that the Navy needs. And there are three critical elements to that. First is the shipbuilders themselves, and shipyards are capital-intensive and require significant investment in order to be able to produce these extraordinarily complex,

large warships. And so in order to support the investment that is required, you have to have throughput in terms of ships. I mean, it is just fundamental.

And so if production drops to an unsustainable level—unsustainable meaning they can't invest in those facilities—then those facilities are going to ultimately shutter. That is one part.

The second part is skilled labor. Shipbuilding requires unique skills in terms of shipfitters, pipefitters. We have nuclear-trained mechanics, production control in the shipyard, very skilled set of labor. And what we can't afford to have happen is a sawtooth effect in terms of hiring and firing at our shipyards.

One, we will be continually dealing with learning in terms of the labor themselves. And, two, we will lose the skilled labor. They will go to other areas where there is more stable employment, and that will come back to us in terms of cost and quality. So we have to maintain those two key elements in our industrial base, and it is particularly fragile at a time when your shipbuilding rates are below where you believe they need to be.

And then the third is the vendor base itself. We can't lose sight of the vendors that support our shipyards because at low rates, quite often those vendors are uniquely supporting our shipbuilding, and at lower rates, they are fragile. So we have to be careful that we don't break the vendor base and have that come back to us again in terms of cost and quality. That is all on the industrial base side.

On the requirement side, we have to make sure that we are building our ships at a rate to support the force structure that we have laid out in terms of our 30-year plan which is backed up by the maritime strategy in support of the national military strategy. And so if you look at our long-term plan, we are below where we need to be. If you look at what we have done over the last 8 years, it has been to try to increase our shipbuilding rates to support that long-term plan. And if you are going to do that when you are starting at a fragile base, those long-term agreements with the shipbuilders to incentivize them to invest and with the vendor base to incentivize them to basically support the shipbuilders through the material flow are absolutely critical.

So in the Department of the Navy—I will stand by the record over the last 8 years—whether it is the LCS program across two shipbuilders, the *Virginia* program across two shipbuilders, the DDG–51 program across two shipbuilders, the T–AO(X) program that we just awarded, with one shipbuilder—program by program we have done our best to be able to line up, whether it is a multiyear or a block buy, a long-term run of production to stabilize performance, to attract, retain the skilled workforce that we need, and to reduce cost from the vendor base right to the shipbuilder because that comes back to us in terms of the government and the taxpayer. And that allows us to, in fact, plow those funds back into whether it is shipbuilding or aviation or whatever it is that is the priority at the time to support our national security strategy.

Ms. GRAHAM. Thank you for that very thorough answer. I really appreciate it, and I am out of time. I want to end with this. Please continue to feel my spirit and my commitment and my thanks for

all that you all do. And I hope that spirit will one day result in an LCS being named after Panama City.

And I will let that be my final comment, and I yield back to the chairwoman. Thank you.

Mrs. HARTZLER. Thank you, Representative Graham. Representative Byrne.

Mr. BYRNE. Thank you. As a member of the Seapower Subcommittee, I am particularly glad to be here today.

Admiral, Mr. Stackley, thank you for your years of experience, for the expertise and professionalism you bring to your jobs. It helps us do our jobs to have you do what you do and give us such great information. Admiral, you stated your years of experience. You can never replace that. We can sit here and read pieces of paper and listen to you, but your experience really speaks volumes to us, so thank you for that.

Admiral, you said that there is a significant need in the Western Pacific and the Mediterranean for the LCS. You said that the fleet commanders are asking for more LCSes and to get them there more quickly, which I heard from Admiral Harris when I was out in Hawaii at the RIMPAC [Rim of the Pacific] exercise. I asked him, what is the message, Admiral? He said get more of them to me. Get them to me as quickly as you possibly can. You also stated that you are 100 percent confident in the LCS and that you have seen the need for the capability it currently has and that you are optimistic of the added capabilities as the program continues to mature. And you stated that there is growing threats in the world and a demonstrated need for both the LCS and its transition to the frigate.

I want to make sure I have summarized what you have told us today. Did I get that right?

Admiral ROWDEN. Yes, sir, I think you nailed it.

Mr. BYRNE. Good. Mr. Stackley, you said that the LCS acquisition program has been steady since 2008, and since then has been under the cost cap. You also explained that the casualties of the LCS have been addressed and that there are no systemic or recurring issues with these casualties. You also said the Navy continues to have a need for 52 small surface combatants, and, in fact, that number may increase. And the reason to go down to 40 LCSes was driven by the budget and not by any sort of operational study.

So I want to make sure that you continue to believe, and the Navy continues to believe, you need 52 of these small surface combatants, these LCSes to frigates?

Have I summarized your statements correctly?

Secretary STACKLEY. Yes, sir. As I described earlier, the 52 number, I don't anticipate any downward change to that number when the updated Force Structure Assessment comes back from the CNO with the next budget.

I want to make a minor correction, but an important correction. In terms of stabilizing the program, I would tag that to the 2010 timeframe, and that is when we basically came over to Congress with the block buy approach, and that is the environment that we are executing in today.

The other comment regarding the casualties, those specific casualties that were identified that we are tackling, those by them-

selves, not systemic, we are correcting those and we are going beyond that though. Naval Sea Systems Command is doing a comprehensive review of propulsion systems for both ship types to ensure that we don't run into further unanticipated casualties that could have been corrected ahead of time.

Mr. BYRNE. Thank you. I have been on, I think, three of these ships at dock and one at sea. And when I go on them, Admiral, I talk to not just to the officers on the ships, I talk to the sailors, because if you want to know what is really happening, you talk to the sailors. You know that better than I do. And what I have heard uniformly from the officers and sailors on these LCSes, is that they love them. They are proud to be serving on them, and they are having fun operating the ships. I know you have been on them. I know you have talked to a lot of these officers and sailors. What are you hearing from the officers and sailors that are actually serving on the LCSes?

Admiral ROWDEN. Sir, I hear a lot of things, clearly, and I think that there are some things that we need to work on, but those comments—and we take those onboard, and we go and we attack them. From my experiences, not only on the LCSes both on the East and West Coast, whether it is the *Freedom* variant or the *Independence* variant, the young men and women that are serving on these ships, they are excited for the mission. They are excited for the mission. They are excited for the opportunities that these ships present.

When I talk to the young men and women that have come back from deployment, the varied missions that they are able to accomplish, the engagement that they are allowed to execute, it gives them a tremendous sense of pride. They also are monumentally innovative, and so they are constantly coming up with new ideas and new ways as we think about the future of these ships in order to be able to fully utilize and fully get the value out of these ships.

They talk about the modularity. You know, one of the things that I think is important is that when we go to modernize a guided-missile destroyer, we have to take that ship offline for a significant period of time; but they understand that we can modernize the module ashore and in a very short period of time have a fully modernized combat system in order to be able to go put it back out to sea, get the crew trained up, and away we go.

And so the capacity and the capability that these ships bring, the opportunities that they bring to contribute to three very important missions, and the opportunities to provide the presence that sometimes we just can't get because the guided-missile destroyers, the cruisers, the submarines, and carriers, are off doing other things. That is what really gets them fired up.

Mr. BYRNE. Well, thank you for that, and thank you for your service, sir. And I yield back.

Mrs. HARTZLER. Thank you. A few more questions here. Dr. Gilmore, what specific LCS platform characteristics and design do you believe that the Navy will need to address in its design for the frigate in order for your office to deem the frigate operationally suitable and effective?

Dr. GILMORE. Well, the most important problem, set of problems, that will have to be addressed, are associated with the continuing reliability problems of many of the ships' systems, and many of

those may end up being the same on the frigate, although Mr. Stackley will know more about that than I do because he is the one who is involved in developing the detailed design, but the initial assumption was that many of those would be the same. And there are continuing reliability problems with those systems. And if those problems are not fixed and addressed, it will be hard to, in fact, probably impossible to say that the frigate would be suitable, but I assume the Navy is looking at that.

And then, of course, in the testing that we have done so far, there are problems with the guns, and some of the guns may end up being the same in terms of the ability of the crews to use them consistently to accomplish the missions that they are supposed to accomplish. They can in some instances accomplish those missions, but it turns out to be very difficult.

But the other thing I have to say about combat missions is that we have only done a very limited amount of testing so far in that regard, very limited testing of the surface warfare package, and then truncated testing of the mine countermeasures package. Of course, the mine countermeasures package isn't at issue for the frigate.

So at this point what I would say is with regard to the problems that might be encountered with the combat systems, the anti-submarine warfare systems, and the augmented surface warfare package on the frigate, we will have to see how that goes. The Navy is in development of those systems, but the Navy should devote a lot of attention, and I think Mr. Stackley has indicated they are devoting a lot of attention to the continuing reliability problems with the systems on the ships.

Mrs. HARTZLER. Thank you. Mr. Stackley, I wanted to ask you about that because in your testimony you talked about the packages that they include, and you said they will deliver when available, and they are ready to deploy. They have successfully fielded the surface warfare. They were late due to budget and technological challenges. I know you went in depth and explained about the mine countermeasures challenges and what you are doing with that regard. But I was a little surprised to hear you talk about how these other packages are ready.

Can you give a little further assessment on that? Are they ready? And it sounds like you are putting old systems on them and bringing on new ones as they come about, or what is the status of the packages?

Secretary STACKLEY. Yes, ma'am. Thanks for the question. I will try to be real clear here. We launched the program with three mission packages as the targeted initial round of capabilities as we delivered the ship. Across those mission packages, certain subsystems were mature and certain subsystems were going through development. And as I indicated in my opening statement, we are delivering mission package capability late. And the lateness ties to the extended development of certain of those subsystems. However, when one is ready, when it is mature, we are bringing it to the ship, so that as those capabilities mature and as these ships deploy, you are seeing increasing capability on board.

And, in fact, I would argue that the approach that we are taking with the LCS regarding bringing mature capability to the ship in

an incremental fashion is exactly what you all have outlined for the Department of Defense to do in the 2017 NDAA. I think if you take that, what you have outlined in terms of practice for the Department, and you line that up with the LCS program, that is the approach that we are taking here. The reason that we are having this hearing frankly is, one of the reasons, is the time that it has taken to complete the development and testing for some of these subsystems. We spend a lot of time talking about the RMMV, for example, but there are other examples where we have had to actually cancel parts of the mission packages because the development was not getting there and then find an alternative.

The beauty is that when that decision is made, we don't have to go in and do a significant redesign to the ship because the ship was designed in a modular fashion, and we can bring these alternatives to the ship with a far less intrusive integration onboard. And I can walk through some of those examples, but I think it is instructive in terms of the benefit of the modular approach.

Mrs. HARTZLER. I think that is a good point because we have talked about open architecture and some of those things in acquisition reform.

Just a question. Curious about the contracting, the subcontractors, so I got a list of them and looked at them because this has been problematic as far as the delay. Are they penalized for not delivering on time, or how is a contract set up initially in that regard?

Secretary STACKLEY. Yes, ma'am. Bottom line, most of these developmental systems are under a cost-plus R&D contract where the terms and conditions of the contract are we take on responsibility for cost in a cost-plus environment, recognizing that in many cases we are looking for new invention and discovery. And so we assume the responsibility in a cost-plus environment for the cost, but the contractor loses if it is a cost overrun or delays, they are going to lose the fee that goes with the work. And ultimately they will lose the contract.

I mean, RMMV was under development with Lockheed Martin. They had their eyes on the production contract and when we cancelled, they didn't just lose the fee on the RMMV development, but they lost the production that was going to come with it.

Mrs. HARTZLER. Very good. And I want to go to other members too, but I do want to ask Mr. O'Rourke a question. You have waited patiently, and you are a known expert on these issues on the Hill.

So GAO has previously indicated that Congress limits their oversight by authorizing a block buy. A few questions. How has the previous block buy been used to manage cost growth, and is Congress able to perform oversight during the block buy? And, third, what are the implications of Congress not approving the next block buy for LCS?

Mr. O'ROURKE. In terms of conducting oversight during the period of a block buy, we have actually been through a test of that over the last several years as we have executed the current block buy contracts. There are many aspects to congressional oversight. One is what we are doing right now, which is asking questions during hearings. And there has been quite a lot of that over the past several years. The LCS has been a recurrent topic of questioning,

sometimes quite intensive or extensive, at the annual Navy budget review hearings.

I would venture that most of the annual Navy posture and budget review hearings have at one point or another discussed the LCS, so there has been a lot of Q&A at the hearings. Another aspect of oversight are legislative provisions and there have been a lot of——

Mrs. HARTZLER. If I could ask you, I think maybe you didn't hear the question. What I am looking for, how has a block buy been used to manage cost growth not oversight? So how has a block buy managed cost growth, and what are the implications for us as Congress if we don't approve a block buy?

Mr. O'ROURKE. Right I was going to the——

Mrs. HARTZLER. That is what we are looking at so——

Mr. O'ROURKE. Right. I had picked out the middle part of your question first.

Mrs. HARTZLER. Yeah there was a question——

Mr. O'ROURKE. But let me return to the first part, which is, if you would say that again, I want to make sure?

Mrs. HARTZLER. Sure. How has a previous block buy been used to manage cost growth?

Mr. O'ROURKE. Okay. I think it is important to get into the record that most of the cost growth on the procurement cost of the seaframes occurred prior to the block buys. Once the program was put under the block buy contracts, there has been only minor growth within that contract, some of which has been paid by the Navy. But the majority of the increase in the cost of the ships occurred during the period of annual contracting on the first four ships.

Mrs. HARTZLER. So you would say block buy locks in the price and helps save money?

Mr. O'ROURKE. It stabilized the costs and put the program into an environment where the costs have been not one that assembled a record of cost growth of anything like what we saw on the first four ships. Furthermore, by doing a block buy contract, you are getting the kinds of savings that are possible under a block buy contract compared to annual contracting. And those savings for the kind of block buy contract we are looking at here, which did not include upfront batch orders of components, could be upwards of 5 percent, so if we had been in an annual contracting environment, the ships might have been that much more expensive as well. A third point on this is that——

Mrs. HARTZLER. Very quickly.

Mr. O'ROURKE. These block buy contracts are fixed price incentive contracts, and so that tends to limit the government's exposure to the amount of cost growth that does occur during the contract. That was the first part of your question.

Mrs. HARTZLER. Makes sense. Thank you very much. Representative Speier.

Ms. SPEIER. Thank you. Let's talk more about block buys, because my understanding is that, Secretary Stackley, you have already put out an RFP [request for proposal] that presupposes a block buy, even though you don't have authorization yet from Congress. Is that correct?

Secretary STACKLEY. What we have put out an RFP for is the 2017 ships with an option for a block buy where we will be coming back to the Congress with the 2018 budget for authorization for the block buy.

Ms. SPEIER. But the shipbuilders are even saying that a block buy at this time won't afford them the necessary time for the completion of design.

Secretary STACKLEY. We are doing the design today with the shipbuilder. We won't award the contract until we have completed a design review so that we, the government, are satisfied based on their presentation of the design information that will inform their proposal for the frigate.

Ms. SPEIER. Ms. Mackin, what are the downsides of a block buy?

Ms. MACKIN. You know, it could have advantages for cost control, number one.

Ms. SPEIER. Which Mr. O'Rourke has talked about.

Ms. MACKIN. Right. The disadvantages in our view, is that, as I mentioned in my opening remarks, the program can be considered, quote-unquote, "locked in," so that any attempt to adjust the procurement pace, if Congress has concerns about the program, they want to make some changes, DOD has consistently come back and said, well, the pricing will increase then.

So you are not locked in. I mean, you can make changes, but there is that risk that, oh, well, the contractors, we had this deal, and now they are going to raise their prices. So, I think it needs to be carefully considered if the block buy proposal for the frigate right now, which will be based initially on LCS prices, is the best strategy.

Ms. SPEIER. Secretary Stackley, and you can provide this for the record if you don't have it off the top of your head, I want to know—and I would like for you to send it to the committee and also to my personal office—how much money we have spent on repairs to the LCS fleet to date, how much has the government spent, and how much has the shipbuilder spent.

Secretary STACKLEY. Yes, ma'am. I will submit that for the record.

[The information referred to was not available at the time of printing.]

Secretary STACKLEY. Now, I am going to ask for clarification because, for example, the LCS 1 has been in the fleet for about 8 years, the LCS 2 for about 7 years; and so when you say how much money for repairs, we will come back with a—it will probably be a large dollar amount for repairs, but you understand that most repair, the predominance of the repair that we do in operations is because of the wear and tear that we put on the ships by operating them. For clarification, are you looking for contractor-responsible deficiencies?

Ms. SPEIER. I want all repairs, and you can give it to us by date so we can look at the date the ship was commissioned and the date of the repairs so we can make that kind of assessment as to whether it is just wear and tear on the ship or whether it is something relative to a newly commissioned ship that has a series of problems, as many of these have already had.

We will make that determination. If you just provide to us the dates of the repairs and how much they cost and who paid for them, that would be sufficient.

Secretary STACKLEY. Yes, ma'am.

Ms. SPEIER. And then I was on the LCS 4 on its very first trip, and I talked to the commander at the time who said they were having trouble with the design of the ship because they couldn't see over the hull. Now they left Cartagena and came back to Coronado to be christened. And as they went through the Panama Canal, the hull got damaged when pieces of the lock penetrated the hull. I would like again, if you don't have that figure off the top of your head, to provide it to me and the committee how much that cost to repair.

Because in my conversations with the commander, I said this seems like a serious problem, and it seems like you need cameras or mirrors or something to be able to see over the hull. And he said, well, we won't be able to get that until it goes back into dry dock in 2 years. And literally within weeks, they had damaged the hull. So if you would provide that to me, I would appreciate it.

Secretary STACKLEY. Yes, ma'am.

[The information referred can be found in the Appendix on page 163.]

Ms. SPEIER. Back to you, Dr. Gilmore, the testing of the modules for the LCS, can you go over that? How many of them—according to the Secretary there is three now. How many of them have been fully tested?

Dr. GILMORE. The only mission module that has been partially tested consistent with the—you know, there is a series of incremental requirements associated with the increments of each package, so we have tested the Increment 2 surface warfare package against its requirements, which are reduced relative to the requirements for surface warfare that the Navy ultimately hopes to meet with the fully capable surface warfare package which will come in the next several years, probably middle of the next decade, perhaps a little sooner.

So what we have done so far in terms of operational testing is to test both LCS variants equipped with the Increment 2 surface warfare package against the Navy's requirements for surface warfare for the Increment 2 package. We had initiated what is called the technical evaluation last year, which was of the mine countermeasures package, which was the lead-up to what was supposed to have happened in operational testing. But given what happened in the technical evaluation testing, the Navy made the decision not to go to operational testing, commissioned an independent review team, and ultimately decided to cancel the RMS [Remote Minehunting System] program and make other changes to the mine countermeasures program. And we now have in place a plan for testing that future mine countermeasures package, which will be different from what the Navy had been thinking, at least in some respects, but that won't take place for several years.

So just to sum up, what we have done so far in terms of operational testing is operational testing of the Increment 2 surface warfare package. There has been a lot of developmental testing done on elements of the other packages. For example, there has

been developmental testing done of a variable depth sonar, not the one that the Navy has recently contracted for, but it was a foreign source variable depth sonar. There was developmental testing done of that. I forget exactly when that was, a year or two ago, and that was very promising. But it was done under conditions that weren't operationally realistic because, you know, the crews doing the testing actually were engineers, and the submarine that they were using the sonar to look for, the operators knew where it was, and the submarine wasn't evading.

Now having said all of that, the test results were nevertheless very promising, and there have been lots of other developmental testing that has been done and that the Navy continues to do. But I am the operational test guy, and what we have done is what I said.

Ms. SPEIER. So if I understand you correctly, this whole concept of having modules that you could interchange on the ship, making it more flexible, has been tabled, and we are now doing single modules for the ships, and only one has been operationally tested?

Dr. GILMORE. Well, the original concept was that different modules could be interchanged among different ships, and that the ship crews and the module crews could be separate and interchangeable.

My understanding is that the Navy as a result of another review in which Admiral Rowden was involved, has decided that they are going to merge the ship crews and the module crews on LCS and pretty much dedicate given modules to given ships and crews. And based on what we have seen, we think that is a good decision, so the Navy is giving up on some of the original vision based on what it has learned as we have done operational and developmental testing.

Now, you still will be able to pull a module off a ship. The points have been made about, well, you can modernize the module and not take the entire ship down. So suppose you want to implement Increment 4 of the surface warfare package, you can take those modules off the ships. You can take the existing surface warfare modules off the ships and replace them with another module for another warfare area, and the ships aren't completely down and going through a lot of construction and changes in a dry dock.

So that part of the concept is still alive, but the Navy has modified its thinking about how it is going to implement modularity on these ships going forward.

Admiral ROWDEN. Ma'am, if I may provide some clarification.

Ms. SPEIER. Sure.

Admiral ROWDEN. Yes ma'am. So, I led the review team that came up with the recommendation to think differently about the modularity of these ships, and in the execution of the review, we were concentrating on three things really: simplification, stabilization, and ownership. My experience in going to sea is that the crew has to own the mission, and my concern was as we were looking at the modularity and shifting the mission over perhaps the course of a weekend, you are taking the vast majority of the crew and you are trying to shift them from hunting submarines on Thursday to hunting mines on Tuesday, and that just didn't make sense to me from the operational perspective. I still value and wanted to fully utilize the modularity of the ships for the reasons that Dr. Gilmore

points out. We can modernize it much more effectively and much more rapidly.

But I think it is important to understand that while we will single up crews and we will single up ships dedicated to a specific mission, if the need arises, we also have those crews given the similarity between the ships, or the identical between the ships, if we need to shift ships from hunting mines to hunting submarines, we have crews available, and we have modules available to do that if we have to expand that capacity.

So we will have divisions dedicated to specific missions, and we will have crews dedicated to specific missions, but we can still utilize the modularity to expand our capacity should we have to do that in a time of crisis.

Ms. SPEIER. Okay. But we started off with a concept. We built eight ships under that concept. We have got another 12 ships in development, and we keep changing our design expectations or assessments. And it just seems to me that we should design and then build because then we built things that aren't adequate to do what we want them to do.

Let me ask you this, Secretary Stackley, and just one more question after that, Madam Chair. It is my understanding that because we didn't have a U.S.-based or U.S. Navy capability, a repair technician was flown to Florida from Australia in 2015 to make a 90-minute repair but essentially delaying operations by 4 days. How many other pieces of equipment could require similar repairs and/or delays, and has this happened more than once?

Secretary STACKLEY. I will have to get back to you on the record in that specific instance and see if there are other instances. But I will describe that for every ship in our Navy, if we have to, and we do, we reach around the world to get the right tech rep there to the ship to provide the technical support that it will need in timely manner. And when we have original equipment manufacturers that are located overseas, then in fact we do on occasion have to go overseas to get that repair assist.

Ms. SPEIER. All right. So if you would just provide to us how many times have we had to utilize resources that were not available within the Navy on these specific ships?

Secretary STACKLEY. Yes, ma'am.

[The information referred to was not available at the time of printing.]

Ms. SPEIER. Okay. And then finally one last question. If we are now taking the LCS and turning it into a frigate, wouldn't we be better served to design a frigate that meets what our needs are? We have always had problems with the LCS because we were bumping up against the weight restriction. We have always had problems with the fact that there is not adequate number of crew on the ship, and we have a hull that is made out of aluminum that gets pierced easily and has been damaged in a number of settings. It seems to me that maybe we should go back to the drawing board and build a frigate that we want as opposed to just superimposing it on an LCS frame that appears to have many problems.

Secretary STACKLEY. Yes, ma'am. Thanks for the question. Back in the 2014 timeframe, we spent a year reviewing design alternatives for this frigate, and we worked with the fleet. We worked

across the design community. We worked with the Joint Staff. We worked with the CNO staff. And we reviewed existing designs, U.S. and foreign frigate designs, as well as considered a clean sheet. So, in fact, we did consider a clean sheet.

We considered other existing designs, other existing designs as parent designs that could be modified, and included in that was the LCS itself. Reviewed all those alternatives, looked at the range of capabilities. The fleet weighed in in terms of their priorities in terms of the capabilities. Had to consider the missions that the ship would perform in, and had to consider things like cost and maturity and risk.

And out of all that and that review that was conducted with OSD, with the Joint Staff, and we invited review by committee staffs as well, out of all of that, we landed on the proposal that came across to Congress last year and which we are continuing to discuss, which is the modified LCS, using the existing ASW and surface warfare capabilities that we either have or are developing to reduce the risk to first and foremost provide the capability that the fleet has prioritized, reduce the risk in terms of technical time and cost, and ensure that when we make a commitment to the Congress in terms of this frigate, this capability, this cost, that we are not bringing a lot of risk to the table and have a repeat of what we just experienced on the LCS at the beginning of this program. We are trying to leverage. It goes back to my comment regarding the 2017 NDAA——

Ms. SPEIER. All right. Ms. Mackin, could you just respond to that as well?

Ms. MACKIN. We also looked at the study. We looked at how the study was done. The study team did a pretty good job given a very limited time that they had. They did consider existing design, modification of existing new designs, and a major and minor modified LCS. As I mentioned earlier, the minor modified LCS, which is now the frigate, was the least capable option that the study team assessed. It did not meet all the fleet's needs, everything that they wanted.

Cost was a big driver in deciding to go with the minor modified LCS, but another big driver was that they didn't want to disrupt the workload at the two existing LCS shipyards, so that was also a factor in addition to cost, and what we have now is the frigate.

Ms. SPEIER. But the actual production is not jeopardized until 2021?

Ms. MACKIN. That is right. And even the study team noted that the current workload, even at that time they were doing their work, was taking both yards into 2021. So as I mentioned, there is no schedule imperative right now to get the frigate into the pipeline for industrial base concerns.

Ms. SPEIER. So for the record, of everything that was studied, this was the least attractive alternative that was, indeed, selected? Is that what you just said?

Ms. MACKIN. It was the least capable option.

Secretary STACKLEY. I would not agree with that, for the record, ma'am.

Ms. SPEIER. All right. Now——

Secretary STACKLEY. For the record, and I would, rather than have this be a debate at this hearing, that you invite your staff or the members to review, we will brief, we will go through the extensive review that was done of the alternatives.

And for the record, the disruption to the shipbuilders, that is important, but the decisionmakers, and that included the CNO first and foremost, and the CNO first and foremost is less concerned about disruption to the shipbuilders and more concerned about delivering capabilities to the fleet. And that was the priority that he placed in terms of the ultimate recommendation that went forth to the Secretary.

Ms. SPEIER. Well Mr. Stackley, I do not want to engage in a discussion on this right now, but I think in the end, for all of us, what is most important is, one, that our seamen are safe and secure at sea and that they can survive and that the ship can survive.

And, two, that we build competent, capable ships, and, three, that the costs be known and that we are prudent in making sure that we are not paying for pigs in the poke. And that we are not providing sweetheart deals to the shipbuilders for not providing us ships at the outset that are capable of doing the job that we contracted for, and that is why that warranty/guaranty issue must be addressed.

With that, I yield back.

Secretary STACKLEY. I 100 percent concur, ma'am.

Mrs. HARTZLER. Very good. Mr. Byrne.

Mr. BYRNE. A couple of follow-up questions. Have we had other classes of ships that have moved through the Panama Canal that have had some sort of damage as they have gone through?

Admiral ROWDEN. Sir, I can't think of any specific instances at this time. However, I will take that for the record; and if that, in fact, has occurred, I will get that back to you, sir.

[The information referred can be found in the Appendix on page 163.]

Mr. BYRNE. When the ship is going through the Panama Canal—I have watched commercial ships go through the canal, and the crew is still on board the ship, but the Panama Canal personnel are actually operating the transit through the locks. Is that true with U.S. Navy ships?

Admiral ROWDEN. Yes, sir, that is.

Mr. BYRNE. So if there has been damage as it is going through the locks, it is really not our personnel that has caused it. It has been caused by the people that work for the Panama Canal?

Admiral ROWDEN. That is correct, sir. And specifically with the latest damage that occurred on the ship, when we took the first ship through and there was some damage associated with it, we sent a team down to the Panama Canal to talk to them about how we needed to take these ships through the canal, the modifications that needed to be made to the way they hook the lines up and pull the ship through the canal.

Unfortunately, and we discussed this at length with how they were going to do it, unfortunately in the most recent transit, that was not executed. We have gone back to them, and we are going to get it squared away in the future, but we know how to get the ships through the canal safely, and if we execute the procedures as

we have outlined them, I don't think we will have any problems with that in the future.

Secretary STACKLEY. If I can add to that?

Mr. BYRNE. Sure.

Secretary STACKLEY. The LCS 2 variant is what we would refer to as Panamax. In other words, the ship design maximizes the beam width of the ship up to the limits of the Panama Canal, so it is going to be tight. And it is also a very unique design in terms of the sides of the ship, and you are well familiar with this.

So the first couple of instances of transiting the canal, the damage has occurred because we are pressing up against the full width of the canal with this unique design, and the system that is used, what's referred to as a fendering system, for all ships—all ships have a fendering system to minimize the damage—just was not prepared for that situation.

So as Admiral Rowden indicated, it is both handling, but it is also the fendering system that we are putting in place to deal with those type constraints.

Mr. BYRNE. And with the casualties that we have experienced with this class of ships, the LCS class, are they on par with other classes of ships when they are new? Is this what you get when you get a new class of ship, that you have a certain level of casualties, any worse or any better?

Secretary STACKLEY. The answer is absolutely yes, but we are not satisfied. And so I reviewed what we refer to as casualty——

Mr. BYRNE. Absolutely yes, that it is on par?

Secretary STACKLEY. Absolutely yes, that it is on par, but we are not satisfied. I reviewed the history of the last 4 years' worth of casualty reports, and LCS is in the mix for combatants in terms of casualty reports status 2, 3 and 4, which are different degrees of severity. So that is in the mix.

However, Dr. Gilmore's comments regarding reliability are absolutely on. This is a relatively new ship class. We do have new ship systems. We are going through what is referred to as reliability growth. And what we have got to do is get there faster on a system-by-system basis so that the concerns that he raises and that we share with regards to reliability, we can retire more quickly, and we will just as we have with every prior ship class that we have introduced to the Navy.

Mr. BYRNE. And, Admiral, one final question for you. We have heard a lot about distributed lethality. I hope I said that right. It is a lot of syllables in a couple words for somebody from Alabama to say. When we added the missile capability to these ships, what did it do to these ships' distributed lethality?

Admiral ROWDEN. Sir, thank you for the question. It is interesting because our first thoughts of how to distribute the lethality of the fleet, distribute the lethality of the force, came when we were up at the Naval War College actually conducting a war game utilizing the littoral combat ship. And in this specific war game, we were playing in the mid 2020s timeframe, and one of the capabilities that we indicated would be available and on the ship at that time was an extended-range over-the-horizon missile.

And this was a war game in that we set up live players, playing live players as we executed the moves. And I was just, I was quite

pleased with the effectiveness that we had out of the littoral combat ships that had been discounted by the adversary given the capability that we had built on to the ship, and they had full understanding of what was happening there.

And so as we have looked back and as we conducted the after-action reports, one of the things that I realized as we were looking at the requirements that we built into our ships is this migration towards pretty defensive ships. Defend the aircraft carrier. Defend the logistics train. Defend the amphibious readiness groups. And what we have found in subsequent war games is that if we increased the offensive capability of the ship, if we increased the range at which we could go out and attack our adversary, it caused a couple problems.

One, they had to think very differently about all of the different aspects of the fight. They had to pay less attention to the undersea domain. They had to pay less attention to the space of the domain because they had to pay much more attention to the surface ships and the lethality of those surface ships.

Mr. BYRNE. Well, I noted when I was at the RIMPAC exercise, that the Chinese ships that were participating were all closest to the *Coronado,* the littoral combat ship, and watching it very carefully. And so I think the Chinese are very interested in what this new capability has been added to that ship and what it would do in that theater.

Thank you, Madam Chairman. I yield back.

Mrs. HARTZLER. Thank you. We have had a very thorough and, I think, helpful hearing today discussing this very important platform for our sailors and for our Nation.

Before we conclude the hearing, I was wondering if any of the witnesses have any closing remarks that they want to make or anything they want to say to put on the record that they haven't gotten to say yet.

So I will just go through Mr. Stackley, if there is anything you want to add.

Secretary STACKLEY. Ma'am, I would be at risk of repeating my opening statement. But just to synopsize, the ship works. We have reliability issues. We will get through those. But the ship works. Concerns with things like redundancy, I agree with Dr. Gilmore's assessment that we need to increase redundancy, particularly for critical systems, and we are going about that, first with the frigate design and then looking at backfitting that to the earlier hulls. The ship works.

The mission packages are correctly selected in terms of warfighting gaps. We have got to deliver that capability regardless of what the platform is, and we have selected the LCS platform to deliver those capabilities. We are late. We understand that, but we are bringing that capability forward in an incremental fashion when it is ready so every deployment, every deployment, littoral combat ships are deploying with increased capability. And yes, we have changed the program as we go. That is because we are learning.

This is a new concept. And concepts that were struck back in the 2001, 2002 timeframe, now that we are out there operating and deploying, we are learning and we are improving.

So I thank you for the hearing, and we will follow up on all the requested actions.

Mrs. HARTZLER. Very good. And you are—each of you can submit comments for the record in addition.

Vice Admiral Rowden, any closing comments?

Admiral ROWDEN. Yes, ma'am. I too sincerely appreciate the opportunity to be here on behalf of the littoral combat ship.

It is an exciting time in our Navy, and it is an exciting time bringing this capability into the fleet. The capabilities that it is going to deliver and understanding that we have a team focused on the issues, we are learning about the issues, we are learning about how to maintain it, and going forward, I am 100 percent confident that we will tackle those issues and we will defeat them.

And as we deliver that capability forward, as we—and in my mind, it is all about the center of the universe, and I think the center of the universe, at least from the professional perspective, are the ships and the men and women that serve on those ships. They are excited about the capability that these ships bring, and I know that they will deliver to the forward forces. And we are going to continue to work hard and make sure that we maximize the value of these ships to our fleet commanders.

Mrs. HARTZLER. Very good.

Ms. Mackin.

Ms. MACKIN. I just would reiterate the need for prudence in pursuing a block buy strategy at this point in time, which will be initially 12 LCS prices, with the frigate upgrades to be added in later. There are a lot of unknowns about the basic ship right now that is going to be modified, what will the design look like, what will the cost be. So I will just reiterate that caution.

And then just for the record, I did want to mention on the warranty issue, we recommended that the Navy take a look and see if it would be possible to move more toward a warranty approach, as the Coast Guard does, and they agreed to do so. That study is supposed to be provided to us this month. So we haven't seen it yet, but we will look forward to taking a look at the results.

Mrs. HARTZLER. Very good.

Dr. Gilmore.

Dr. GILMORE. I just emphasize what I said in my opening comments, which is we need to acknowledge the many problems that exist and fix them. And I am glad the Navy is now acknowledging many of these problems, but in the past, that always hasn't been true.

For example, in 2014 testimony from senior Navy officials, they said the Remote Minehunting System completed its reliability growth program this past year and continues to test well. At that time, that simply wasn't the case. It was testing poorly.

So I hope that the Navy, as it is now doing and as it did with its mine countermeasures independent review team, thoroughly reviews all of the test results that are available, takes those onboard, and provides the resources, with your help, to fix these problems. And it seems that Mr. Stackley and Admiral Rowden are committed to doing that, and I hope they continue to do that in the future.

Mrs. HARTZLER. Very good. Thank you.

Mr. O'Rourke.

Mr. O'ROURKE. Thanks for having me at the hearing today. Just to close the loop on your earlier question about block buys and oversight. There is a lot of aspects of oversight. We talked about Q&A [question and answer] at the hearings. There is legislative provisions, there have been many of those over the years, lots of report language in the committee reports, a lot of GAO reports also, as well as—as well as my tracking report and CBO [Congressional Budget Office] report. So those are all other aspects of oversight that have taken place during the block buy contracts that we have executed.

There is one additional aspect of conducting oversight, and that is the ability to terminate the program if you are just dissatisfied with it. Congress does retain the ability to terminate a block buy contract, and a block buy contract can be written without a cancellation penalty. Furthermore, a block buy contract can be implemented without upfront batch buys of components that might add to your reluctance to cancel the contract, and in fact, that is how the Navy has done the LCS block buy contracts, without any upfront batch buys.

The block buy contract does add to your reluctance to cancel the program, but it might also be argued that most of the reluctance for terminating a program arises from the mere fact that the program has begun procurement. There have been relatively few defense acquisition program cancellations over the years, and the vast majority of those programs that have not been canceled were done under annual contracting.

One final note. If we were to do a down-select as currently planned and then use annual contracting, we could be getting ourselves into a situation of limiting the Navy's ability to use leverage in its negotiation with the contractor. When you down select to a single builder, you are creating a monopoly supplier at that point. And if the Navy then has to go back to that sole builder and contract on an annual basis and get into an annual negotiation with that builder, the Navy's leverage in that situation might be reduced.

That is a situation we are in, for example, with aircraft carriers, and people have expressed dissatisfaction with the fact that we have only one builder of aircraft carriers and we have to then negotiate with them every time we build a carrier. If you were to do a down-select on the LCS program and then also use annual contracting rather than block buy, you are creating a situation not too unlike that one that people have expressed dissatisfaction with.

Mrs. HARTZLER. Great. Thank you all for your service to this Nation. This hearing is now adjourned.

[Whereupon, at 12:10 p.m., the subcommittee was adjourned.]

# A P P E N D I X

DECEMBER 8, 2016

## PREPARED STATEMENTS SUBMITTED FOR THE RECORD

DECEMBER 8, 2016

**Opening Remarks of Chairwoman Vicky Hartzler**
**Subcommittee on Oversight & Investigation Hearing**
**"Oversight Review of the U.S. Navy's Littoral Combat Ship (LCS) Program"**

**December 8, 2016**

Today we take testimony on the Littoral Combat Ship program. We seek to gain a deeper understanding of the challenges that this program has presented us in the past, and the opportunities that exist as the program moves forward.

We need to grow the size of this nation's surface fleet. The LCS [Littoral Combat Ship] could have an important role in increasing our capabilities and flexibility. I know that there is a critical need to replace our less capable and decommissioned mine-countermeasures ships, patrol craft, and Oliver Hazard Perry-class Frigates. I believe that the Littoral Combat Ship, and the eventual upgrade to the Frigate design, has great potential to fulfill the roles for the platforms it replaces. This is why the LCS enjoys bipartisan support in the Seapower subcommittee.

The concept of LCS and the decision to begin the program came at a time in the department of defense's acquisition history in which senior leaders of the department thought it was necessary (and possible) to disregard the natural evolution of technology by skipping a generation of development. It was good theory, but proved costly and cumbersome to implement. We have learned many lessons from this period. For example, introducing immature technologies into acquisition programs will lead to cost and schedule growth. Awarding contracts without a stable design and directing prescriptive government specifications also increases costs and schedule.

It is only with unleashing the power of best buying practices that we can realize acquisition efficiencies. These lessons have been hard learned in a multitude of acquisition contracts. For example, stable government funding is essential to providing material ordering and labor efficiencies. Additionally, innovative multi-year procurements or block buys save money because long term agreements with subcontractors and vendors provides contracting stability. Dangerous reductions below minimum order quantities only serve to exacerbate our industrial base and increase the cost to the taxpayer. That is why the House has advocated adding a third LCS in FY 2017 and has expressed reservations about the Navy's acquisition strategy which involves procuring one LCS frigate every year during fiscal years 2018, 2019 and 2020.

I also want to discuss the Navy's force structure requirement of 52 small surface combatants. The Navy's force structure is based on their ability meet combatant commander requirements, both in peace and in war. That is why I am perplexed with Secretary Carter's determination that we only need

40 LCS frigates.

I believe the secretary's decision lacks analytical rigor. I am hoping that the next administration will review this issue. We must absolutely integrate the program's acquisition lessons learned as we evaluate with prudent scrutiny the opportunity to invest an additional $14 billion dollars to complete the purchase of LCS and transition its hull-form into a frigate design. We must also ensure that the "mission modules" which are integral to the first LCS designs are successfully completed, tested, and fielded at the lowest possible price.

I look forward to discussing this program with our distinguished panel of witnesses we have before us today.

**Opening Statement of Ranking Member Jackie Speier**
**Subcommittee on Oversight and Investigations hearing on**
**"Oversight Review of the U.S. Navy's Littoral Combat Ship (LCS) Program"**

**December 8, 2016**

We are here today to examine a case study in gross mismanagement on the part of the Navy. At virtually every decision point—from conceiving the initial flawed concept, to the concurrent acquisition process, to the huge cost overruns, to the huge fundamental flaws in the ships themselves, and to the feeble attempts by the Navy and DOD to correct course—the Navy has wasted billions in taxpayer dollars and failed to produce a ship that meets its objectives.

What I hope to examine today is: Has the Navy learned its lesson? Have they corrected course and are they moving forward with a stable ship design based on a sound analytical foundation?

From the testimony of the witnesses today, I fear the answer is a resounding no.

I'd especially like to know who certified the LCS would cost $220 million each, but now costs more than double per ship at $478 million. Who briefed this to Congress and who signed off on this assertion? While cost overruns are by no means acceptable, perhaps they could be explained if they resulted in a functional ship. But the LCS isn't just outrageously expensive – it's also outrageously bad at doing its job.

Just look at how many issues six of the eight ships in service have had. Just over the past year, the LCS has experienced six "engineering casualties," in which engines flooded, couplings cracked, and ships broke down in transit. The USS Montgomery, which was commissioned mere months ago, has already had two engine failures and two collisions that resulted in major damage. What's even worse is that because of the way the Navy structured the contracts, taxpayers are still responsible for most of these repair costs, even when the shipbuilders are at fault. These contracts mean that in some cases, the shipbuilders aren't responsible for even one cent of potential defects. Why is it that the Coast Guard can hold its shipbuilders responsible for defects, but the Navy puts the burden on taxpayers?

Meanwhile, the Secretary of Defense has admitted that continuing to produce two versions of the ship makes no sense, and has ordered a down-select. The Navy has admitted that its "transformative" interchangeable mission module will likely never be interchanged as originally envisioned. The Navy has also admitted that its "transformative" crewing concept won't work, and essentially scrapped it. Look at how much the program has changed from the Navy's early pie-in-the-sky promises.

Now, in all of the Navy's wisdom, they have decided to change the name of the LCS to a "Frigate" and plan to purchase more of what is essentially still an LCS but whose modifications are unproven, lack critical capabilities and can't pass original survivability tests. Why? Because they've determined it will meet their multi-mission requirements. Yet, once again, we don't have a ship design, don't know what it will cost, or whether the ship can survive in combat. Instead, as I've joked many times, we have a ship that even the Chinese don't want to copy.

You'd think all this uncertainty would prompt calls for a pause to get the LCS's conceptual house in order before the Navy does a binge-buy for more—but if you think that, you don't know the LCS program. Instead, in an act of astonishing arrogance and disregard of the taxpayers' money, reports indicate that the Department of the Navy is gearing up to ask Congress for a "block buy" of 12 of these new ships. This would give up all our leverage with the contractor to ensure the ships are tested and fixed. What are they thinking? Does anyone honestly believe that the taxpayers, the tea party, or President-elect Donald Trump would approve this buy?

From the beginning, the Navy has regularly submitted LCS budget requests that are not consistent with shipbuilding programs, making it nearly impossible for Congress to exercise oversight. It did this in 2003 when it funded the first ships with research & development funding and in 2010 when it wanted to switch to a plan of buying 2 parallel LCS designs inside of a 20 ship block buy. When issues continued to occur throughout construction and fielding, the block buy was always cited as the reason why Congress shouldn't slow the program down.

Yet again, as the Navy moves toward a different design that they claim will address many of the LCS shortcomings, they are looking for block buy authority before the design has even been completed. This is a strategy that even the shipyards criticized, since it doesn't give them time to complete the Frigate design before beginning construction. The single greatest contributor to the cost inflation on LCS was an incomplete design when construction began. The Navy still hasn't learned their lesson.

I am glad that the Navy has acknowledged reality and changed some of its operational concepts. But in many respects I am concerned they are still hiding the ball. The next time LCS flaws become apparent; it could be in the heat of battle and get our sailors killed. Furthermore, if the Navy's plan for a "block-buy" moves forward, Congress and the Navy's hands will be tied.

I realize what this is really about. We know the LCS is the Ford Edsel of the sea. And yet certain of my colleagues say we can't afford to pause production and get it right because of "industrial base concerns" even though the shipyards will be building these ships until 2021 even if we canceled funding towards the program today.

Let's be real. This is about getting pork back to their districts. The LCS is a $120 billion pork ship, and they are putting pork-barrel politics above the safety of our service members.

The Navy has shown a callous disregard for the taxpayer and frankly the Congress has been derelict in doing its job. We think no one will notice. We think our obligation is to the ship builder to keep building a defective ship just because we want to retain jobs.

Today, we need the guts to say that the LCS was a mistake. To protect the United States' interests and to do what's best for our service men and women, we need a ship that is capable of fulfilling its intended mission. The taxpayers deserve to know if what they are paying for is actually effective. That's why Congress needs to find out if the most recent changes will really make the LCS better, or if we are just trying to make a silk purse out of a pig's ear.

I look forward to your insights about how we got here, how we should go forward, and who is to blame.

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

STATEMENT

OF

THE HONORABLE SEAN J. STACKLEY
ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT AND ACQUISITION)

AND

VADM THOMAS S. ROWDEN
COMMANDER, NAVAL SURFACE FORCES

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

ON

THE LITTORAL COMBAT SHIP

DECEMBER 8, 2016

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

Chairman Hartzler, Ranking Member Speier, and distinguished members of the Subcommittee, 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 FY 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 FY 2020:
    - 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.

- 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.
- 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 FY 2018 in support of IOC in FY 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 FY 2021:
  - 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.

- 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.
- 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.
- 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 FY 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 FY 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 FY 2017 on the FREEDOM variant and a TRACKEX on the INDEPENDENCE variant in FY 2017. The program is on track to operationally test the SSMM in FY 2018 in support of IOC in the second quarter of FY 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 awarded 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 sub-system 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 FY 2018 through FY 2019. The second "assess and decide" phase will evaluate data from the FY 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 FY 2019. The final "re-baselining" phase efforts focus on the long-term plan to deliver MCM capability to support IOC in FY 2021 to address legacy surface and airborne mine countermeasures systems end of service life.

To execute the IRT implementation plan, the Navy submitted an FY 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 FY 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 (FY 2023) and last ship delivery (FY 2028) with no gap in production; and could support a subset of capability and survivability upgrades on LCS production ships as early as FY 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 FY 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 FY 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 FY 2019. In response to the SECDEF direction, the Navy has outlined a path to down select to one shipbuilder (one variant) as early as FY 2018, but no later than FY 2019, for the last twelve ships of the program based on the FF design. The Navy intends to make a down select 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 FY 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.

**The Honorable Sean J. Stackley**
**Assistant Secretary of the Navy**
**(Research, Development and Acquisition)**
**7/28/2008 - Present**

Sean J. Stackley assumed the duties of assistant secretary of the Navy (ASN) (Research, Development & Acquisition (RDA)) following his confirmation by the Senate in July 2008. As the Navy's acquisition executive, Mr. Stackley is responsible for the research, development and acquisition of Navy and Marine Corps platforms and warfare systems which includes oversight of more than 100,000 people and an annual budget in excess of $50 billion.

Prior to his appointment to ASN (RDA), Mr. Stackley served as a professional staff member of the Senate Armed Services Committee. During his tenure with the Committee, he was responsible for overseeing Navy and Marine Corps programs, U.S. Transportation Command matters and related policy for the Seapower Subcommittee. He also advised on Navy and Marine Corps operations & maintenance, science & technology and acquisition policy.

Mr. Stackley began his career as a Navy surface warfare officer, serving in engineering and combat systems assignments aboard USS John Young (DD 973). Upon completing his warfare qualifications, he was designated as an engineering duty officer and served in a series of industrial, fleet, program office and headquarters assignments in ship design and construction, maintenance, logistics and acquisition policy.

From 2001 to 2005, Mr. Stackley served as the Navy's LPD 17 program manager, with responsibility for all aspects of procurement for this major ship program. Having served earlier in his career as production officer for the USS Arleigh Burke (DDG 51) and project Naval architect overseeing structural design for the Canadian Patrol Frigate, HMCS Halifax (FFH 330), he had the unique experience of having performed a principal role in the design, construction, test and delivery of three first-of-class warships.

Mr. Stackley was commissioned and graduated with distinction from the United States Naval Academy in 1979, with a Bachelor of Science in Mechanical Engineering. He holds the degrees of Ocean Engineer and Master of Science, Mechanical Engineering from the Massachusetts Institute of Technology. Mr. Stackley earned certification as professional engineer, Commonwealth of Virginia, in 1994.

**Vice Admiral Thomas S. Rowden**
**Commander, Naval Surface Forces**

A native of Washington, D.C. and a 1982 graduate of the United States Naval Academy, Vice Admiral Thomas Rowden has served in a diverse range of sea and shore assignments.

Rowden's sea duty assignments include duty in cruisers, destroyers and aircraft carriers in both the Atlantic and Pacific Fleets. During these tours, he deployed to the Arabian Gulf, Western Pacific, Sea of Japan, South China Sea, East China Sea, Philippine Sea, Mediterranean Sea, Indian Ocean, Black Sea and Gulf of Guinea/West Africa areas of operation. He commanded USS Milius (DDG 69), served as reactor officer on USS George Washington (CVN 73); commander, Destroyer Squadron 60; commander, Carrier Strike Group 7; commander, USS Ronald Reagan (CVN 76) Strike Group; commander Carrier Strike Group 11, and commander, USS Nimitz (CVN 68) Strike Group.

Ashore, he has served on the Joint Staff as an action officer in the Defense and Space Operations Division (J38); on the chief of naval operations staff as the theater missile and air defense branch head for the director, Navy Missile Defense (N71), and as the executive assistant to the director of Surface Warfare (N76). He completed a tour as Surface Warfare Officer (nuclear) assignment officer at the Bureau of Naval Personnel Command, and served as commanding officer of Surface Warfare Officers School Command, Newport, Rhode Island, where he oversaw the training of every officer en route to duty on ships at sea.

His first flag assignment was commander, U.S. Naval Forces Korea. His most recent assignment was on the Chief of Naval Operations Staff as director, Surface Warfare Division. Rowden earned his Master of Arts in National Security and Strategic Studies from the U.S. Naval War College.

His current assignment is Commander Naval Surface Forces/Naval Surface Force, U.S. Pacific Fleet.

Rowden's decorations include the Distinguished Service Medal, the Legion of Merit, the Meritorious Service Medal, the Navy and Marine Corps Commendation Medal, Navy and Marine Corps Achievement Medal and other personal, unit and campaign awards.

Updated: 20 November 2014

United States Government Accountability Office

Testimony

Before the Subcommittee on Oversight and Investigations, Committee on Armed Services, House of Representatives

For Release on Delivery
Expected at 9:00 a.m. ET
Thursday, December 8, 2016

# LITTORAL COMBAT SHIP AND FRIGATE

## Slowing Planned Frigate Acquisition Would Enable Better-Informed Decisions

Statement of Michele Mackin, Director, Acquisition and Sourcing Management

# GAO Highlights

Highlights of GAO-17-279T, a testimony before the Subcommittee on Oversight and Investigations, Committee on Armed Services, House of Representatives

## 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. This statement discusses: (1) the evolution of the LCS acquisition strategy and where it stands today; (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 frigate 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 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. GAO has also suggested that Congress take certain actions to support better LCS and frigate outcomes.

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# LITTORAL COMBAT SHIP AND FRIGATE

## Slowing Planned Frigate Acquisition Would Enable Better-Informed Decisions

## What GAO Found

The Navy's vision for the 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. Cost, schedule, and capability expectations have eroded over time, as shown in the table below. More recently, the Navy attributed a series of engineering casualties on delivered LCS to shortfalls in crew training, seaframe design, and construction quality.

**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 |
| **Crewing** | LCS would be minimally manned (55-60 crew) | Crew size has increased over time to 70 |

Source: GAO analysis of Navy documentation. | GAO-17-279T

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. Many 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.

Soon, Congress will be asked to make key decisions that have significant funding and oversight implications, but without having important information. The Navy plans to request fiscal year 2018 authorization for its frigate block buy approach. Of note, the pricing the Navy intends to seek from the shipyards will be for 12 basic LCS. Only later will the shipyards submit their proposals for adding frigate capabilities to the LCS hulls. Congress will be asked to authorize this approach many months before the Department of Defense (DOD) prepares an independent cost estimate. Further, there is no industrial base imperative to continue with the Navy's planned pace for the frigate acquisition. LCS workload backlogs, when combined with 2 LCS awarded earlier in 2016 and 2 more planned for award in fiscal year 2017, will take construction at both shipyards into 2021.

Chairwoman Hartzler, Ranking Member Speier, and Members of the Subcommittee:

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 warfare, 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 Navy—with the Secretary of Defense's approval—changed course in late 2014 to pursue a more capable frigate based on the LCS concept.[1] The current Secretary of Defense also directed that the total seaframe buy be reduced from 52 to 40.

Today, with 26 ships delivered or under contract, the LCS program again stands at a crossroads. The Navy's fiscal year 2017 budget request asked Congress to fund the last two planned LCS. Further, early next year Congress will need to decide whether 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) how the LCS program has evolved over time to where it stands today; (2) LCS program cost, schedule, and performance, including several recent engineering casualties on delivered ships; (3) key risks in the Navy's plans for the frigate based on the LCS program; and (4) remaining oversight opportunities for the LCS and frigate 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 Department of Defense (DOD) officials, work that also was conducted in accordance with generally accepted government auditing standards.

## The LCS Program Has Changed Significantly over Time

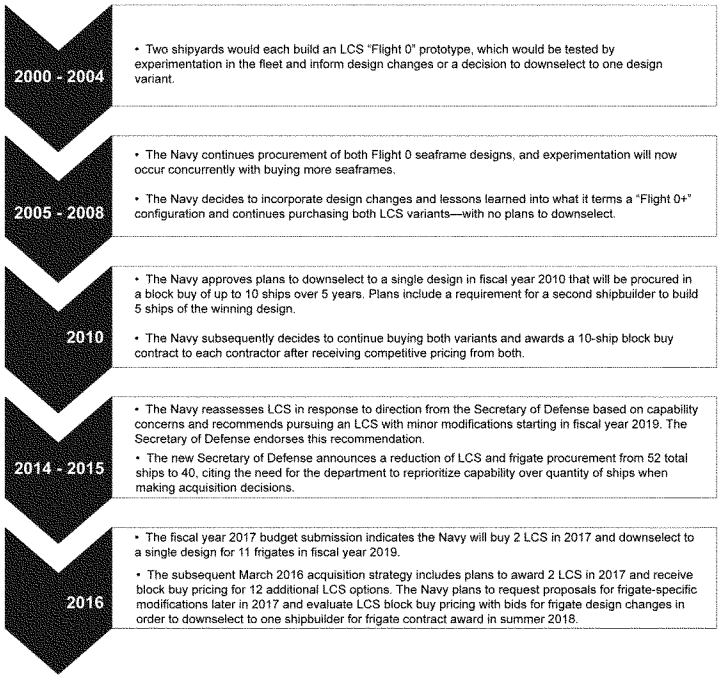
When the Navy first conceived the LCS in the early 2000s, the concept was that two shipbuilders would build prototypes based on commercial designs—Lockheed Martin's Freedom variant and Austal USA's Independence variant.[3] The Navy planned to experiment with these ships to determine its preferred design 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 questioned the appropriate capability and quantity of the LCS and directed a re-evaluation of the small surface combatant needs consistent with frigate-like capabilities. Thus, 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

[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). A list of additional related GAO products can be found at the end of this statement.

[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.

for ship construction has also changed. This evolution is captured in figure 1.

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




Source: GAO analysis of Department of Defense data. | GAO-17-279T

While one could argue that a new concept could 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, budgets were requested and approved, contracts were awarded, and ship construction was undertaken at two shipyards. This all happened without adherence to the principles that lead to sound shipbuilding outcomes—namely, ensuring the maturity of technologies, requirements, and design before construction begins, and delaying commitments until testing can prove that needed capabilities will be delivered.

As a result, taxpayers have paid for 8 delivered LCS, with 14 more in some stage of the construction process (including LCS 21, with a planned December 2016 construction start) without an understanding of the capability that the ships will ultimately provide and with notable performance issues discovered among the few ships that have already been delivered. I will outline these issues in more detail below.

## LCS Cost, Schedule, and Performance Expectations Have Eroded

In addition to significant changes to the acquisition strategy for LCS, the program has also deviated substantially from expectations about its cost, schedule, and the capabilities the ship would provide with the seaframes as well as with the modular mission packages. All the while, the Navy has continued to request funding to buy more ships and mission packages, and Congress has appropriated funds. Table 1 compares the Navy's initial expectations of the LCS cost, schedule, capabilities, and crewing concepts 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<br>• $220 million per seaframe<br>• 64 mission packages, $2.3 billion total cost | • 40 seaframes (includes 12 frigates)<br>• $478 million per seaframe<br>• 64 mission packages, $5.8 billion |
| 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<br>• 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<br>• 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-mile 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<br>• 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<br>• 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<br>• Reliance on shore-based maintenance remains challenging. Despite manning increases, crew has been unable to adequately address maintenance<br>• 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-17-279T

Note: Costs are in fiscal year 2005 dollars.

We reported in July 2014 on issues with LCS training, manning, and maintenance constructs during the 2013 deployment of USS Freedom. We found that the seaframe crew experienced high workload even though

they were augmented by mission module crew and contractor ship riders, and that gaps remained in fully training LCS sailors prior to deployment.[4]

The Navy has attributed a series of recent engineering casualties on delivered LCS to shortfalls in crew training, seaframe design, and construction quality. According to the Navy, these failures have resulted in substantial downtime and costs for repairs or replacements. Table 2 describes the recent major failures at sea.

**Table 2: High Profile LCS Incidents during the Last 12 Months**

| Ship | Date | Casualty |
|---|---|---|
| LCS 5 | December 2015 | High speed clutch assembly failure and debris in combining gear filter systems |
| LCS 3 | January 2016 | Port and starboard combining gear bearings (operated without oil) |
| LCS 1 | July 2016 | Main propulsion diesel engine seawater contamination |
| LCS 4 | August 2016 | Water jet shaft coupling failure |
| LCS Fleet | July – August 2016 | Fleetwide engineering stand down |
| LCS 8 | September 2016 | Water jet hydraulic system seawater contamination |
| LCS 8 | October 2016 | Sustained hull crack along weld seam from tugboat |
| LCS 8 | October 2016 | Hull damage during Panama Canal transit |

Source: GAO analysis of Navy documentation. | GAO-17-279T

However, these types of major incidents are not limited to the past 12 months. For example, LCS 4 also rubbed against the sides of the Panama Canal locks and experienced hull damage in February 2014 when pieces of the lock penetrated the hull.

The question may be asked: who pays for these types of damage and deficiencies? Our past work has found that, by virtue of using guaranty provisions as opposed to warranties (such as the U.S. Coast Guard generally uses), the Navy is responsible for paying for the vast majority of

[4]GAO, *Littoral Combat Ship: Deployment of USS Freedom Revealed Risks in Implementing Operational Concepts and Uncertain Costs*, GAO-14-447 (Washington, D.C.: July 8, 2014).

defects.[5] Specifically regarding LCS, we found that for LCS 4, the Navy's guaranty provisions were structured such that the Navy paid all of the costs to correct all defects. For LCS 3, the shipbuilder was responsible for 30 percent of the cost of the first $100,000 in defects—a number the Navy surpassed just days after delivery. Thus, the Navy was 100 percent responsible for the costs of all remaining defects. For LCS 5-8, the shipbuilder is responsible for some portion of the first $1 million in defects for each ship. Time will tell whether this amount is sufficient to account for discovered defects.[6]

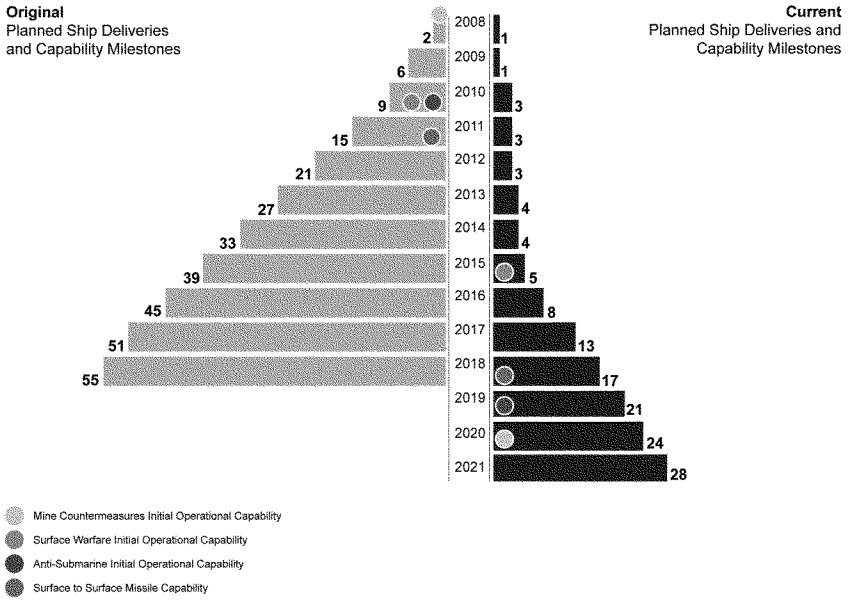
Turning to cost and schedule, our recent work has shown that LCS under construction have exceeded contract cost targets, with the government responsible for paying for a portion of the cost growth. This growth has prompted the Navy to request $246 million in additional funding for fiscal years 2015-2017, largely to address cost overruns on 12 LCS seaframes. Similarly, deliveries of almost all LCS under contract at both shipyards (LCS 5-26) have been delayed by several months, and, in some cases, close 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.

The LCS mission packages have also lagged 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 already be delivered by the time all three mission packages achieve only a minimum level of capability.

[5]Warranty provisions, as are outlined in the Federal Acquisition Regulation (FAR), normally provide that the government may direct the contractor to repair or replace defective items at the contractor's expense. Guarantees are Navy-specific contractual mechanisms that provide for the correction of defects but the responsibility for paying for these corrections varies depending upon contract terms. GAO, *Navy and Coast Guard Shipbuilding: Navy Should Reconsider Approach to Warranties for Correcting Construction Defects,* GAO-16-71 (Washington, D.C.: Mar. 3, 2016).

[6]We are currently reviewing the Navy's post-delivery policies and practices, including the condition of Navy vessels at the time they are delivered from the shipyard and passed to the fleet. LCS is in our scope of work and we expect to issue our report in the spring of 2017.

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




Source: GAO analysis of Department of Defense data. | GAO-17-279T

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. 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.

Another area of concern is changes to the LCS concept of operations as a consequence of less than expected lethality and survivability. 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 3.

**Table 3: 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.<br>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. |
| 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-17-279T

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 reports of these events. Results from air defense and cybersecurity testing also indicate capability concerns, and both seaframe variants were found to have significant reliability and maintainability issues during several tests and trials.

A final issue I will comment on regarding testing is that the Navy's Chief of Naval Operations recently determined that LCS 1-4 will be test ships. This decision supports an aggressive testing schedule between fiscal years 2017 and 2022. The Navy noted that testing requirements have contributed to limited operational availability for delivered LCS. Because operational testing was not conducted in a timely manner to inform any needed design changes to seaframes, additional deficiencies discovered during upcoming tests could require expensive changes to the seaframes and mission packages that have already been delivered.

## Frigate Acquisition Strategy Rushes Procurement in Light of Continued Unknowns

The Navy has elected to pursue an acquisition strategy that starts with getting what it calls block buy pricing from both shipyards for 12 LCS.[7] These basic LCS will then be converted to frigates at a later point in time. The frigate, as planned, will provide multi-mission capability—which 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.

Despite these uncertainties, the Navy's current acquisition strategy indicates it intends to request authorization from Congress for all of the planned frigates—12 in total—and for funding the lead frigate before establishing realistic cost, schedule, and technical parameters. Further, the frigate will inherit many of the shortcomings or uncertainties of the LCS and does not address all of the priorities that the Navy had identified for its future frigate.

[7]The Navy plans to request authorization 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 provides a disincentive to the Navy or Congress to take any action that might disrupt the program because of the potential for the government to have to pay more for ships. If similar terms are included in the frigate contract, the same potential effect may apply.

## 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, though this is still just an initial estimate. 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 4.

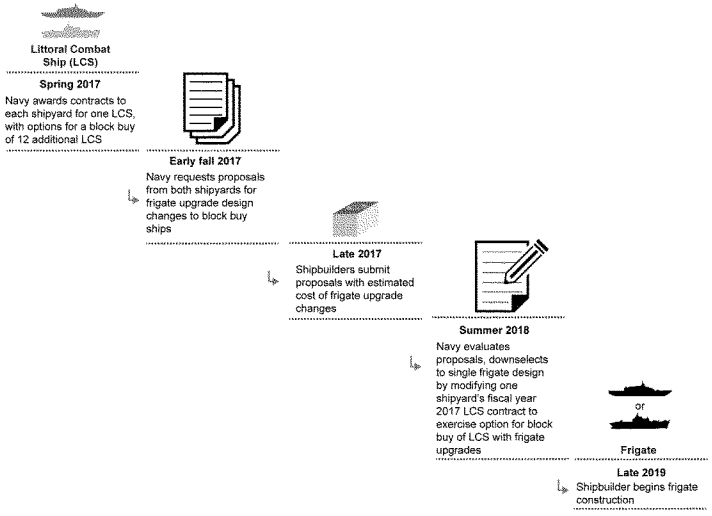
**Table 4: Changes in Frigate Acquisition Plan**

| 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-17-279T

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 to one shipyard is planned to 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-17-279T

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.[8] Further, without a year of frigate detail design that had been previously planned before the contract award, the Navy plans to rely on a

[8]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).

contractor-driven design process that is less prescriptive than a government-driven design process. This approach is similar to what the Navy used for 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 LCS Design Limitations

As LCS costs grew and capabilities diluted, the Secretary of Defense directed the Navy in February 2014 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. As we reported in June 2016, 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.[9] 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 direction 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—and more expensive—small surface combatant options. Navy leadership indicated this decision was based on LCS's relatively lower cost and quicker ability to field, as well as the ability to upgrade remaining LCS and maintain stability in the industrial base and vendor supply chain.

Table 5 presents an analysis from our June 2016 report, 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 warfare mission packages simultaneously instead of just one at a time (e.g., in a modular fashion) like LCS. However, the Navy's planned frigate upgrades will not result in significant improvements in survivability areas related to vulnerability—the

[9]GAO-16-356.

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 5: 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.<br>Improve shock hardening in anti-air missile system | Armor reduces vulnerability; intended to lessen risk of magazine detonation.<br>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-17-279T

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 those 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 based on the Navy's planned timeframes.

## Limited Opportunities Remain to Shape LCS and Frigate Programs

Over the past 10 years, we have made recommendations to DOD on a number of issues with the LCS program. We have also suggested actions for Congress to consider. Now, with the fiscal year 2018 budget request imminent, opportunities for Congress to affect the way forward for this program are becoming limited. This upcoming request, which will include the start of frigate acquisition, presents Congress with an opportunity to ensure the Navy possesses sufficient knowledge before making a substantial commitment to the frigate.

Our recommendations to DOD since 2005 have largely focused on LCS combat capability shortfalls and the Navy's acquisition strategy. While DOD agreed, at times, with these recommendations, it seldom took action if a consequence would be to slow LCS procurement, even when doing so would enable the Navy to build and demonstrate sufficient knowledge in critical areas. Table 6 highlights some of our past recommendations and the department's response.

**Table 6: Department of Defense (DOD) Responses to Selected GAO Recommendations for the Littoral Combat Ship (LCS) and Frigate Programs**

| Year | GAO recommendation | DOD response |
|---|---|---|
| 2005 | • Revise LCS acquisition strategy to ensure that the Navy has sufficiently experimented with both ship designs, captured lessons learned, and mitigated operational and technology risks before award of a detail design and construction contract. | • DOD partially agreed with this recommendation stating that it would review the acquisition strategy before award of contracts for additional ships. DOD noted, however, that the LCS program entailed risk by design, and that DOD seeks to balance the program's acquisition risks with the risk of delaying closure of the warfighting gaps that LCS will fill. |

| Year | GAO recommendation | DOD response |
|---|---|---|
| 2010 | • Update the LCS acquisition strategy to account for operational testing delays in the program and re-sequence planned purchases of ships and mission packages, as appropriate. | • DOD agreed with this recommendation; however, since issuance of the report, the Navy significantly altered its acquisition strategy resulting in the award of block buy contracts in 2010 without demonstrating knowledge related to, among other things, operational testing of at least one of the mission packages on each variant. |
| 2013 | • Procure the minimum quantity and rate of ships required to preserve the mobilization of the production base until the successful completion of the full-rate production decision review.<br>• Report to Congress on the relative advantages of each seaframe variant for each of the three mission areas. | • DOD did not agree with our recommendation regarding the quantity and rate of ships to be purchased, stating that it would unnecessarily decrease production and result in higher pricing for individual seaframes with no value added to the program.<br>• DOD agreed with this recommendation, and Congress directed the Navy to provide additional information on some of the risk areas GAO identified, but the Navy essentially suggested that since the two variants are built to the same requirements they perform the same way. |
| 2014 | • Before approving the release of the request for proposals for future contracts for either seaframe variant, require both variants to, among other things, deploy to a forward overseas location and complete rough water, ship shock, and total ship survivability testing. | • DOD partially agreed with this recommendation, stating its intention to complete as many of the tests and demonstrations as possible before releasing the request for proposals. The department, however, maintained that the release of the request for proposals should not hinge on these actions. |
| 2015 | • Ensure that the Navy's acquisition strategy for the modified LCS does not place industrial base concerns ahead of demonstrating the ship's lethality, survivability, and affordability | • DOD agreed with this recommendation, stating that the Secretary will ensure that industrial base concerns are balanced against cost, schedule and fleet requirements. In March 2016, however, the department approved the Navy's strategy to acquire a minor modified LCS, or frigate—a ship concept it had previously recommended to the department based in large part on industrial base considerations. |
| 2016 | • Before a downselect decision for the frigate, require the program to submit milestone documentation, which could include an independent cost estimate, an acquisition program baseline, and a plan to incorporate the frigate into DOD's Selected Acquisition Reports to Congress. | • DOD partially agreed, stating that the Navy views the LCS transition to the frigate as an incremental upgrade. DOD stated that the Navy would be required to provide key documentation, including an independent cost estimate and an updated acquisition program baseline. The response did not address our concerns about transparency in the Selected Acquisition Reports. |

Source: GAO analysis of prior GAO reports and DOD actions taken or planned. | GAO-17-279T

In addition to these recommendations to DOD, our past reports have made suggestions to Congress on actions to support better LCS program outcomes. For instance, in 2013, we asked Congress to consider restricting construction funding for additional LCS seaframes until the Navy had adequate knowledge to mitigate substantial unknowns about LCS capabilities, use, and costs. Congress responded to our suggestion in the National Defense Authorization Act for Fiscal Year 2014, restricting the use of funds for LCS seaframes until the Navy submitted information to the defense committees on LCS requirements, maturity, testing, and concept of operations. In other cases, however, Congress has opted to

take alternative routes. For example, we suggested in June 2016 that the Congress consider a pause in LCS procurement funding for fiscal year 2017. In doing so, we noted such a pause would provide the Navy with an opportunity to address unresolved LCS performance concerns without creating production problems at the shipyards. However, the Conference Report accompanying the National Defense Authorization Act for Fiscal Year 2017 reflects funding for two more LCS, suggesting that LCS procurement will continue as planned.

The Navy's plans for fiscal year 2018 involve significant decisions for Congress in terms of the way forward in the immediate future the frigate program, including potential future commitments of about $9 billion based on early budget estimates. On the heels of the decision to fund two LCS in fiscal year 2017 is a decision on whether to authorize the frigate contracting approach and fund the lead frigate.

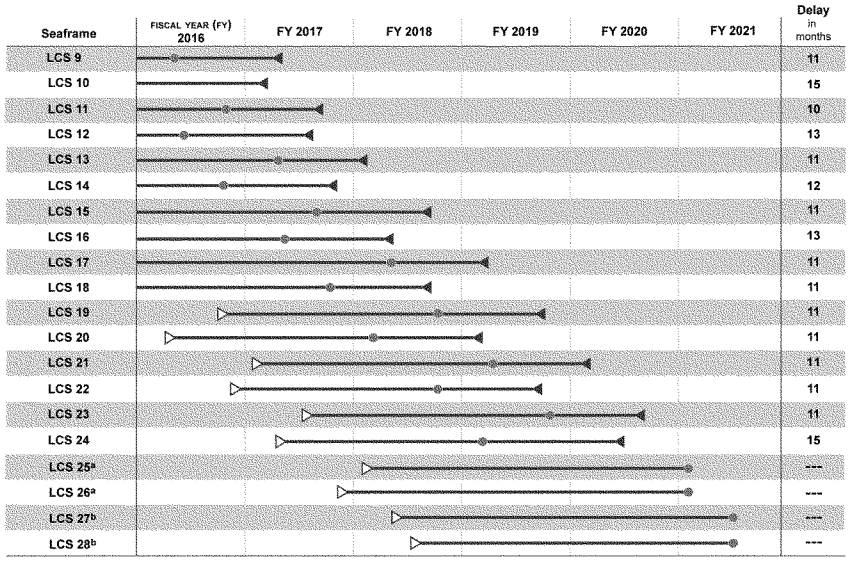
As I noted above, the current acquisition plans for the frigate have been accelerated during the past year. If these plans hold, the Navy will ask Congress in a few months to consider authorizing a block buy of 12 frigates and funding the lead frigate when the fiscal year 2018 budget is proposed. This request appears premature, as it requires Congress to make a decision on the frigate before detail design has begun and before the scope and cost of the design changes needed to turn an LCS into a frigate are well understood. The Navy will not establish its cost estimate until May 2017—months after requesting authorization from Congress for the block buy contracting approach for 12 frigates. Further, DOD's Office of Cost Assessment and Program Evaluation is not expected to complete an independent cost estimate on the frigate until fiscal year 2018. This means that the upcoming budget request is unlikely to reflect the most current costs for the program moving forward.

Similar to what we previously have advised about LCS block buy contracting, a frigate block buy approach also could reduce funding flexibility. For example, the LCS block buy contracts provide that a failure to fully fund the purchase of a ship in a given year would make the contract subject to renegotiation. DOD has pointed to this as a risk that the contractors would supersede the block buy pricing with higher prices. Thus, DOD and Congress have had a notable disincentive to take any action that might delay procurement, even when a program is underperforming as has been the case with LCS.

Also, the shipyards' existing LCS construction workload suggests that a request to authorize the frigate in early 2017 (with the fiscal year 2018

budget request) may not only be premature, but also unnecessary. 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 both shipyards have sufficient workload remaining from prior LCS contract awards that could offset the need to award the frigate in 2018 as planned. 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. As figure 4 depicts, delays that have occurred for previously funded ships have resulted in a construction workload that extends into fiscal year 2020. This prolonged workload, when combined with the two LCS awarded earlier in 2016 and the two LCS planned to be awarded in fiscal year 2017, takes construction at both shipyards into 2021.

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




Source: GAO analysis of Navy contract data and budget documents. | GAO-17-279T

[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, so start and delivery dates represent current plans.

With 14 LCS in various phases of construction (LCS 9-22) and 3 more (LCS 23, 24, and 26) set to begin construction later in fiscal year 2017, delaying a decision on the frigate until fiscal year 2019 would enable the Navy and the shipbuilders to improve design and cost knowledge. This, in

turn, would offer Congress an opportunity to be better informed on the expectations for the frigate before making a decision on the program.

## Summary

Congress is faced at this point in time with a basic oversight question: does it want to authorize an investment of a potential $9 billion for a program that has no independent cost estimate, capabilities that are uncertain, and a compressed contract award schedule when there is no industrial base or other imperative to do so?

I will reiterate that the block buy pricing the Navy intends to seek from the LCS contractors in 2017 will be for the basic LCS seaframes that the Navy has acknowledged do not meet its needs. In 2010, the shipbuilders—when faced with the prospect of a downselect—provided the Navy with competitive pricing that propelled it to continue production at both shipyards. Subsequent history shows those prices have not been achievable. Even if LCS prices offered once again appear favorable, the ships ultimately are intended to be frigates, and the upgrade cost—to be proposed by the shipyards later—is a significant unknown.

A decision by Congress to authorize the block buy of 12 frigates is effectively the final decision for the entire buy of 40 LCS and frigates. While, according to the Navy's approved acquisition strategy, the frigates would still require annual appropriations and Congress could thus conduct oversight of the program through that 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 such as it has done previously with LCS.

Chairwoman Hartzler, Ranking Member Speier, and Members of the Subcommittee, 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 Michele Mackin at (202) 512-4841 or mackinm@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 Diana Moldafsky (Assistant Director), Pete Anderson, Jacob Leon Beier, Laurier Fish, Laura Greifner, Kristine Hassinger, C. James Madar, Sean Merrill, LeAnna Parkey, Anne Stevens, Roxanna Sun, Abby Volk, and Robin Wilson.

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Prior to GAO, Ms. Mackin served for two years as a Peace Corps volunteer in the former Republic of Zaire. She also worked for private, non-profit organizations in New Orleans and Washington, D.C. Ms. Mackin has received, among other recognitions, GAO's meritorious service, client service, and mentoring awards. She has a bachelor's degree in English literature from Louisiana State University and a master's degree in public administration from George Washington University.

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COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

STATEMENT
BY

J. MICHAEL GILMORE
DIRECTOR, OPERATIONAL TEST AND EVALUATION
OFFICE OF THE SECRETARY OF DEFENSE

BEFORE THE
U.S. HOUSE OF REPRESENTATIVES ARMED SERVICES COMMITTEE

ON

# THE NAVY'S LITTORAL COMBAT SHIP PROGRAM

NOT FOR PUBLIC RELEASE
UNTIL APPROVED BY THE
COMMITEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES
HASC – DECEMBER 8, 2016

**J. Michael Gilmore**
**Director, Operational Test and Evaluation (DOT&E)**
**Office of the Secretary of Defense**

Chairman Thornberry, Ranking Member Smith, 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 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

[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.

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 FY16, 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 FY20.

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 system, 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 FY14 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 FY17 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 FY14 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, ship-handling, 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 FY18. 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 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 FY12."[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

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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.

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.

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 FY20 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 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 FY20. 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

[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).

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 employ the Common Unmanned Surface Vehicle (CUSV) and AN/AQS-20C as the primary replacement for

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[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.

the RMS, even by its own optimistic schedule the Navy will not complete IOT&E of the system until at least FY21. 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 FY17, 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 FY21.

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 FY22. 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 FY17 or FY18, 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 FY16, 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 FY22.

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 FY16 following operational testing in FY15. Now, however, the earliest the LCS program might achieve IOC for the ASW mission package is FY19 for the *Freedom* variant and FY20 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 relative 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 limitations 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 FY16 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 composition. 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

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

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.

**Dr. J. Michael Gilmore**
**Director of Operational Test and Evaluation**
**Office of the Secretary of Defense**

Dr. J. Michael Gilmore was sworn in as Director of Operational Test and Evaluation on September 23, 2009. A Presidential appointee confirmed by the United States Senate, he serves as the senior advisor to the Secretary of Defense on operational and live fire test and evaluation of Department of Defense weapon systems.

Prior to his current appointment, Dr. Gilmore was the Assistant Director for National Security at the Congressional Budget Office (CBO). In this position, he was responsible for CBO's National Security Division, which performs analyses of major policy and program issues in national defense, international affairs, and veterans' affairs. Specific areas of investigation included the long-term implications of current defense policies and programs, the implications of transformation for equipping and operating U.S. military forces, the effectiveness and costs of alternative approaches to modernizing U.S. military forces, and the resource demands associated with operating and supporting U.S. military forces.

Dr. Gilmore is a former Deputy Director of General Purpose Programs within the Office of the Secretary of Defense, Program Analysis and Evaluation (OSD(PA&E)). As the Deputy Director, he was responsible for developing, formulating, and implementing Secretary of Defense policies on all aspects of Department of Defense general purpose programs, including analyzing the operational effectiveness and costs of U.S. conventional military forces and supporting programs. Before serving as a Deputy Director, Dr. Gilmore served as the Division Director of Operations Analysis and Procurement Planning, within the Office of the Deputy Director, Resource Analysis and prior to that as an Analyst for Strategic Defensive and Space Programs Division, Office of the Deputy Director, Strategic and Space Programs. Dr. Gilmore's service with Program Analysis and Evaluation covered 11 years.

Early in his career, Dr. Gilmore worked at the Lawrence Livermore National Laboratory, Livermore, California performing research in their magnetic fusion energy program. He has also worked as an Analyst with the Falcon Associates, McLean, VA, and the McDonnell Douglas Washington Studies and Analysis Group, where he became Manager, Electronic Systems Company Analysis.

A native of Ohio and resident of Virginia, Dr. Gilmore is a graduate of The Massachusetts Institute of Technology, Cambridge, Massachusetts, where he earned a B.S. in Physics. He subsequently earned a M.S. and Ph.D. in Nuclear Engineering from the University of Wisconsin, Madison, Wisconsin.

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TESTIMONY

Statement of

**Ronald O'Rourke**
Specialist in Naval Affairs

Before

Committee on Armed Services
Subcommittee on Oversight and Investigations
U.S. House of Representatives

Hearing on

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

December 8, 2016

**Congressional Research Service**
7-5700
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<Product Code>

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Prepared for Congress

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

# A Program at a Crossroads for Multiple Reasons

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

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

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

# Issue for Congress

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

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

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

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

# Analytical Foundation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

# Program Quantity

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

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

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

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

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

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

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

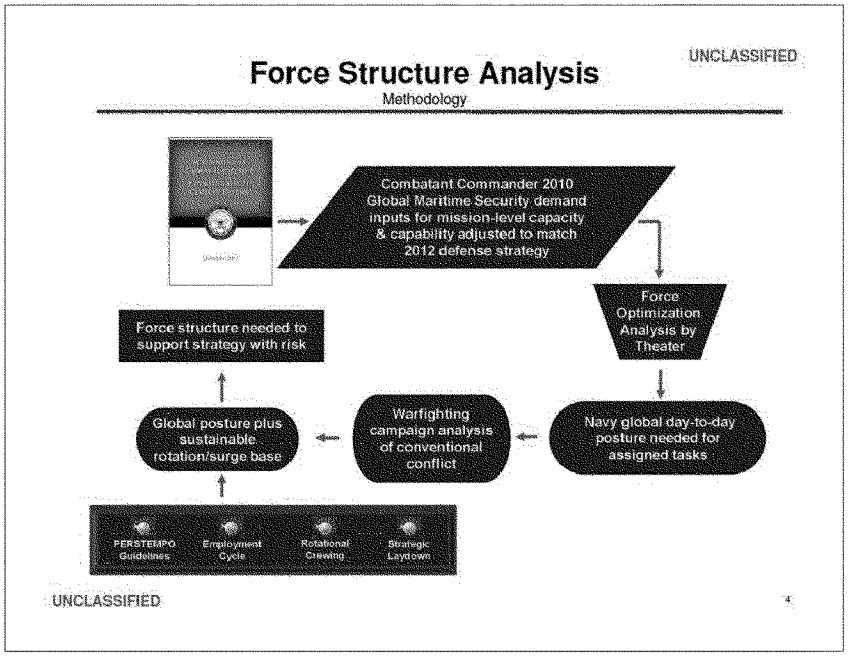
[4] CRS Report R44635, *Navy Force Structure: A Bigger Fleet? Background and Issues for Congress*, by Ronald O'Rourke.

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

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

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

**Figure 1. Navy Force Structure Analysis (FSA) Process**




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

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

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

## Down Select

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

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

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

## Block Buy Contracting

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

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

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

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

(continued...)

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

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

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

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

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(...continued)

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

For more on block buy contracting, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz.

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

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

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

# Survivability

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

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

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

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

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

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

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

# Mine Countermeasures (MCM) Mission Module

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

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

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

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

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

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

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

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

# Propulsion Equipment Problems

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

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

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

# New Crewing and Operating Approach

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

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

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

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

# Defense-Acquisition Policy Lessons Learned[12]

Another oversight issue for Congress concerns what defense-acquisition policy lessons, if any, the LCS program may offer to policymakers, particularly in terms of the rapid acquisition strategy that the Navy pursued for the LCS program, which aimed at reducing acquisition cycle time (i.e., the amount of time between starting the program and getting the first ship into service). One possible perspective is that the LCS program demonstrated that reducing acquisition cycle time can be done. Supporters of this

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

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

Another possible perspective is that the LCS program demonstrated the risks or consequences of attempting to reduce acquisition cycle time. Supporters of this perspective might argue that the program's rapid acquisition strategy resulted in design-construction concurrency (i.e., building the lead ships before their designs were fully developed), a practice long known to increase risks in defense acquisition programs. Supporters of this perspective might argue that the cost growth, design issues, and construction-quality issues experienced by the first LCSs were due in substantial part to design-construction concurrency, and that these problems embarrassed the Navy and reduced the Navy's credibility in defending other acquisition programs. They might argue that the challenges the Navy has faced in terms of developing an LCS concept of operations (CONOPS), LCS manning and training policies, and LCS maintenance and logistics plans were increased by the rapid acquisition strategy, because these matters were partly deferred to later years (i.e., to today) while the Navy moved to put LCSs into production. Supporters of this perspective might argue that the costs of the rapid acquisition strategy are not offset by very much in terms of a true reduction in acquisition cycle time, because the first LCS to be equipped with a mission package that had reached IOC (initial operational capability) did not occur until 2014. Supporters of this perspective could argue that the Navy could have avoided many of the program's early problems and current challenges—and could have had a fully equipped first ship enter service in 2011 or 2012—if it had instead pursued a traditional acquisition approach for a new frigate or corvette. They could argue that the LCS program validated, for defense acquisition, the guideline from the world of business management that if an effort aims at obtaining something fast, cheap, and good, it will succeed in getting no more than two of these things,[13] or, more simply, that the LCS program validated the general saying that haste makes waste.

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

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

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

# Appendix A. Analytical Foundation

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

## Three Analyses That Can Strengthen an Analytical Foundation

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

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

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

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

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

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

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

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

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

(continued...)

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

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

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

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

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(...continued)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(...continued)

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

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

A February 26, 2016, press report states:

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

A March 6, 2016, press report states:

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

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

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

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

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

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

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

**Table B-1. Frigate and LCS procurement profiles**

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

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

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

# Appendix C. December 1 Navy Testimony on LCS Propulsion Casualties

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

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

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

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

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

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

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

# Appendix D. New Crewing and Operating Approach

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

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

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

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

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

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

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

**Biography -- Ronald O'Rourke (updated 9/6/16)**

Mr. O'Rourke is a Phi Beta Kappa graduate of the Johns Hopkins University, from which he received his B.A. in international studies, and a valedictorian graduate of the University's Paul Nitze School of Advanced International Studies, where he received his M.A. in the same field.

Since 1984, Mr. O'Rourke has worked as a naval analyst for the Congressional Research Service of the Library of Congress. He has written numerous reports for Congress on various issues relating to the Navy. He regularly briefs Members of Congress and Congressional staffers, and has testified before Congressional committees on several occasions.

In 1996, Mr. O'Rourke received a Distinguished Service Award from the Library of Congress for his service to Congress on naval issues.

In 2012, Mr. O'Rourke received the CRS Director's award for his outstanding contributions in support of the Congress and the mission of CRS.

Mr. O'Rourke is the author of several journal articles on naval issues, and is a past winner of the U.S. Naval Institute's Arleigh Burke essay contest. He has given presentations on Navy-related issues to a variety of audiences in government, industry, and academia.

**DOCUMENTS SUBMITTED FOR THE RECORD**

DECEMBER 8, 2016

# LCS: Leaking Cracked Ship

| | | |
|---|---|---|
| **USS Freedom: Commissioned Nov 2008**<br>  <br>Feb 2011: Six-inch crack in hull<br>July 2013: Immobilized during trial run<br>Feb 2016: Coupling crack<br>June 2016: Engine rebuilt or replaced | **USS Independence: Commissioned Jan 2010**<br>  <br>June 2011: Severe corrosion | **USS Fort Worth: Commissioned Sept 2012**<br>  <br>Jan 2016: Broke down because operators did not follow proper maintenance procedures |
| **USS Coronado: Commissioned Apr 2014**<br>  <br>Aug 2016: Broke down due to engineering problem | **USS Milwaukee: Commissioned Nov 2015**<br>  <br>Dec 2015: Broke down due to software malfunction | **USS Montgomery: Commissioned Sept 2016**<br>  <br>Sept 2016: Engine failure<br>Sept 2016: Second engine failure<br>Oct 2016: Cracked hull & bent interior beams due to collision<br>Oct 2016: Split side |

# LCS Broken Promises

| | Early program | "Updated" program |
|---|---|---|
| Cost overruns | • $220 million per seaframe<br>• 64 mission packages, **$2.3 billion** | • $478 million per seaframe<br>• 64 mission packages, **$5.8 billion** |
| Delayed schedule | • Initial operational capability in 2007, **3 years after program start** | • Initial operational capability in 2013, **9 years after program start** |
| Design changes | • Use **low-cost existing designs** | • **High-cost changing designs** throughout first several ships built |
| Cannot survive combat | • **To be used in major combat operations**<br>• Self-sufficient in nearshore operations | • **Weapons systems offer "little chance of survival in a combat scenario"**<br>• Cannot be deployed alone in combat without large multi-mission escort |
| Poor mission capability | • **Can handle three types of mission**<br>• Can switch rapidly between missions | • **Can only handle one type of mission, for which requirements were reduced**<br>• Takes 12-29 days to switch missions |

**WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING**

DECEMBER 8, 2016

## RESPONSE TO QUESTION SUBMITTED BY MS. SPEIER

Secretary STACKLEY. USS CORONADO (LCS 4) transited the Panama Canal in February, 2014. As the ship transited the canal, CORONADO suffered four separate allisions (instances where the ship structure was pierced or deformed by hitting the Panama Canal wall structure). Two of the allisions were created transiting the Gatun Locks and the two others were created in the Pedro Miguel Locks. The total cost to repair CORONADO as a result of the damage was $820,492. Initially, temporary repairs were conducted to remove debris and install additional structure to the damaged areas to continue operating at sea, until the ship was able to conduct more permanent repairs. Permanent repairs were completed during CORONADO's Post Shakedown Availability (PSA). Lessons learned from prior LCS ships transiting the Panama Canal are being incorporated to mitigate the risk of recurring instances of the damages referenced above. For instance, prior to the transit of the Panama Canal, both LCS 6 and LCS 8 had a temporary fendering system installed to provide additional mooring fender strengthening. Permanent Independence variant improvements to protect against ship damage in the canal and in port include strengthening for fendering and tug loads. This improvement will be accomplished during PSA for LCS 6 through LCS 12 and in line construction on LCS 14 and follow. The decision for the point of incorporation for each of these improvements is based upon available funding, and considerations for minimizing schedule disruption and significant amounts of re-work in the construction yard. In addition to addressing hull strengthening issues, a delegation from the Navy has held on-going meetings with the Panama Canal Authority (ACP), most recently on February 7, 2017 to discuss lessons learned and actions that could be taken by the ACP to mitigate or eliminate damage to LCS ships during canal transits. The February 2017 meeting was very productive and Commander, FOURTH Fleet is codifying the agreements reached in a letter to the ACP. [See page 32.]

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## RESPONSE TO QUESTION SUBMITTED BY MR. BYRNE

Admiral ROWDEN. The following table summarizes all known incidents of ships sustaining damage while transiting the Panama Canal:

| SHIP | Hull Number | Date of Incident | Incident |
|---|---|---|---|
| USS TORTUGA | LSD 46 | 13 Feb 06 | Allision |
| SWIFT | HSV 2 | 02 Apr 07 | Allision |
| USS HALYBURTON | FFG 40 | 16 Nov 07 | Grounding |
| USNS COMFORT | T–AH 20 | 21 Jul 09 | Allision |
| USNS DAHL | T–AKR 312 | 03 Jan 10 | Allision |
| USNS 1st LT JACK LUMMUS | T–AK 3011 | 10 May 10 | Allision |
| USS PASADENA | SSN–752 | 25 Aug 11 | Allision |
| USS INDEPENDENCE | LCS 2 | 15 Apr 12 | Allision |
| USS CORONADO | LCS 4 | 23 Feb 14 | Allision |
| USS BARRY | DDG 52 | 09 Feb 16 | Damage to Flight Deck Nets |

[See page 36.]

## QUESTIONS SUBMITTED BY MEMBERS POST HEARING

DECEMBER 8, 2016

## QUESTIONS SUBMITTED BY MRS. HARTZLER

Mrs. HARTZLER. In your written testimony you stated that the revised Independent Review Team (IRT) implementation plan focuses on one delivery vehicle with the current MCM package sonar; however, the FY17 NDAA Conference report requires a review of synthetic aperture sonar technologies for the MCM package. Please provide the subcommittee the following information:

- Does the Navy plan to test and evaluate any additional conventional or synthetic aperture sonar technologies as part of its revised IRT implementation plan briefed to the committees in September 2016?
- In light of the Conference Report requirement (section 1071), does the Navy intend to revise its September 2016 implementation plan for testing sonar technologies for the MCM package?
- Has the Navy considered all available synthetic aperture sonar technologies to include those from our ally navies?
- How many conventional and synthetic aperture sonar technologies does the Navy plan to test to meet the requirements of the FY17 NDAA and to ensure the success of the MCM package?

Admiral ROWDEN. The Navy has selected the Common Unmanned Surface Vehicle as the tow vehicle for the minehunting sonar as part of the MCM Mission Package. The Navy continues to conduct testing and evaluation of synthetic aperture sonar technologies through existing program of records (POR).

*Does the Navy plan to test and evaluate any additional conventional or synthetic aperture sonar technologies as part of its revised IRT implementation plan briefed to the committees in September 2016?*

Yes, additional direct testing and evaluation of synthetic aperture sonar technologies is being conducted through existing programs of record (POR).

- The AQS–20C production configuration of the towed sonar is conducting subsystem testing.
- The AQS–24C towed sonar and the Surface Mine Countermeasure Unmanned Underwater Vehicle (SMCM UUV) POR containing the Knifefish Engineering Design Model (EDM) are both currently undergoing in-water developmental testing.
- The AQS–24C sensor configuration for the MH–53E helicopter is undergoing production testing with an anticipated completion date of July 2017.
- In addition to these POR efforts, the Navy has coordinated with and sent observers to the UK Royal Navy through technology exchange agreements to participate in ongoing evaluations of the Thales sonar system towed by both the ATLAS Elektronik and Thales unmanned surface vehicles.

*In light of the Conference Report requirement (section 1071), does the Navy intend to revise its September 2016 implementation plan for testing sonar technologies for the MCM package?*

No, the current test and evaluation approach is sufficient to provide a sound technical and operational assessment to support the IRT Implementation for the MCM mission package and the Congressional reporting requirements.

*Has the Navy considered all available synthetic aperture sonar technologies to include those from our ally navies?*

Yes, the Navy has evaluated foreign produced systems and continues through technology exchange agreements to monitor ongoing allied efforts of the most mature systems that have potential application for the MCM mission package. The most mature foreign systems under review are produced by ATLAS Elektronik and Thales, both of which are being assessed by the UK Royal Navy.

*How many conventional and synthetic aperture sonar technologies does the Navy plan to test to meet the requirements of the FY17 NDAA and to ensure the success of the MCM package?*

The current Navy plan assesses a total of six (6) sonar technologies that will inform the final configuration of the MCM mission package: 1) AQS–20C configuration with a synthetic aperture sonar, a digital gap filler sonar, and a high frequency wide band forward looking sonar is the primary candidate at present. 2) AQS–24C configuration with a high speed synthetic aperture sonar and high frequency wide band

rear looking sonar. 3) Knifefish UUV with low frequency broad band synthetic aperture sonar. 4) AQS–20A configuration with conventional real aperture sonar. 5) AQS–24B configuration with high speed synthetic aperture sonar. 6) Thales towed sonar with synthetic aperture sonar.*

## QUESTIONS SUBMITTED BY MS. SPEIER

Ms. SPEIER. Your written testimony states that "the department chose a frigate concept based on a minor modified LCS in lieu of more capable—and more expensive—small surface combatant options."

What are the key mission capabilities that the Navy identified and prioritized as needed for a potential frigate in its recent study of alternatives?

Ms. MACKIN. Our report GAO–16–356, "Littoral Combat Ship: Need to Address Fundamental Weaknesses in LCS and Frigate Acquisition Strategies" described our evaluation of the Navy's Small Surface Combatant Task Force's efforts to meet the Secretary of Defense's direction to study alternatives to the LCS that would provide capabilities "consistent with a frigate". As we reported, the task force identified eight concepts for the capability of the small surface combatant (SSC)—known as capability concepts—representing the range of operationally acceptable mission alternatives. These are shown below.

**Eight Ultimate Capability Concepts (CC) in Small Surface Combatant Study**

| Mission area capabilities | CC 1 | CC 2 | CC 3 | CC 4 | CC 5 | CC 6 | CC 7 | CC 8 |
|---|---|---|---|---|---|---|---|---|
| Self-defense against air, surface, undersea threats | ● | ● | ● | ● | ● | ● | ● | ● |
| Local surface warfare | | ● | ● | ● | ● | ● | ● | ● |
| Over-the-horizon surface warfare | | | | | ● | ● | ● | ● |
| Anti-submarine warfare | ● | | ● | ● | | | ● | ● |
| Local anti-air warfare | ● | ● | | ● | | ● | | ● |

CC = Capability concept

Source: GAO analysis of Navy data. | GAO-16-356

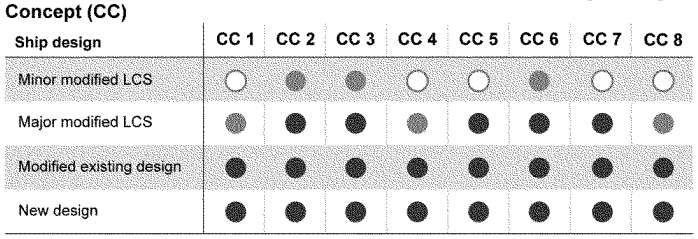
The task force found that a minor modified LCS (of either variant) was the least technically feasible of meeting any of the eight capability concepts among all of design categories that it considered. As shown, 7 of the 8 concepts included local surface warfare (meaning the ship can defend other ships against threats and attack targets within a medium range); 5 feature local anti-air warfare (meaning the ship can defend other ships against air-based threats within a medium range), and 5 also featured anti-submarine warfare capability. However, based on direction from senior Navy leaders, the task force ultimately focused on creating ship design concepts based on capability concept 7, which does not include a local anti-air warfare capability.

As part of its methodology, the task force solicited feedback from fleet operators. In these fleet engagement sessions, Navy operators were given a set of performance capabilities—like speed, range, over-the-horizon surface warfare capability, and others—and were told to prioritize them. All of the concepts featured some degree of multi-mission capability—meaning that the ship can conduct more than one type of mission (e.g., surface warfare and anti-submarine warfare) at one time. The fleet operators consistently ranked local anti-air warfare and over-the-horizon surface warfare with anti-submarine warfare as their highest priorities for a future SSC. However, as noted above, capability concept 7 does not have local anti-air warfare capability. Other trade-offs were also made. For example, the fleet operators also highly valued an endurance range of 4,000 nautical miles and an ability to remain underway for 30 days. The chosen capability concept will have a range of less than 4,000 nautical miles, and only a 14 day underway duration.

*U.S. Navy controlled testing is not planned but performance data will be captured for comparison via existing data/technology exchange agreements.

As shown below, the task force found that an LCS with minor modifications was the least feasible at meeting the Navy's identified capability requirements, meaning that LCS with minor modifications was the least capable option considered.

**Initial Small Surface Combatant Task Force Assessment of Design Categories, by Capability Concept (CC)**




Task force found the design was not feasible to meet capability requirements

Task force found the design was marginally feasible to meet capability requirements

Task force found a design was fully feasible to meet capability requirements

CC = Capability concept

LCS = Littoral Combat Ship

Source: GAO analysis of Navy data. | GAO-16-356

Ms. SPEIER. How does GAO rank-order the capabilities and design characteristics of each of the ships that the Navy considered during its study to determine how to develop the frigate platform, and how does GAO assess the capabilities of the ship that the Navy ultimately chose as the baseline for the frigate?

Ms. MACKIN. GAO does not have the information to conduct a detailed analysis such as this, because the task force used statistical analysis software that GAO does not possess to assess the most likely cost and characteristics of over 19 million potential ship designs. Since new designs provide the most flexibility, the Navy would be able to identify many potential new design configurations to meet any set of SSC requirements. For existing designs, the task force analyzed 23 designs, but its supporting workpapers do not contain adequate information for a rank-ordering since limited information is presented about each option and the relative cost.

We found that the task force considered both new and existing ship design options that were more capable than the LCS with minor modifications than the Navy ultimately selected. According to task force documentation, the inherent space, weight, power, and cooling constraints of the LCS with minor modifications limited the extent of changes that could be accommodated. With modifications, the task force found that other existing designs could provide additional capability, including local anti-air warfare. For example, the task force identified that an LCS with major modifications and a modified U.S. Coast Guard National Security Cutter—which, like LCS, is also currently in production—could both provide a full multi-mission capability, would provide greater weight and other margins which would allow for future upgrades, and have greater range and underway days. The task force also found that most of the existing designs considered could accommodate survivability improvements above those found on LCS.

Ms. SPEIER. Does GAO believe that the minor modified LCS will or will not meet the combatant commander's stated operational requirements for a frigate? Why, or why not?

Ms. MACKIN. A frigate based on an LCS with minor modifications will not meet all the requirements prioritized by the fleet operators during engagement sessions. The results of the fleet engagement process imply that the fleet prioritized local anti-air warfare capabilities which are not included in ability concept 7, and the Navy subsequently based its frigate requirements on a reduced capability concept 7, so it may no longer be reflective of the concepts developed in consultation with the fleet. An LCS with minor modifications could not achieve these requirements. The task force also determined that a minor modified LCS could not be modified to the level of vulnerability resistance like that of a legacy FFG 7 class frigate due to LCS weight and design constraints that would prevent adding more physical structure. If a greater level of vulnerability resistance was desired, a minor modified LCS would also not meet these requirements.

The task force found that a minor modified LCS (of either variant) was the least technically feasible of meeting any of the eight capability concepts among all of de-

sign categories that it considered. According to the task force's report, the Navy would need an LCS with major design modification, a new design, or a modified (non-LCS) existing design if it wanted an SSC with multi-mission surface warfare, anti-submarine warfare, and local anti-air warfare capability and/or major survivability improvements. An LCS with minor modifications could not support these upgrades. Moreover, a minor modified LCS will not fully address all lethality and survivability concerns raised by the former Secretary of Defense.

The planned modifications to LCS will offer some improvements (multi-mission capability and some survivability improvements related to reducing the susceptibility of the ship to attack). However, beyond the addition of an over-the-horizon missile that is also under consideration for addition to LCS, the proposed frigate does not add any new offensive anti-submarine or surface warfare capabilities that are not already part of LCS.

Ms. SPEIER. Were other options considered that were more capable at meeting all of the Navy's capability priorities other than LCS?

Ms. MACKIN. The task force identified a number of designs that were more capable than the minor modified LCS, including a major modified LCS (of either variant), a modified National Security Cutter, and some foreign frigate designs. New designs—since they are by definition the most flexible—could also be developed to achieve the higher levels of capability sought by the Navy. However, Navy leaders, based on affordability concerns and a desire not to have a production break at the current LCS shipyards, ultimately recommended the minor modified LCS.

Ms. SPEIER. What role did industrial base considerations have in the frigate study and in the Navy's choice of using a minor modified LCS for the frigate baseline?

Ms. MACKIN. In a November 2014 memo in which it recommends selecting a minor modified LCS, senior Navy leadership highlighted the speed with which they believe a minor modified LCS based frigate could be fielded as a deciding factor in its deliberations, as well as a desire to maintain stability in the LCS industrial base and vendor supply chain. The task force report stated that this option could achieve full capability faster than the others, and with a neutral impact to the industrial base (i.e., the LCS shipyards). In particular, the task force wrote that a minor modified LCS design would provide the shortest timeline to first ship delivery and that a major modified LCS and new and existing designs would result in production gaps of 1 to 5 years. Due to the scope and timeframe for our audit, we did not verify these task force findings.