



# **Navy Littoral Combat Ship (LCS) Program: Background, Oversight Issues, and Options for Congress**

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May 5, 2009

**Congressional Research Service**

7-5700

[www.crs.gov](http://www.crs.gov)

RL33741

## Summary

The Navy is procuring a new type of surface combatant called the Littoral Combat Ship (LCS). The LCS is a small, fast, relatively inexpensive combat ship that is to be equipped with modular “plug-and-fight” mission packages. The basic version of the LCS, without any mission packages, is referred to as the LCS sea frame. The Navy wants to procure a total of 55 LCSs.

The Navy substantially restructured the LCS program in 2007 in response to significant cost growth and construction delays in the program. The first ship in the program—LCS-1—was commissioned into service on November 8, 2008. A second—LCS-2—is to be delivered to the Navy later this year. Two more LCSs were funded in FY2009 at a cost of \$1,020 million and are now under construction. The Navy is expected to request roughly \$1,500 million in its proposed FY2010 budget for the procurement of three more LCSs.

Section 122 of the compromise version of the FY2009 defense authorization bill (S. 3001/P.L. 110-417 of October 14, 2008) delayed the implementation of the LCS sea frame unit procurement cost cap to ships procured in FY2010 and subsequent years. (The cost cap previously was to be applied to ships procured in FY2008 and subsequent years.)

The issue for Congress is whether to approve, reject, or modify the Navy’s plans for the LCS program. The LCS program raises potential oversight issues for Congress relating to cost growth, total program acquisition cost, the procurement cost cap, technical risk, operational evaluation and competition for production, a proposed common combat system, and coordination of sea frames and mission packages. This report will be updated as events warrant.

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## Introduction

The Navy is procuring a new type of surface combatant called the Littoral Combat Ship (LCS). The LCS is a small, fast, relatively inexpensive combat ship that is to be equipped with modular “plug-and-fight” mission packages. The basic version of the LCS, without any mission packages, is referred to as the LCS sea frame. The Navy wants to procure a total of 55 LCSs. The Navy’s planned force of 55 LCSs accounts for about 18% of its planned fleet of 313 ships of all types.<sup>1</sup>

The Navy substantially restructured the LCS program in 2007 in response to significant cost growth and construction delays in the program. The first ship in the program—LCS-1—was commissioned into service on November 8, 2008. A second—LCS-2—is to be delivered to the Navy later this year. Two more LCSs were funded in FY2009 at a cost of \$1,020 million and are now under construction. The Navy is expected to request roughly \$1,500 million in its proposed FY2010 budget for the procurement of three more LCSs.

Section 122 of the compromise version of the FY2009 defense authorization bill (S. 3001/P.L. 110-417 of October 14, 2008) delayed the implementation of the LCS sea frame unit procurement cost cap to ships procured in FY2010 and subsequent years. (The cost cap previously was to be applied to ships procured in FY2008 and subsequent years.)

The issue for Congress is whether to approve, reject, or modify the Navy’s plans for the LCS program. Decisions that Congress makes on this issue could affect future Navy capabilities and funding requirements, and the shipbuilding industrial base.

## Background

### The LCS

The LCS program was announced on November 1, 2001.<sup>2</sup> The LCS is a small, fast, relatively inexpensive surface combatant that is to be equipped with modular “plug-and-fight” mission packages, including unmanned vehicles (UVs). Rather than being a multimission ship like the Navy’s larger surface combatants, the LCS is to be a focused-mission ship equipped to perform one primary mission at any one time. The ship’s mission orientation is to be changed by changing out its mission packages. The basic version of the LCS, without any mission packages, is referred to as the LCS sea frame.

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<sup>1</sup> For more on the Navy’s planned 313-ship fleet, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O’Rourke.

<sup>2</sup> On November 1, 2001, the Navy announced that it was launching a Future Surface Combatant Program aimed at acquiring a family of next-generation surface combatants. This new family of surface combatants, the Navy stated, would include three new classes of ships: a destroyer called the DD(X)—later redesignated the DDG-1000—for the precision long-range strike and naval gunfire mission; a cruiser called the CG(X) for the air defense and ballistic missile mission, and a smaller combatant called the Littoral Combat Ship (LCS) to counter submarines, small surface attack craft, and mines in heavily contested littoral (near-shore) areas. For more on the DDG-1000 program, see CRS Report RL32109, *Navy DDG-1000 and DDG-51 Destroyer Programs: Background, Oversight Issues, and Options for Congress*, by Ronald O’Rourke. For more on the CG(X) program, see CRS Report RL34179, *Navy CG(X) Cruiser Program: Background, Oversight Issues, and Options for Congress*, by Ronald O’Rourke.

The LCS's primary intended missions are shallow-water antisubmarine warfare, mine countermeasures, countering small boats, and intelligence, surveillance, and reconnaissance (ISR). Secondary intended missions include homeland defense, maritime intercept operations, and support of special operations forces.

The LCS displaces about 3,000 tons, making it about the size of a corvette (i.e., a light frigate) or a Coast Guard cutter. It has a maximum speed of more than 40 knots, compared to something more than 30 knots for the Navy's larger surface combatants. The LCS has a shallower draft than the Navy's larger surface combatants, permitting it to operate in certain coastal waters and visit certain ports that are not accessible to the Navy's larger surface combatants. The LCS employs automation to achieve a reduced "core" crew of 40 sailors. Up to 35 or so additional sailors are to operate the ship's embarked aircraft and mission packages, making for a total crew of about 75, compared to more than 200 for the Navy's frigates and about 300 (or more) for the Navy's current destroyers and cruisers.

Navy plans call for procuring a total of 55 LCSs. The Navy currently plans to procure a total of 64 mission packages for the 55 ships. Earlier Navy plans anticipated procuring between 90 and 110 mission packages for a 55-ship fleet.

## **Two Industry Teams, Each With Its Own Design**

On May 27, 2004, the Navy awarded contracts to two industry teams—one led by Lockheed Martin, the other by General Dynamics (GD)—to design two versions of the LCS, with options for each team to build up to two LCSs each. The two teams' LCS designs are quite different—Lockheed's uses a semi-planing steel monohull, while GD's uses an aluminum trimaran hull. The Lockheed team was assigned LCS-1 and (the subsequently canceled) LCS-3, while the GD team was assigned LCS-2 and (the subsequently canceled) LCS-4.<sup>3</sup> Lockheed announced plans to build its LCSs at Marinette Marine of Marinette, WI, and Bollinger Shipyards of Lockport, LA, with LCS-1 being built by Marinette and LCS-3 to have been built by Bollinger. GD announced plans to build its LCSs at the Austal USA shipyard of Mobile, AL.<sup>4</sup>

## **Planned Procurement**

As shown in **Table 1**, the Navy's FY2009 budget submission included a total of 18 LCSs in FY2009-FY2013.

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<sup>3</sup> The designations LCS-3 and LCS-4 are now being reused by the Navy to refer to two other LCSs—the two LCSs funded in FY2009. The "new" LCS-3 and LCS-4 are not the same ships as those that the Navy cancelled; see **Table 3**.

<sup>4</sup> Austal USA was created in 1999 as a joint venture between Austal Limited of Henderson, Western Australia and Bender Shipbuilding & Repair Company of Mobile, AL. The GD LCS team also includes GD/BIW as prime contractor to provide program management and planning, provide technical management, and to serve as "LCS system production lead."

**Table 1. Planned LCS Procurement, FY2009-FY2013**

(following restructuring of program in 2007)

FY09	FY10	FY11	FY12	FY13
2	3	3	4	6

Source: Navy FY2009 budget submission.

## Program Funding

Table 2 shows LCS acquisition (i.e., research and development plus procurement) funding for FY2007 through FY2013 as reflected in the FY2009 budget submission. The figures in the table reflect reprogramming of prior-year program funding undertaken as part of the Navy's 2007 restructuring of the LCS program. In addition to the funding shown in the table, the LCS program also received about \$1.7 billion in acquisition funding between FY2003 and FY2006.

**Table 2. LCS Program Acquisition Funding, FY2007-FY2013**

(millions of dollars; figures rounded to nearest million)

Budget account <sup>a</sup>	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total for FY07 thru FY13
RDT&EN	664	304	371	281	139	168	116	2044
SCN	93	337 <sup>b</sup>	920	1380	1380	1840	2760	8709
APN	37	37	55	73	76	96	103	478
WPN	0	0	3	25	47	45	11	131
OPN	79	0	131	235	242	252	227	1167
<b>TOTAL</b>	<b>873</b>	<b>678</b>	<b>1480</b>	<b>1994</b>	<b>1884</b>	<b>2401</b>	<b>3217</b>	<b>12529</b>

Source: Navy FY2009 budget submission. Figures may not add due to rounding. The program also received about \$1.7 billion in acquisition funding between FY2003 and FY2006.

- RDT&EN = Research, Development, Test, and Evaluation, Navy account; SCN = Shipbuilding and Conversion, Navy account; APN = Aircraft Procurement, Navy account; WPN = Weapons Procurement, Navy account; OPN = Other Procurement, Navy account.
- This funding was rescinded by Congress as part of its action on the FY2009 budget.

With Congress's permission, the Navy procured the first and second LCSs through the Navy's research and development account. Subsequent LCSs are being procured through the Navy's ship-procurement account, called the Shipbuilding and Conversion, Navy (SCN) account. The Navy is procuring LCS mission packages through the Other Procurement, Navy (OPN) account.

## Total Acquisition Cost

The Navy has not provided an estimated total acquisition (i.e., development plus procurement) cost for the LCS program. CRS estimates that the LCS program (including mission packages) might have a total acquisition cost of roughly \$29.4 billion. This estimate includes \$2.5 billion in research and development costs (including the construction of first two LCS sea frames and the procurement of the first four mission packages), procurement of 53 additional LCS sea frames at

a cost of \$460 million each, and procurement of 60 additional mission packages procured at an average cost of about \$42.3 million each.<sup>5</sup> This estimate does not include costs for LCS-related aircraft procurement or weapon procurement, such as those shown in the APN and WPN rows of **Table 2**.

## 2007 Program Restructuring

### March 2007 Navy Restructuring Plan

In response to significant cost growth and schedule delays in the building of the first LCSs that first came to light in January 2007 (see next section), the Navy in March 2007 announced a plan for restructuring the LCS program that:

- canceled the two LCSs funded in FY2007 and redirected the funding for those two ships to pay for cost overruns on earlier LCSs;
- announced an intention to lift a 90-day stop-work order that the Navy had placed on LCS-3 in January 2007—provided that the Navy reached an agreement with the Lockheed-led industry team by April 12, 2007, to restructure the contract for building LCSs 1 and 3 from a cost-plus type contract into a fixed price incentive (FPI)-type contract—or terminate construction of LCS-3 if an agreement on a restructured contract could not be reached with the Lockheed team by April 12, 2007;
- announced an intention to seek to restructure the contract with the General Dynamics-led industry team for building LCSs 2 and 4 into an FPI-type contract—if LCSs 2 and 4 experienced cost growth comparable to that of LCSs 1 and 3—and, if such a restructuring were sought, terminate construction of LCS-4 if an agreement on a restructured contract for LCS-2 and LCS-4 could not be reached;
- reduced the number of LCSs requested for FY2008 from three to two (for the same requested FY2008 procurement funding of \$910.5 million), and the number to be requested for FY2009 from six to three; and
- announced an intention to conduct an operational evaluation to select a favored design for the LCS that would be procured in FY2010 and subsequent years, and to conduct a full and open follow-on competition among bidders for the right to build that design.<sup>6</sup>

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<sup>5</sup> The Navy reportedly wants to procure 24 mine warfare mission packages at an average cost of \$68 million each, 16 antisubmarine warfare packages at an average cost of \$42.3 million each, and 24 surface warfare packages at an average cost of \$16.7 million each. (Emelie Rutherford, Littoral Combat Ship Mission Packages Range In Costs, Features," *Inside the Navy*, September 3, 2007; for similar figures, see Christopher P. Cavas, "First LCS Mission Package Ready For Delivery," *DefenseNews.com*, August 29, 2007.)

<sup>6</sup> Source: Navy briefing to CRS and Congressional Budget Office (CBO) on Navy's proposed LCS program restructuring plan, March 21, 2007.



### April 2007 Termination of LCS-3

On April 12, 2007, the Navy announced that it had not reached an agreement with Lockheed on a restructured FPI-type contract for LCS-1 and LCS-3, and consequently was terminating construction of LCS-3.<sup>7</sup> (The Navy subsequently began referring to the ship as having been partially terminated—a reference to the fact that Lockheed was allowed to continue procuring certain components for LCS-3, so that a complete set of these components would be on hand to be incorporated into the next LCS built to the Lockheed design.) (The designation LCS-3 is now being reused to refer to one of the two LCSs procured in FY2009.)

### November 2007 Termination of LCS-4

In late-September 2007, it was reported that the Navy on September 19 had sent a letter to General Dynamics to initiate negotiations on restructuring the contract for building LCSs 2 and 4 into an FPI-type contract. The negotiations reportedly were to be completed by October 19, 2007—30 days from September 19.<sup>8</sup> On November 1, 2007, the Navy announced that it had not reached an agreement with General Dynamics on a restructured FPI-type contract for LCS-2 and LCS-4, and consequently was terminating construction of LCS-4.<sup>9</sup> (The designation LCS-4 is now being reused to refer to one of the two LCSs procured in FY2009.)

### Summary of Status of LCSs Funded in FY2005-FY2009

**Table 3** below summarizes the status of the nine LCSs funded by Congress from FY2005 through FY2009. As shown in the table, of the nine ships, five were later canceled, leaving four ships in place through FY2009—LCSs 1 and 2, and the two LCSs funded in FY2009. Ship designations LCS-3 and LCS-4 are being reused as the designations for the two ships funded in FY2009.

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<sup>7</sup> Department of Defense News Release No. 422-07, April 12, 2007, “Navy Terminates Littoral Combat Ship 3.”

<sup>8</sup> Geoff Fein, “Navy Seeking To Negotiate FPI Contract With General Dynamics,” *Defense Daily*, September 24, 2007; Geoff Fein, “Navy, General Dynamics Meet To Discuss New LCS Fixed Price Structure,” *Defense Daily*, September 27, 2007; Tony Capaccio, “General Dynamics Urged To Take Fixed Price On Warship Contract,” *Bloomberg News*, September 28, 2007; Jason Sherman, “Navy, General Dynamics Discuss Fixed-Price Contract For LCS,” *Inside the Navy*, October 1, 2007.

<sup>9</sup> Department of Defense News Release No. 1269-07, November 1, 2007, “Navy Terminates Littoral Combat Ship (LCS 4) Contract.”

**Table 3. Status of LCSs Funded in FY2005-FY2009**

<b>Ships funded</b>	<b>FY funded</b>	<b>Navy hull designation</b>	<b>Status</b>
1 <sup>st</sup>	2005	LCS-1	<b>Commissioned into service</b> on November 8, 2008.
2 <sup>nd</sup>	2006	LCS-2	<b>Under construction</b> ; ship launched April 26, 2008.
3 <sup>rd</sup>		LCS-3 (not the same ship as LCS-3 below)	<b>Canceled by Navy</b> in April 2007 after being placed under contract due to inability to come to agreement with contractor on revised (fixed-price) contract terms for LCSs 1 and 3.
4 <sup>th</sup>		LCS-4 (not the same ship as LCS-4 below)	<b>Canceled by Navy</b> in November 2007 after being placed under contract due to inability to come to agreement with contractor on revised (fixed-price) contract terms for LCSs 2 and 4.
5 <sup>th</sup>	2007	none (ship canceled before being placed under contract)	<b>Canceled by Navy</b> in March 2007 before being placed under contract as part of Navy's LCS program restructuring; funds reapplied to cover other program costs.
6 <sup>th</sup>		none (ship canceled before being placed under contract)	<b>Canceled by Navy</b> in March 2007 before being placed under contract as part of Navy's LCS program restructuring; funds reapplied to cover other program costs.
7 <sup>th</sup>	2008	LCS-5 (for a while, at least, although the ship was canceled before being placed under contract)	<b>Canceled by Navy following Congress' decision</b> in September 2008, as part of its action on the FY2009 defense appropriations bill, to rescind the funding for the ship.
8 <sup>th</sup>	2009	LCS-3 (not the same ship as LCS-3 above; the ship designation is being reused)	<b>Funded in FY2009 and Under Construction.</b> Contract to build the ship awarded to Lockheed Martin on March 23, 2009. Ship is currently under construction.
9 <sup>th</sup>		LCS-4 (not the same ship as LCS-4 above; the ship designation is being reused)	<b>Funded in FY2009 and Under Construction.</b> Contract to build the ship awarded to General Dynamics on May 1, 2009. Ship is currently under construction.

**Source:** Prepared by CRS.

## Acquisition Strategy for FY2009 And Subsequent Ships

### FY2009 and FY2010 Ships

Under the Navy's acquisition strategy for the LCS program, the FY2009 and FY2010 LCSs are to be built under fixed-price type contracts. The Navy bundled together the two LCSs funded in FY2009 (LCSs 3 and 4) with the three LCSs that are to be requested in FY2010 into a single, five-ship solicitation. The Navy announced that each LCS industry team would be awarded a contract for one of the FY2009 ships, and the prices that the two teams bid for both the FY2009 ships and the FY2010 ships would determine the allocation of the three FY2010 ships, with the winning team getting two of the FY2010 ships and the other team getting one FY2010 ship. This strategy appears intended to use the carrot of the third FY2010 ship to generate bidding pressure on the two industry teams for both the FY2009 ships and the FY2010 ships.

The Navy stated that the contracts for the two FY2009 ships would be awarded by the end of January 2009. The first contract (for Lockheed Martin, to build LCS-3) was awarded March 23, 2009; the second contract (for General Dynamics, to build LCS-4) was awarded May 1, 2009. The delay in the awarding of the contracts past the end-of-January target date may have been due in part to the challenge the Navy faced in coming to agreement with the industry teams on prices for the two FY2009 ships that would permit the three FY2010 ships to be built within the \$460 million LCS sea frame unit procurement cost cap.

At a March 10, 2009, hearing on the LCS program, the Navy stated the following regarding the acquisition strategy for LCSs procured in FY2009 and FY2010:

In October 2008, the Undersecretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) approved a revised acquisition strategy for LCS to cover procurement of the FY 2009 and FY 2010 ships. The updated acquisition strategy combines the FY 2009 procurement and FY 2010 options in order to maximize competitive pressure on pricing as a key element of cost control. Increasing the quantity solicited by adding the FY 2010 ships to the FY 2009 solicitation as options will also enable industry to better establish longer term supplier relationships and offer the potential for discounting to the prime contractors and subcontractors. FY 2010 ship options will be a competition for quantity....

As a result of congressional direction contained in the FY 2009 Defense Appropriations Act, the Navy amended the LCS seaframe construction solicitation to delete the FY 2008 ship. This amended solicitation continues the competition between the two incumbent industry teams. The Navy may award one ship to each industry team in FY 2009 and intends to hold a competition for the FY 2010 option ships soon after award of the FY 2009 contracts. Affordability remains a key tenet of the LCS program as the Navy works with industry to provide this capability for the lowest cost.

The FY 2009 and FY 2010 awards will be fixed-price incentive contracts, with the Navy anticipating that each LCS prime contractor receives one ship in FY 2009. The Navy remains committed to effective cost control and has modified contracting strategies and management practices to provide program stability. The FY 2009 and FY 2010 ships will be designated as Flight 0+ and will include only existing approved engineering changes along with improvements to construction or fabrication procedures. The Navy will incorporate further lessons learned from LCS 1 and 2 sea trials into the FY 2009 and FY 2010 ships prior to production. Any such changes will be limited to those essential for safety, operability or affordability. Furthermore, the RFP requests that the proposals for the FY 2010 option ships include alternative prices for both a full-up ship and separately priced contract line item numbers (CLINs) for a core seaframe (only systems for safe operation at sea), core combat system and individual combat systems and equipments (such as the gun or radar). This allows us the opportunity to manage the integration of the combat systems separately if that proved to be more affordable.

In the interim prior to FY 2009 contract awards, both industry teams were authorized and funded to pursue limited design and construction efforts while source selection proceeded. The scope of these efforts was carefully coordinated with prime contractors with an eye on preserving critical shipbuilding skills or to improve production process engineering. Once the FY 2009 ships are awarded, these sustaining efforts will be subsumed in the shipbuilding contracts.<sup>10</sup>

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<sup>10</sup> Statement of RADM Victor Guillory, U.S. Navy Director of Surface Warfare, and RADM William E. Landay, III, Program Executive Officer Ships, and Ms. E. Anne Sandel, Program Executive Officer Littoral and Mine Warfare, (continued...)

## **FY2011 and Subsequent Ships**

The Navy has not yet settled on an acquisition strategy for LCSs to be procured in FY2011 and subsequent years. Areas of uncertainty include whether and when the Navy will neck down to a single LCS design, which yard or yards will build the ships, and whether a common combat system will developed for the two designs (should they both remain in production).

Keeping both designs in production could permit the Navy to use competition between the two designs to control production costs, and could permit the Navy to field a combination of LCSs of both designs that bests takes advantage of the somewhat differing capabilities of the two designs. (The Navy has testified, for example, that the Lockheed design has, among other things, good features for handling small boats that are deployed from the LCS, while the General Dynamics design has, among other things, a generously sized fight deck for supporting helicopter and UAV operations.)

Necking down to a single design could permit the Navy to make maximum use of production learning-curve benefits in reducing LCS construction costs, and would not necessarily preclude the use of competition between competing firms to control costs for producing that one design.

The two LCS designs currently use two different, contractor-furnished combat systems.<sup>11</sup> The Navy testified in July 2007 that it wanted to shift to a common, government-furnished combat system for LCSs procured in FY2010 and beyond.<sup>12</sup> The Navy now states that it is reviewing the question of whether to shift to a common combat system.

At the March 10, 2009, hearing on the LCS program, the Navy stated the following regarding the acquisition strategy for LCSs procured in FY2011 and subsequent years:

Acquisition strategies for FY 2011 and outyear ships are under development. The Navy's strategy will be guided by cost and performance of the respective designs, as well as options for sustaining competition throughout the life of the program. Evaluations of combat systems and hull, mechanical and electrical (HM&E) performance will be conducted throughout those tests and trial periods and, as was mentioned earlier, we are already looking for opportunities to reduce total ownership costs through commonality, reductions or consolidations based on return-on-investment analysis.<sup>13</sup>

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(...continued)

before the Subcommittee on Seapower and Expeditionary Forces of the House Armed Services Committee [hearing] on the Current Status of the Littoral Combat Ship Program, March 10, 2009, pp. 7-8.

<sup>11</sup> A ship's combat system typically includes its sensors, computers, displays, and weapon launchers. The discussion here refers to the part of the LCS combat system that is permanently built into each sea frame, and not to the part that would be added by a modular mission package.

<sup>12</sup> Statement of VADM Paul Sullivan et al., Before the Subcommittee on Seapower and Expeditionary Forces of the House Armed Services Committee on Surface Combatant Construction Update, July 24, 2007, p. 8.

<sup>13</sup> Statement of RADM Victor Guillory, U.S. Navy Director of Surface Warfare, and RADM William E. Landay, III, Program Executive Officer Ships, and Ms. E. Anne Sandel, Program Executive Officer Littoral and Mine Warfare, before the Subcommittee on Seapower and Expeditionary Forces of the House Armed Services Committee [hearing] on the Current Status of the Littoral Combat Ship Program, March 10, 2009, p. 7.

## **Cost Growth on LCS Sea Frames**

### **Summary of Cost Growth**

The Navy originally spoke of building LCS sea frames for about \$220 million each in constant FY2005 dollars. Estimated LCS sea frame procurement costs have since grown substantially above that figure. The estimate for LCS-1 has grown from \$215.5 million in the FY2005 budget to \$531 million in the FY2009 budget. The estimate for LCS-2 has grown from \$213.7 million in the FY2005 budget to \$507 million in the FY2009 budget.

The figures of \$531 million and \$507 million in the previous paragraph are end-cost figures. End cost is the figure often reported as the total procurement cost of a Navy ship. It is a fairly comprehensive figure for a ship's procurement cost, but it does exclude certain cost elements. The FY2009 budget submission states that when additional costs for outfitting and post delivery and for "final system design/mission systems and ship integration team" are included, the total estimated procurement costs of LCS-1 and LCS-2 become \$631 million and \$636 million, respectively.

The Navy stated that although costs for "final system design/mission systems and ship integration team" are shown in the Navy's FY2009 budget-justification documents as part of the total estimated procurement costs of LCS-1 and LCS-2, the work in question is normally funded from a shipbuilding program's general research and development funds, rather than from funds used to pay for the construction of individual ships in the program. The Navy stated that in the case of the LCS program, these costs are shown as part of the total procurement costs of LCS-1 and LCS-2 because this is where there was room in the LCS program's line-item funding breakdown to accommodate these costs.<sup>14</sup> Removing these costs from the total procurement costs of LCS-1 and LCS-2 would lead to adjusted total procurement costs of \$606 million and \$582 million, respectively, for the two ships.

The FY2009 budget submission also showed that the estimated cost of follow-on LCS sea frames had increased to \$460 million each—the same figure that Congress used in 2007 in amending the unit procurement cost cap for LCS sea frame procurement.

A March 2008 press report suggested that the cost of LCS-2 might increase by \$41 million above the figures reported in the FY2009 budget submission. This increase, if realized, would increase the cost of LCS-2 to \$548 million (end cost) or \$677 million (more broadly defined cost).

CBO testified in March 2008 that it estimated that the cost of LCS-1 and LCS-2 (more broadly defined) could increase to about \$700 million each, and that the cost of follow-on LCSs could increase to about \$550 million each.

### **Review of Cost Growth Over Time**

Estimated LCS sea frame procurement costs can be viewed as having increased three times—in early 2006, early 2007, and early 2008.

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<sup>14</sup> Source: Navy briefing to CRS and CBO on the LCS program, May 2, 2008.

### *Early 2006*

The proposed FY2007 Navy budget, submitted in February 2006, showed that:

- the estimate for the first LCS had increased from \$215.5 million in the FY2005 budget and \$212.5 million in the FY2006 budget to \$274.5 million in the FY2007 budget—an increase of about 27% from the FY2005 figure and about 29% from the FY2006 figure;
- the estimate for the second LCS increased from \$213.7 million in the FY2005 budget and \$256.5 million in the FY2006 budget to \$278.1 million—an increase of about 30% from the FY2005 figure and about 8% from the FY2006 figure; and
- the estimate for follow-on ships scheduled for FY2009-FY2011, when the LCS program was to have reached a planned maximum annual procurement rate of six ships per year, had increased from \$223.3 million in the FY2006 budget to \$298 million—an increase of about 33%.

The Navy stated in early 2006 that the cost increase from the FY2006 budget to the FY2007 budget was due mostly to the fact that LCS procurement costs in the FY2006 budget did not include items that are traditionally included in the so-called end cost—the total budgeted procurement cost—of a Navy shipbuilding program, such as Navy program-management costs, an allowance for changes, and escalation (inflation). The absence of these costs from the FY2006 LCS budget submission raised certain potential oversight issues for Congress.<sup>15</sup>

### *Early 2007*

On January 11, 2007, the Navy reported that LCS-1 was experiencing “considerable cost overruns.” The Navy subsequently stated that the estimated shipyard construction cost of LCS-1 had grown to \$350 million to \$375 million. This suggested that the end cost of LCS-1—which also includes costs for things such as Navy program-management costs and an allowance for changes—could be in excess of \$400 million. The Navy did not publicly provide a precise cost overrun figure for LCS 2, but it stated that the cost overrun on LCSs 1 and 2 was somewhere between 50% and 75%, depending on the baseline that is used to measure the overrun.

The Government Accountability Office (GAO) testified in July 2007 that according to its own analysis of Navy data, the combined cost of LCSs 1 and 2 had increased from \$472 million to

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<sup>15</sup> These oversight issues included the following:

—Why were these costs excluded? Was this a budget-preparation oversight? If so, how could such an oversight occur, given the many people involved in Navy budget preparation and review, and why did it occur on the LCS program but not other programs? Was anyone held accountable for this oversight, and if so, how? If this was not an oversight, then what was the reason?

—Did the Navy believe there was no substantial risk of penalty for submitting to Congress a budget presentation for a shipbuilding program that, for whatever reason, significantly underestimated procurement costs?

—Do LCS procurement costs in the budget now include all costs that, under traditional budgeting practices, should be included? If not, what other costs are still unacknowledged?

—Have personnel or other resources from other Navy programs been used for the LCS program in any way? If so, have the costs of these personnel or other resources been fully charged to the LCS program and fully reflected in LCS program costs shown in the budget?

\$1,075—an increase of 128%.<sup>16</sup> The Congressional Budget Office (CBO) testified in July 2007 that:

Several months ago, press reports indicated that the cost could well exceed \$400 million each for the first two LCS sea frames. Recently, the Navy requested that the cost cap for the fifth and sixth sea frames be raised to \$460 million, which suggests that the Navy's estimate of the acquisition cost for the first two LCSs would be around \$600 million apiece....

As of this writing, the Navy has not publicly released an estimate for the LCS program that incorporates the most recent cost growth, other than its request to raise the cost caps for the fifth and sixth ships. CBO estimates that with that growth included, the first two LCSs would cost about \$630 million each, excluding mission modules but including outfitting, postdelivery, and various nonrecurring costs associated with the first ships of the class. As the program advances, with a settled design and higher annual rates of production, the average cost per ship is likely to decline. Excluding mission modules, the 55 LCSs in the Navy's plan would cost an average of \$450 million each, CBO estimates.<sup>17</sup>

### Early 2008

As mentioned above, the proposed FY2009 budget, submitted in February 2008, showed that the estimated end costs of LCS-1 and LCS-2 had increased to \$531 million and \$507 million, respectively (or to \$606 million and \$582 million, respectively, when outfitting and post-delivery costs are included), and that the estimated unit cost of follow-on ships in the program has increased to \$460 million.

On March 14, 2008, the Navy testified that

The end costs included in the FY 2009 President's Budget request for LCS reflects [sic] the current estimates for LCS 1 and LCS 2 end cost. However, on February 25, 2008, after the submission of the President's Budget to Congress, General Dynamics submitted to the Navy and over target baseline request for LCS 2. The Navy is reviewing the request prior to granting approval for General Dynamics to implement. The details of the request are business sensitive and proprietary. The Navy will continue to actively monitor LCS 1 and 2 cost and schedule performance and to keep the Office of the Secretary of Defense and Congress informed of those estimated costs. The Navy will seek congressional support to complete the reprogramming of FY 2007 LCS shipbuilding funds to complete LCS 1 and 2.<sup>18</sup>

A March 26, 2008, press report stated that the cost of LCS-2 will increase \$41 million “for the year ending Sept. 30,” according to “a defense official with knowledge of the increase.”<sup>19</sup> The

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<sup>16</sup> Defense Acquisitions[:] Realistic Business Cases Needed to Execute Navy Shipbuilding Programs, Statement of Paul L. Francis, Director, Acquisition and Sourcing Management Team, Testimony Before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives, July 24, 2007 (GAO-07-943T), pp. 4 and 22.

<sup>17</sup> Statement of J. Michael Gilmore, Assistant Director for National Security, and Eric J. Labs, Senior Analyst, [on] The Navy's 2008 Shipbuilding Plan and Key Ship Programs, before the Subcommittee on Seapower and Expeditionary Forces Committee on Armed Services U.S. House of Representatives, July 24, 2007, p. 18.

<sup>18</sup> Statement of Vice Admiral Barry McCullough, Deputy Chief of Naval Operations For Integration of Capabilities and Resources, and Ms. Allison Stiller, Deputy Assistant Secretary of the Navy (Ship Programs), before the Subcommittee on Seapower and Expeditionary Forces of the House Armed Services Committee on Navy Force Structure and Shipbuilding, March 14, 2008, p. 4.

<sup>19</sup> Tony Capaccio, “General Dynamics Littoral Combat Ship Cost Jumps 9.3 Percent,” *Bloomberg News*, March 26, (continued...)

press report characterized the \$41-million increase as an increase of 9.3% in the ship's estimated basic construction cost of \$440 million. Basic construction cost is a component of ship end cost. When measured against the ship's estimated end cost or its adjusted total procurement cost (which also includes outfitting and post-delivery costs) as shown in the FY2009 budget (\$507 million or \$582 million, respectively), an increase of \$41 million would equate to an increase of about 8.1% or about 7.0%, respectively.

## June 2008 CBO Report

CBO reported on June 9, 2008 that:

Historical experience indicates that cost growth in the LCS program is likely. In particular, using the lead ship of the FFG-7 Oliver Hazard Perry class frigate as an analogy, historical cost-to-weight relationships indicate that the Navy's original cost target for the LCS of \$260 million in 2009 dollars (or \$220 million in 2005 dollars) was optimistic. The first FFG-7 cost about \$670 million in 2009 dollars to build, or about \$250 million per thousand tons, including combat systems. Applying that metric to the LCS program suggests that the lead ships would cost about \$600 million apiece, including the cost of one mission module. Thus, in this case, the use of a historical cost-to-weight relationship produces an estimate that is less than the actual costs of the first LCSs to date but substantially more than the Navy's original estimate.

Based on actual costs the Navy has incurred for the LCS program, CBO estimates that the first two LCSs could cost about \$700 million each, including outfitting and postdelivery and various nonrecurring costs associated with first ships of a class but excluding mission modules. However, as of May 1, 2008, LCS-1 was 83 percent complete and LCS-2 was 68 percent complete. Thus, additional cost growth is possible, and CBO's estimate reflects that cost risk.

Overall, CBO estimates that the LCSs in the Navy's plan would cost about \$550 million each, on average, excluding mission modules. That estimate assumes that the Navy would select one of the two existing designs and make no changes. As the program advanced with a settled design and higher annual rates of production, average ship costs would probably decline. If the Navy decided to make changes to that design, however, the costs of building future ships could be higher than CBO now estimates.<sup>20</sup>

## Reasons for Cost Growth

Various reasons have been cited for cost growth in the LCS program, including the following:

- **Unrealistically low original estimate.** Some observers believe that the original cost estimate of \$220 million for the LCS sea frame was unrealistically low. If so, a potential follow-on question would be whether the LCS represents a case of "low-balling"—using an unrealistically low cost estimate in the early stages of a

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2008.

<sup>20</sup> Congressional Budget Office, *Resource Implications of the Navy's Fiscal Year 2009 Shipbuilding Plan*, June 8, 2008, pp. 26-27.



proposed weapon program to help the program win approval and become an established procurement effort.

- **Impact of Naval Vessel Rules (NVR).** Navy and industry officials have attributed some of the cost growth to the impact of applying new Naval Vessel Rules (NVR)—essentially, new rules specifying the construction standards for the ship—to the LCS program. The NVR issued for the LCS program incorporated, among other things, an increase in the survivability standard (the ability to withstand damage) to which LCSs were to be built.<sup>21</sup> Building the ship to a higher survivability standard represented a change in requirements for the ship that led to many design changes, including changes that made ship more rugged and more complex in terms of its damage-control systems. In addition, Navy and industry officials have testified, the timing of the issuing of NVR created a situation of concurrency between design and construction in the LCS program, meaning that the ship was being designed at the same time that the shipyard was attempting to build it—a situation long known to be a potential cause of cost growth. This concurrency, Navy officials testified, was a consequence of the compressed construction schedule for the LCS program, which in turn reflected an urgency about getting LCSs into the fleet to meet critical mission demands.
- **Improperly manufactured reduction gear.** Navy and industry officials testified that cost growth on LCS-1 was partly due to a main reduction gear<sup>22</sup> that was incorrectly manufactured and had to be replaced, forcing a reordering of the construction sequence for the various major sections of the ship.
- **Increased costs for materials.** Some observers have attributed part of the cost growth in the program to higher-than-estimated costs for steel and other materials that are used in building the ships.
- **Emphasis on meeting schedule combined with cost-plus contract.** Some portion of cost growth on LCS-1 has been attributed to a combination of a Navy emphasis on meeting the ship's aggressive construction schedule and the Navy's use of a cost-plus contract to build the ship.<sup>23</sup>

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<sup>21</sup> The LCS was earlier conceived as a ship that would be built to a survivability standard that would be sufficient, in the event of significant battle damage, to save the ship's crew, but not necessarily the ship. The survivability standard for the LCS was increased as part of the issuing of NVR to one that would be sufficient to save not only the ship's crew, but the ship as well. (Other U.S. Navy combat ships are built to a still-higher survivability standard that is sufficient not only to save the crew and the ship, but to permit the ship to keep fighting even though it has sustained damage.)

<sup>22</sup> A ship's reduction gear is a large, heavy gear that reduces the high-speed revolutions of the ship's turbine engines to the lower-speed revolutions of its propellers.

<sup>23</sup> The Senate Armed Services Committee, as part of its discussion of the LCS program in its report (S.Rept. 110-77 of June 5, 2007) on the FY2008 defense authorization bill (S. 1547), stated:

Reviewing this LCS situation will undoubtedly result in a new set of "lessons learned" that the acquisition community will dutifully try to implement. However, the committee has previously expressed concerns about the LCS concept and the LCS acquisition strategy. The LCS situation may be more a case of "lessons lost." Long ago, we knew that we should not rush to sign a construction contract before we have solidified requirements. We also knew that the contractors will respond to incentives, and that if the incentives are focused on maintaining schedules and not on controlling cost, cost growth on a cost-plus contract should surprise no one. After the fact, everyone appears ready to agree that the original ship construction schedule for the lead ship was  
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- **Shipyard Performance.** Shipyard performance and supervision of the LCS shipyards by the LCS team leaders and the Navy has been cited as another cause of cost growth.<sup>24</sup>

### *Press Reports on Shipyard Performance and Supervision*

Regarding shipyard performance and supervision of the LCS shipyards by the LCS team leaders and the Navy, a February 4, 2008, press report stated:

Marinette Marine, the Wisconsin shipyard building the first Littoral Combat Ship, never received proper certification to manage the project, which has suffered severe cost growth and schedule delays, according to an internal naval audit obtained by sister publication Inside the Pentagon [ITP].

The interim report is the most damning account yet of the LCS program's failure to use earned value management (EVM). Pentagon officials and contractors are supposed to use the process to manage the cost, schedule and performance of acquisition efforts. The idea is to coordinate key project goals and objectively measure progress.

In prepared testimony for his Senate confirmation hearing last October, Pentagon acquisition executive John Young noted that EVM was a "serious deficiency" in the LCS program.

The audit reveals how this deficiency has undermined work on the Freedom (LCS-1), which Marinette Marine is building for Lockheed Martin.

The review, which began a year ago, is still ongoing. However, ITP obtained a redacted copy of the Jan. 7 interim report, originally stamped "for official use only," through the Freedom of Information Act....

The review reveals Marinette Marine's poor management and faults the Navy, the Defense Contract Management Agency (DCMA) and Lockheed for failing to notice and fix the problem.

The press report also states:

Robert Herre, the president and general manager of Manitowoc Marine Group, which operates the shipyard, told ITP in an interview that Marinette Marine never worked on a project before that required the robust EVM needed for the Freedom contract. The management software that the shipyard acquired several years ago was not up to the task.

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overly aggressive. (Page 98)

<sup>24</sup> A recent press report based on remarks made by Admiral Gary Roughead, the Chief of Naval Operations, included remarks on causes of cost growth in the LCS program:

"There was a rush, and we thought we could get by with some commercial specifications," Roughead said. "As we got into building the ship, some of those commercial applications weren't going to do it from a survivability standpoint. That required some recasting of specifications."...

The Navy sought to design and build the ship concurrently, "which is not necessarily a good thing," Roughead said. And in an effort to improve efficiency, the service "backed off" staffing in technical and oversight areas in the shipyards. "That came back to bite us," he said.

(Katherine McIntire Peters, "Navy's Top Officer Sees Lessons In Shipbuilding Program Failures," September 24, 2008.)

Marinette Marine tried to adapt for the Freedom project by using a manual system, too, Herre said, but it became “more of a cumbersome process than first thought.”

Lockheed spokesman Craig Quigley blamed “cost and schedule baseline disconnects” on the Navy for making big changes to the Freedom without agreeing, until last November, to rebaseline both the program’s cost and schedule. Previously only the schedule had been rebaselined, he said. Lockheed’s team has maintained an EVM system baseline on the program and accurately reported monthly variances, he said.

“Not having the cost and schedule baseline in synchronization prohibits accurate system predictions, but that was accounted for via adjunct reports,” he added.

The report says DCMA and Naval Sea Systems Command did not provide sufficient oversight to ensure proper management of the contract; the Navy’s Gulf Coast-based shipbuilding office and industry did not effectively review the EVM, or lack thereof; and the program office and the shipyard “placed limited emphasis” on the implementation of EVM for the contract.

DCMA initially granted a “conditional approval” for Marinette Marine’s EVM system in April 2006, the report says. The conditional nod was based on a Navy-led EVM system review conducted the year before. However, Pentagon policy does not allow for a “conditional approval” of a contractor’s EVM system. DCMA only recognized its error 10 months later, in February 2007, according to the report. The agency then alerted the program office, Lockheed and Marinette Marine that the “conditional approval” had been inappropriate.

Now all agree Marinette Marine lacks a DCMA-validated EVM system, a problem that must be fixed.

The report says Marinette Marine’s EVM system did not provide valid and reliable cost, schedule, and technical performance data to support the LCS program office’s decision-making. Auditors found the shipyard was not following 24 of the Pentagon’s 32 EVM rules. DCMA failed to check whether the 32 rules were being followed. Further, the Navy and DCMA failed to perform formal surveillance to ensure the shipyard heeded the rules, the report says. And Marinette Marine failed to use EVM as an integrated program management tool.

As a result, the Navy is “not receiving full value for program management services and information paid for under this contract,” the report states.

The press report also states:

The report describes a “significant breakdown in internal controls.” Navy decision-makers are not receiving accurate and reliable earned value data for the Freedom, the review says. The shipyard’s projected estimates-at-completion for the Freedom contract are “not supported.” Further, the program office “did not have visibility” for project work totaling approximately \$51 million. The lack of oversight left the Navy’s financial interest in the ship’s construction unprotected, the review concludes....

Auditors recommended eight fixes. The report says four remain to be done, but Quigley said two remain to be done. Last November, the Navy completed a new estimate for the cost of completing the Freedom contract, conducted a schedule review and had the program develop a new baseline for the ship. Officials have also had Lockheed start work on a plan to fix the problems.

Quigley said officials have reviewed, approved and monitored Lockheed's plan. He also said the shipyard's efforts are now being checked continuously against the 32 rules.

In March [2008], the Navy plans to review the new baseline. And DCMA is due to conduct a review to ensure the shipyard is following the rules by year's end, the report says. Quigley said that last step could take 18 months.

Unlike Marinette Marine, Lockheed and Gibbs & Cox (another team member), have EVM certification, he said.

Young's predecessor, Kenneth Krieg, warned in a memo last summer that the Pentagon's EVM efforts were "insufficient, especially given the number of major defense programs experiencing execution problems."<sup>25</sup>

A July 14, 2008, press report states:

The Navy's Littoral Combat Ship program has not one, but two black eyes on earned value management because both LCS shipbuilders violated Defense Department rules for managing the cost, schedule and performance of acquisition efforts, a new audit finds.

The June 12 report by the Naval Audit Service reveals that Austal, General Dynamics and the Navy all failed to apply the rules to the second Littoral Combat Ship, Independence (LCS-2). The report is stamped "for official use only." *Inside the Pentagon* obtained a redacted version through the Freedom of Information Act.

This finding is nearly as bad as the failure of Marinette Marine, Lockheed Martin and the Navy to apply the rules to the first LCS, Freedom (LCS-1), a debacle documented by auditors earlier this year. In that case, Marinette Marine ran afoul of more rules and also lacked the required management certification.

The idea behind earned value management is to coordinate key project goals and objectively measure progress. Many Pentagon contractors and programs have failed to use the tool properly. But the failures in the LCS program are particularly well documented, providing a road map for how not to do earned value management.

The latest audit—conducted from February 2007 to April 2008—reveals Alabama-based Austal, the shipyard building LCS-2 for prime contractor General Dynamics, failed to heed 20 of the Pentagon's 32 rules for earned value management.

GD spokesman Jim DeMartini said the company had not yet reviewed the June 12 report.

"However, we are aware of the issue and we are aggressively taking actions to improve the implementation and oversight of EVM in the LCS program," he told ITP. "We are working in close cooperation with our Navy customer and have achieved a number of noteworthy accomplishments along the path to improving the implementation of EVM in the LCS program."

GD intends to "continue to aggressively address these issues until they are resolved, and to execute the established processes and procedures for the duration of the LCS program," DeMartini said....

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<sup>25</sup> Christopher J. Castelli, "Audit Exposes Failed Management of Troubled Littoral Warship," *Inside the Navy*, February 4, 2008.

“We found that EVM was not sufficiently implemented and overseen by any of the responsible parties on the LCS-2 ‘Independence’ detailed design and construction contract,” the report states.

The audit warns the Navy’s supervisor at GD’s Bath Iron Works shipyard did not provide adequate surveillance over Austal’s EVM implementation.

GD, as the prime contractor, did not effectively oversee Austal’s EVM implementation, auditors write.

And the Navy’s program executive office for ships, as well as the program manager, lacked adequate visibility over the LCS contractor’s cost, schedule, and technical performance because they “placed limited emphasis on the implementation of EVM,” the report says.

The report faults the Defense Contract Management Agency and Naval Sea Systems Command for insufficient oversight that failed to ensure EVM was properly implemented for LCS-2. The Defense Contract Audit Agency did not perform the required audits of Austal’s earned value management system, the report adds.

“The Navy is committed to earned value management and is working proactively to ensure that it is implemented properly,” Navy spokesman Lt. Clay Doss told ITP. “We asked the Naval Audit Service to independently review how EVM was being used on the Littoral Combat Ship program in order to provide a baseline for continuous self-assessment. We are in the process of taking the corrective actions as recommended in the report.”

The report’s recommendations aim to bring Austal into compliance with the 32 rules, provide better oversight and ensure required audits are conducted.

The audit also critiques the work of the Navy’s LCS program management assist group (PMAG), which studied the cost growth on the first LCS and the projected costs for three more LCSs in early 2007. Though the PMAG answered all nine questions regarding cost estimates, cost growth, contractor and subcontractor arrangement, EVM, and oversight issues, the review was “not comprehensive,” the audit finds, noting the PMAG was given less than 15 working days to do its study.

“Given the complexity of the ship design and construction process, use of multiple contractors, geographical dispersion of the key players, and the size of the LCS acquisition program, we believe 15 days was not sufficient time to adequately conduct in-depth analyses to fully assess the validity and accuracy of program data and decisions used to support their findings,” the report says.<sup>26</sup>

### ***July 2007 GAO Testimony***

GAO testified in July 2007 that:

We have frequently reported on the wisdom of using a solid, executable business case before committing resources to a new product development effort....

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<sup>26</sup> Christopher J. Castelli, “Audit Reveals Both LCS and Industry Teams Violated Management Rules,” *Inside the Pentagon*, July 10, 2008. The article was reprinted in essentially identical form, with the same headline, in the July 14, 2008, issue of sister publication *Inside the Navy*.

A sound business case would establish and resource a knowledge-based approach at the outset of a program. We would define such a business case as firm requirements, mature technologies, and an acquisition strategy that provides sufficient time and money for design activities before construction start. The business case is the essential first step in any acquisition program that sets the stage for the remaining stages of a program, namely the business or contracting arrangements and actual execution or performance. If the business case is not sound, the contract will not correct the problem and execution will be subpar. This does not mean that all potential problems can be eliminated and perfection achieved, but rather that sound business cases can get the Navy better shipbuilding outcomes and better return on investment. If any one element of the business case is weak, problems can be expected in construction. The need to meet schedule is one of the main reasons why programs cannot execute their business cases. This pattern was clearly evident in both the LPD 17 [amphibious ship] and LCS programs. In both cases, the program pushed ahead with production even when design problems arose or key equipment was not available when needed. Short cuts, such as doing technology development concurrently with design and construction, are taken to meet schedule. In the end, problems occur that cannot be resolved within compressed, optimistic schedules. Ultimately, when a schedule is set that cannot accommodate program scope, delivering an initial capability is delayed and higher costs are incurred....

What happens when the elements of a solid business case are not present? Unfortunately, the results have been all too visible in the LPD 17 and the LCS. Ship construction in these programs has been hampered throughout by design instability and program management challenges that can be traced back to flawed business cases. The Navy moved forward with ambitious schedules for constructing LPD 17 and LCS despite significant challenges in stabilizing the designs for these ships. As a result, construction work has been performed out of sequence and significant rework has been required, disrupting the optimal construction sequence and application of lessons learned for follow-on vessels in these programs....

In the LCS program, design instability resulted from a flawed business case as well as changes to Navy requirements. From the outset, the Navy sought to concurrently design and construct two lead ships in the LCS program in an effort to rapidly meet pressing needs in the mine countermeasures, antisubmarine warfare, and surface warfare mission areas. The Navy believed it could manage this approach, even with little margin for error, because it considered each LCS to be an adaptation of an existing high-speed ferry design. It has since been realized that transforming a high-speed ferry into a capable, networked, survivable warship was quite a complex venture. Implementation of new Naval Vessel Rules (design guidelines) further complicated the Navy's concurrent design-build strategy for LCS. These rules required program officials to redesign major elements of each LCS design to meet enhanced survivability requirements, even after construction had begun on the first ship. While these requirements changes improved the robustness of LCS designs, they contributed to out of sequence work and rework on the lead ships. The Navy failed to fully account for these changes when establishing its \$220 million cost target and 2-year construction cycle for the lead ships.

Complicating LCS construction was a compressed and aggressive schedule. When design standards were clarified with the issuance of Naval Vessel Rules and major equipment deliveries were delayed (e.g., main reduction gears), adjustments to the schedule were not made. Instead, with the first LCS, the Navy and shipbuilder continued to focus on achieving the planned schedule, accepting the higher costs associated with out of sequence work and rework. This approach enabled the Navy to achieve its planned launch date for the first Littoral Combat Ship, but required it to sacrifice its desired level of outfitting. Program officials report that schedule pressures also drove low outfitting levels on the second Littoral Combat Ship design as well, although rework requirements have been less intensive to date. However, because remaining work on the first two ships will now have to be completed out-

of-sequence, the initial schedule gains most likely will be offset by increased labor hours to finish these ships.

The difficulties and costs discussed above relate to the LCS seaframe only. This program is unique in that the ship's mission equipment is being developed and funded separately from the seaframe. The Navy faces additional challenges integrating mission packages with the ships, which could further increase costs and delay delivery of new antisubmarine warfare, mine countermeasures, and surface warfare capabilities to the fleet. These mission packages are required to meet a weight requirement of 180 metric tons or less and require 35 personnel or less to operate them. However, the Navy estimates that the mine countermeasures mission package may require an additional 13 metric tons of weight and 7 more operator personnel in order to deploy the full level of promised capability. Because neither of the competing ship designs can accommodate these increases, the Navy may be forced to reevaluate its planned capabilities for LCS.<sup>27</sup>

## **Summary of Congressional Action in FY2005-FY2009**

### **FY2005**

In FY2005, Congress approved the Navy's plan to fund the construction of the first two LCS sea frames using research and development funds rather than shipbuilding funds, funded the first construction cost of the first LCS (LCS-1), required the second LCS (LCS-2) to be built (when funded in FY2006) to a different design from the first, prohibited the Navy from requesting funds in FY2006 to build a third LCS, and required all LCSs built after the lead ships of each design to be funded in the SCN account rather than the Navy's research and development account.

### **FY2006**

In FY2006, Congress funded the procurement of LCSs 2, 3, and 4. (The Navy requested one LCS for FY2006, consistent with Congress's FY2005 action. Congress funded that ship and provided funding for two additional ships.) Congress in FY2006 also established a unit procurement cost limit on the fifth and sixth LCS sea frames of \$220 million per ship, plus adjustments for inflation and other factors (Section 124 of the FY2006 defense authorization bill [H.R. 1815/P.L. 109-163] of January 6, 2006), required an annual report on LCS mission packages, and made procurement of more than four LCSs contingent on the Navy certifying that there exists a stable design for the LCS.

### **FY2007**

In FY2007, Congress funded the procurement of LCSs 5 and 6. (The Navy canceled these two ships in 2007 before they were placed under contract for construction.)

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<sup>27</sup> Defense Acquisitions[:] Realistic Business Cases Needed to Execute Navy Shipbuilding Programs, Statement of Paul L. Francis, Director, Acquisition and Sourcing Management Team, Testimony Before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives, July 24, 2007 (GAO-07-943T), pp. 8-11.

## **FY2008**

In FY2008, Congress accepted the Navy's cancellation of LCSs 3 through 6; funded the procurement one additional LCS in FY2008 (which the Navy called LCS-5);<sup>28</sup> significantly reduced the Navy's FY2008 funding request for the LCS program; amended the LCS sea frame unit procurement cost cap to \$460 million per ship for LCSs procured in FY2008 and subsequent years (Section 125 of the conference report [H.Rept. 110-477 of December 6, 2007] on H.R. 1585, the FY2008 defense authorization bill, which was enacted as H.R. 4986/P.L. 110-181 of January 28, 2008); and required the Navy to use fixed-price-type contracts for the construction of LCSs procured in FY2008 and subsequent years.

The Navy in 2007 requested that Congress amend the existing unit procurement cost cap for the fifth and sixth ships to \$460 million, plus adjustments for inflation and other factors. Congress amended the cost cap to \$460 million, but applied it not only to the fifth and sixth LCSs, but to all LCSs procured in FY2008 and subsequent years. The use of fixed-price contracts for future LCSs was something that the Navy had stated an intention to do as part of its plan for restructuring the LCS program.

## **FY2009**

In FY2009, Congress delayed the implementation of the LCS sea frame unit procurement cost cap by two years, to ships procured in FY2010 and subsequent years (Section 122 of the FY2009 defense authorization bill [S. 3001/P.L. 110-417 of October 14, 2008]); rescinded \$337 million in FY2008 shipbuilding funds for the LCS program, effectively canceling the funding for the LCS procured in FY2008 (Section 8042 of the FY2009 defense appropriations bill [Division C of H.R. 2638/P.L. 110-329 of September 30, 2008]); and funded the procurement of two LCSs at a cost of \$1,020 million.

# **Potential Oversight Issues for Congress**

## **Cost Growth on LCS Sea Frames**

Potential oversight questions for Congress concerning cost growth on LCS sea frames include the following:

- Has the Navy taken sufficient action to prevent further growth in LCS sea frame unit procurement costs?
- How much of the cost increases on LCSs 1 and 2 are attributable to Navy actions in managing the program? To prime contractor performance? To shipyard performance? To performance by supplier firms?

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<sup>28</sup> The Navy apparently called this ship LCS-5 because the original LCS-5 and LCS-6 were canceled by the Navy before they were replaced under contract, leaving LCS-4 as last LCS under contract to have been canceled. In spite of its designation, LCS-5 would have been the third LCS in the restructured LCS program, and was the seventh to have been funded by Congress.



- Concurrency in design and construction has long been known as a source of risk in shipbuilding and other weapon-acquisition programs. Eliminating concurrency forms part of DOD's effort to move toward best practices in acquisition. In retrospect, did the Navy make a good decision in letting its sense of urgency about the LCS override the known risks of concurrency in design and construction?
- Do the estimated costs of LCSs 1 and 2 reflect systems, components, or materials provided by vendors at reduced prices as part of an effort by those vendors to secure a role in the 55-ship LCS program? If so, how much more expensive might these systems, components, or materials become on later LCSs? Is this a source of concern regarding the potential for cost growth on follow-on LCSs?
- In light of cost growth on LCS sea frames, where does the LCS program now stand in relation to the Nunn-McCurdy provision (10 U.S.C. §2433), which requires certain actions to be taken if the cost of a defense acquisition program rises above certain thresholds?
- How might the increase in LCS unit procurement costs affect the number of LCSs that the Navy can afford to procure each year, and the total number it can afford to procure over the long run?
- Is the Navy financing cost growth on LCS sea frames by reducing funding for the procurement of LCS mission packages? For example, is cost growth on LCS sea frames linked in some way to the reduction in the planned number of LCS mission packages from an earlier figure of 90 to 110 to the current figure of 64? If the Navy is financing cost growth on LCS sea frames by reducing funding for the procurement of LCS mission packages, how might this reduce the capabilities of the planned 55-ship LCS fleet?
- In light of the cost growth, is the LCS program still cost-effective? For follow-on LCSs, what is the unit procurement cost above which the Navy would no longer consider the LCS program cost-effective?
- If Congress had known in 2004, when it was acting on the FY2005 budget that contained funding to procure LCS-1, that LCS sea frame unit procurement costs would increase to the degree that they have, how might that have affected Congress's views on the question of approving the start of LCS procurement?
- How might the increase in LCS unit procurement costs affect the affordability and executability of the Navy's overall shipbuilding program?<sup>29</sup>
- What implications, if any, does the increase in LCS unit procurement costs have for estimated procurement costs of other new Navy ship classes?<sup>30</sup>

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<sup>29</sup> For a discussion of the potential affordability of the Navy's overall shipbuilding program, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

<sup>30</sup> On this point, CBO testified in March 2008: "The relatively simple design of the LCS and the substantial cost increases that have occurred in the program suggest that the Navy may also have trouble meeting its cost targets for the larger, much more complex surface combatants in its shipbuilding plan, such as the DDG-1000 and the CG(X)." (Statement of Eric J. Labs, Senior Analyst, [on] Current and Projected Navy Shipbuilding Programs, before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, U.S. House of Representatives, March 14, 2008, p. 24.)

## Total Program Acquisition Cost

Although this CRS report estimates that a 55-ship LCS program with 64 mission packages might have a total acquisition cost of roughly \$29.4 billion, the potential total acquisition cost of the LCS program is uncertain. Supporters could argue that total program acquisition cost will become clearer as the Navy works through the details of the program. Critics could argue that a major acquisition program like the LCS program should not proceed at full pace until its potential total acquisition costs are better understood.

## Procurement Cost Cap

In light of current estimated costs for building LCS-1 and LCS-2, some observers are concerned that it might not be possible to build complete follow-on LCSs for \$460 million each, even if the number of LCSs procured each year is increased, as the Navy plans. In addition, unlike cost caps for certain other Navy shipbuilding programs that Congress has established in recent years, the \$460-million cost cap for the LCS program (Section 125 of the conference report [H.Rept. 110-477 of December 6, 2007] on H.R. 1585, the FY2008 defense authorization bill, which was enacted as H.R. 4986/P.L. 110-181 of January 28, 2008) does not include a provision allowing the \$460 million figure to be increased over time in response to inflation. Other observers have argued that the LCS cost cap is written in a way so as to include costs not included in cost caps for other Navy shipbuilding programs.<sup>31</sup> The Navy testified in February 2008 that it anticipated asking Congress at some point to amend the cost cap to permit the cap to be adjusted over time for inflation.<sup>32</sup>

## Technical Risk

### Seaframe

Regarding technical risk in developing the LCS seaframe, GAO reported the following in March 2009:

#### Technology Maturity

Fifteen of 19 critical technologies for the two seaframe designs are fully mature, and 2 technologies are approaching maturity. The overhead launch and retrieval system in the LCS 1 design and the aluminum structure in the LCS 2 design are immature. The Navy identified the watercraft launch and recovery concept as a major risk to both seaframe designs. This capability is essential to complete the LCS anti-submarine warfare and mine countermeasures missions. According to the Navy, industry watercraft launch and recovery designs are unproven. To mitigate risk, the Navy is conducting launch and recovery modeling and simulation, model basin testing, and experimentation and is encouraging the seaframe industry teams to adopt similar approaches. Final integration of mission package vehicles with each seaframe will not occur until post-delivery test and trials—planned first for LCS 1

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<sup>31</sup> For further discussion, see Andrea Shalal-Esa, “Navy Unhappy With LCS Bids, Wants Cost Cap Raised,” *Reuters*, September 9, 2008; Emelie Rutherford, “Defense Authorization Conferees Weighing Changes To LCS Cost Cap,” *Defense Daily*, September 22, 2008.

<sup>32</sup> Source: transcript of spoken remarks of Allison Stiller at February 27, 2008 hearing on Navy shipbuilding before the Defense subcommittee of the House Appropriations Committee.

in 2010 using the mine countermeasures mission package. Any problems detected could require redesign and costly rework, which could delay the introduction of LCS to the fleet.

### **Design and Production Maturity**

The Navy assesses LCS design stability by monitoring changes to requirements documents, execution of engineering change proposals, and the completion of contract deliverables related to drawings, ship specifications, and independent certification of the design. Construction is monitored using earned value management and through evaluation of manufacturing hours spent on rework, deficiencies detected and corrected, and the number of test procedures performed.

The Navy adopted a concurrent design-build strategy for the first two LCS seaframes, which has proven unsuccessful. Contributing challenges included the implementation of new design guidelines, delays in major equipment deliveries, and an unwavering focus on achieving schedule and performance goals. These events drove low levels of outfitting, out-of-sequence work, and rework—all of which increased construction costs. Also, incomplete designs during construction led to weight increases for both seaframes. According to the Navy, this weight growth contributed to a higher than desired center of gravity on LCS 1 that degraded the stability of the seaframe. In fact, an inclining experiment performed during acceptance trials showed LCS 1 may not meet Navy stability requirements for the damaged ship condition. The Navy is taking steps to remove weight and implement stability improvements for LCS 1, while also incorporating design changes for future seaframes.

### **Other Program Issues**

As part of LCS 1 acceptance trials, the Navy's Board of Inspection and Survey (INSURV) identified 21 critical "starred" deficiencies and recommended the Chief of Naval Operations authorize delivery of LCS 1 after correction or waiver of these deficiencies. According to Navy officials, only 9 of these deficiencies were corrected prior to delivery. Navy officials report that transiting the ship away from Marinette, Wisconsin, prior to the winter freeze was a higher priority than timely correction of starred deficiencies. The Navy intends to correct remaining deficiencies during planned post-delivery maintenance availabilities. The Navy plans to hold an INSURV review of LCS 2 upon completion of construction and builder's trials for that seaframe.

Navy officials report that the earned value management systems in each of the LCS shipyards do not meet Defense Contract Management Agency requirements for validation. Thus, the cost and schedule data reported by the prime contractors cannot be considered fully reliable by the Navy when evaluating contractor cost proposals or negotiating for construction of follow-on ships.

### **Program Office Comments**

The Navy stated the LCS program is delivering vital capabilities to the fleet and will be a critical component of the Navy. It noted that LCS 1 was delivered September 18, 2008—6 years and 1 day after the LCS program was established. In fiscal year 2009, the program will deliver a second ship of a completely different design. According to the Navy, while the initial cost and schedule objectives were overaggressive—and necessitated a concurrent design and construction plan—they provided the tension and urgency for these achievements, and lessons learned will be applied to future shipbuilding programs. In August 2008, INSURV evaluated LCS 1 and found it to be "capable, well-built, and inspection-

ready.” The Navy stated it is leveraging lessons learned from LCS 1 and LCS 2 to ensure future ship awards provide the right mix of capability and affordability.<sup>33</sup>

## Mission Packages

Regarding technical risk in developing the modular mission packages for the LCS, GAO reported the following in March 2009:

### Technology Maturity

Operation of the MCM, SUW, and ASW packages on the LCS requires a total of 25 critical technologies, including 13 sensors, 5 weapons, and 7 vehicles. Of these technologies, 17 are currently mature and 8 are nearing maturity.

The first of 24 MCM packages was delivered in September 2007 and included 7 of 10 planned mission systems. Four systems are not yet mature; two of these are struggling to reach full maturity. Officials note the Organic Airborne and Surface Influence Sweep is being redesigned to address corrosion issues and the Rapid Airborne Mine Clearance System requires design changes to perform in all environmental conditions. An airborne mine countermeasures system was decertified and its tow cable is being redesigned following the results of testing with the helicopter. The Navy also decertified the Remote Minehunting System during testing in 2007 due to reliability issues, and, according to officials, results of a recent operational assessment are pending. The Navy now plans to deliver the third and fourth mission packages in fiscal year 2011 and has delayed delivery of the baseline package until fiscal year 2012.

The first of 24 SUW packages was delivered in July 2008 and included 1 of 2 planned mission systems. The SUW package includes the fully mature 30mm gun and a variant of the Army’s Non-Line-of-Sight (NLOS) system (missile and launcher), which is nearing maturity. The first package consisted of two gun engineering development models, without the NLOS launcher or missiles. The NLOS design for LCS has not yet been validated. Integration of the gun with LCS is not complete. A design review for the gun module is scheduled for October 2009. Delivery of a baseline package has been delayed to fiscal year 2013.

The first of 16 ASW packages was delivered in September 2008 and included 4 of 10 planned mission systems. Three systems remain immature including the Unmanned Surface Vehicle’s Dipping Sonar, the Remotely Towed Array and the Remotely Towed Array Source. Failure to develop these technologies as expected could increase reliance on the MH-60R helicopter. The Navy has delayed delivery of a second ASW package until fiscal year 2011, and delayed baseline capability from fiscal year 2011 to 2013.

### Other Program Issues

The development cost of the LCS packages has increased by more than \$300 million, or 64 percent since last year. Procurement costs have decreased for MCM, in part because the delivery of the more expensive baseline capability has been delayed. Reductions in fiscal year 2008 and 2009 budget requests have slowed mission package procurement to account for continuing delays in seaframe acquisition. The explanatory statement accompanying

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<sup>33</sup> Government Accountability Office, Defense Acquisitions[:] Assessments of Selected Weapon Programs, GAO-09-326SP, March 2009, p. 106.

DOD Appropriation Act for Fiscal Year 2009 Congress asked the Navy to develop a plan for fielding the MCM capability independent of LCS. The program office indicates all packages are currently scheduled to undergo operational assessments with both LCS seaframe designs, beginning in June 2010. According to program officials, in September 2008, the Navy conducted a shore based integration exercise using simulated seaframe mission bays. Officials note this activity accelerated MCM mission package integration with both seaframes and reinforced previous crew training.

#### **Program Office Comments**

Program officials noted that changes to the program between the 2008 and 2009 president's budgets resulted in an apparent increased development cost. Costs for the SUW package bought in fiscal year 2009 were realigned from procurement to development to support technical and operational evaluations. In addition, data provided to GAO for last year's assessment did not include costs of common equipment that was subsequently distributed among the MCM and ASW packages. The program office acknowledges technical maturity challenges for some mission systems and is working closely with mission system program offices to resolve any issues. The program office is leading a coordinated test approach to prove mission package capabilities and suitability for fleet delivery. The program office also provided technical comments that were incorporated as appropriate.<sup>34</sup>

## **Acquisition Strategy for LCSs Procured in FY2011 and Beyond**

Potential oversight questions for Congress regarding the Navy's acquisition strategy for the LCSs procured in FY2011 and subsequent years include the following:

- When does the Navy plan to settle on an acquisition strategy for LCSs to be procured in FY2011 and subsequent years?
- What are the comparative costs and benefits of keeping both LCS designs in production versus necking down to a single design?
- Should competition for building LCSs be opened up to shipbuilders that are not members of either LCS industry team? What are the costs and benefits of this option compared to having LCSs built only by the current LCS industry teams?
- What are the comparative costs and benefits of maintaining the current contractor-furnished LCS combat systems vs. shifting to a common, government-furnished combat system?
- Given the shifts that have occurred over the years in the announced LCS acquisition strategy, why should Congress have confidence that the acquisition strategy for these ships will not shift again at some point? How might such shifts affect Congress's ability to evaluate and conduct oversight of the LCS program?

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<sup>34</sup> Government Accountability Office, Defense Acquisitions[:] Assessments of Selected Weapon Programs, GAO-09-326SP, March 2009, p. 108.

## Options for Congress

A primary issue for Congress in 2009 is whether to approve, reject, or modify the Navy's restructured LCS program as presented in the proposed FY2010 budget.

### General Options

Potential options for Congress included but are not limited to the following:

- **FY2010 budget request.** Congress could approve, reject, or modify the Navy's FY2010 budget request for the LCS program in areas such as research and development funding, sea frame procurement, or mission package procurement.
- **Acquisition Strategy for Follow-On Ships in Program.** Congress could establish terms and conditions for the acquisition strategy for LCSs procured in FY2011 and subsequent years.
- **Reporting requirements.** Congress could impose new reporting requirements for the program so as to facilitate congressional oversight on issues such as cost growth.

### Potential for Common Hulls

#### In General

Some observers, including some Members of Congress, have expressed interest in the idea of using common hulls for Navy and Coast Guard ships, so as to improve economies of scale in the construction of these ships and thereby reduce their procurement costs. In earlier years, this interest focused on using a common hull for the LCS and the Offshore Patrol Cutter (OPC), a cutter displacing roughly 3,000 tons that is to be procured under the Coast Guard's Deepwater acquisition program.<sup>35</sup> More recently, this interest has focused on using a common hull for the LCS and the National Security Cutter (NSC), a cutter displacing about 4,300 tons that is also being acquired under the Deepwater program.

#### Reported Proposal to Build Variant of NSC for Navy

In January 2008, it was reported that Northrop Grumman, the builder of the NSC, had submitted an unsolicited proposal to the Navy to build a version of the NSC for the Navy as a complement to, rather than a replacement for, the LCS.

#### *January 14, 2008, Press Report*

A press report dated January 14, 2008, stated:

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<sup>35</sup> For more on the Deepwater program, see CRS Report RL33753, *Coast Guard Deepwater Acquisition Programs: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

The U.S. Navy is stumbling to build the ship it wants—the Littoral Combat Ship (LCS)—so shipbuilder Northrop Grumman is urging the service to turn to a ship it can get sooner and cheaper: a patrol frigate version of the Coast Guard’s National Security Cutter (NSC).

“We have listened to what the Navy has said—to be more efficient, be innovative and produce affordable and capable ships,” said Phil Teel, president of Northrop’s Ship Systems sector. “The patrol frigate is a response to that, and to the Navy’s new National Maritime Strategy.”

Northrop’s analysts have studied remarks and themes oft repeated by senior Navy leaders and concluded a de facto requirement exists for a frigate-size ship capable of handling a range of low- and mid-intensity missions. Those missions, said Eric Womble, head of Ship Systems’ Advanced Capabilities Group, are detailed in the Navy’s new Maritime Strategy and include forward presence, deterrence, sea control, maritime security, humanitarian assistance and disaster response.

“You don’t want a high-end Aegis ship to handle those missions,” Womble said, “you want something cheaper and smaller.”

The National Security Cutter (NSC) as configured for the Coast Guard could easily handle those roles, Womble said.

The first NSC, the *Bertholf*, successfully carried out its initial trials in early December and will be commissioned this year by the Coast Guard. Womble said a Navy version would avoid the first-of-class issues that have plagued numerous Navy programs, including both designs being built for the LCS competition.

Northrop in late December began briefing select Navy leaders on its unsolicited proposal. The company is taking pains to avoid presenting the ship as an LCS alternative, instead calling it an LCS “complement,” which is being built under a competition between Lockheed Martin and General Dynamics.

Key features of Northrop’s concept are:

- The ship is based on a proven design already under construction.
- The NSC’s weapons, sensors and systems already have a high degree of commonality with Navy systems, increasing affordability.
- While the NSC is 15 knots slower than the 45-knot LCS, the cutter can stay at sea up to two months, much longer than the LCS.

The report also stated:

Northrop is claiming it can deliver the first ship at the end of 2012 at an average cost of less than \$400 million per ship, exclusive of government-furnished equipment, in fiscal 2007 dollars. That’s close to the \$403 million contract cost of the third NSC, which incorporates all current design upgrades.

A major element of Northrop’s proposal, Womble said, is that the Navy should make no changes to the current Block 0 design. “That’s the only way we can deliver the ship at this price.”

The design, however, has plenty of room for upgrades, Womble claimed, and Northrop is proposing future upgrades be handled in groups, or blocks, of ships, rather than modifying individual ones. Those upgrades could include non-line-of-sight missiles, SeaRAM missile launchers and more capabilities to handle unmanned systems. The design even has room for an LCS-like reconfigurable mission area under the flight deck, he claimed.

Northrop admits the ships are deficient in one significant Navy requirement: full compatibility with the Naval Vessel Rules (NVR), essentially building codes developed by the Naval Sea Systems Command and the American Bureau of Shipping. The belated application of the NVR to both LCS designs was a major factor in the cost growth on those ships.

Most of the NSC design already is NVR-compatible, Womble said, but upgrading the entire design to NVR standards would involve a fundamental redesign and eliminate the proposal's cost and construction time attributes.

"We'd need a waiver [from the NVR rules] to make this proposal work," he said.

The report also stated:

Navy Response: 'No Requirement'

The official response from the Navy to Northrop's proposal so far is unenthusiastic.

"There is currently no requirement for such a combatant," said Lt. Clay Doss, a Navy spokesman at the Pentagon. The Navy's other surface ship programs, he said, "address specific requirements."

Doss did note that "the Navy and Coast Guard have considered a common platform for the LCS and the Coast Guard's National Security Cutter. However, due to the unique mission requirements of each service, a common hull is not a likely course of action."

Problems with the LCS have caused some observers to predict the program's demise, but the Navy "is completely committed to the LCS program," Doss said. "We need 55 Littoral Combat Ships sooner rather than later, and we need them now to fulfill critical, urgent war-fighting gaps."

Northrop however, is not alone in proposing the NSC as an LCS alternative. Coast Guard Capt. James Howe, writing in the current issue of the U.S. Naval Institute's Proceedings magazine, is urging Navy leaders to consider the NSC.

"I think the Navy should look at it," he said Jan. 10. "Northrop is building a naval combatant here. It has standard U.S. Navy weapon systems as part of its packages. Its communications are interoperable. It can handle underway replenishment. If there's a possibility it could be a cost saver or a good deal for the Navy, it needs to be explored."

Howe, who said he was unaware of Northrop's patrol frigate proposal, agreed the NSC is capable of further enhancements. "There's a lot of space on that ship," he said.

'Potential Game-changer'

Northrop likely is facing an uphill battle with its patrol frigate, as the Navy culturally prefers to dictate requirements based on its own analysis.



But the Navy is having trouble defending the affordability of its shipbuilding plan to Congress and bringing programs in on budget. One congressional source noted the service “can’t admit their plan won’t work.” An unsolicited proposal, the source said, “opens the way for someone else to come up with a potential game-changer.”

Northrop’s plan, the source said, may be an unexpected opportunity.

“Northrop is listening to the people who have been criticizing the Navy’s shipbuilding plan,” the source said. “They’ve gotten a sense that maybe the Navy is looking for a solution, and the Navy can’t produce a solution because it might be too embarrassing.”

One more aspect that could be at work in the Northrop proposal: “I think there’s something coy going on here,” the source said. “They may be promoting this as an LCS complement, but their idea might be part of a strategic plan to replace the LCS.”<sup>36</sup>

### ***January 17, 2008, Press Report***

A press report dated January 17, 2008, stated:

Northrop Grumman Corp said on Wednesday [January 16, 2008, that] a proposal to turn its 418-foot Coast Guard cutter into a new class of Navy frigates is sparking some interest among U.S. Navy officials and lawmakers.

Northrop is offering the Navy a fixed price for the new ship of under \$400 million and could deliver the first one as early as 2012 to help out with maritime security, humanitarian aid and disaster response, among other things, said Eric Womble, vice president of Northrop Grumman Ship Systems.

So far, the officials briefed have found Northrop’s offer “intriguing,” Womble told Reuters in an interview. “They like the fact that we’re putting an option on the table. No one has told us, ‘Go away, don’t come back, we don’t want to hear this’,” Womble said.

At the same time, the Navy says it remains committed to another class of smaller, more agile ships—the Littoral Combat Ships (LCS) being built by Lockheed Martin Corp (LMT.N: Quote, Profile, Research) and General Dynamics Corp (GD.N: Quote, Profile, Research)—amid huge cost overruns.

“There currently is no requirement for a frigate,” Navy spokesman Lt. Clay Doss said. He said the Navy and Coast Guard had discussed a common hull during the initial stage of the LCS competition, but agreed that was “not a likely course of action due to the unique mission capabilities.”

For now, he said the Navy was proceeding as quickly as it could with the 55-ship LCS program as well as design work on a new DDG-1000 destroyer, and a planned cruiser, CG-X....

The report also stated:

Virginia-based defense consultant Jim McAleese said the fixed-price offer could be good news for the Navy, which has typically borne the risk of cost-based shipbuilding contracts.

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<sup>36</sup> Christopher P. Cavas, “Northrop Offers NSC-Based Vessel To Fill LCS Delays,” *Defense News*, January 14, 2008.

“That is a potential catalyst that could have a huge impact on the way the Navy buys small- and mid-sized surface combatants,” McAleese said.

Northrop says its new Coast Guard cutter also experienced some cost growth, but says that was mainly due to requirements added after the Sept. 11, 2001, hijacking attacks. The first of the new ships is due to be delivered to the Coast Guard in March, followed by one ship annually over the next few years.

Northrop said it could offer the Navy a fixed price on the frigate because design work on the ships is already largely completed. Its price excludes government-furnished equipment that would still have to be put on board.

“We’re not advocating an LCS replacement,” said spokesman Randy Belote. “But after listening to the Navy leadership and studying the new maritime strategy, we think we can get hulls and capabilities into the water at a much faster pace.”

Womble said Northrop analysts and an outside consultant studied the Navy’s needs and concluded the Navy could use another ship that can operate in shallow water, be forward deployed, has the range and endurance to operate independently, and can work with U.S. allies, if needed.

The press report also stated:

The proposed ship can be deployed for 60 days without new supplies, has a range of 12,000 nautical miles, and can travel at 29 knots, fast enough to keep up with other warships. That compares to 20 days and a range of 3,500 miles for LCS.

Northrop began sharing a PowerPoint presentation about the proposal with Navy officials and lawmakers at the end of December, and has already met with several senior officials, including Chief of Naval Operations Adm. Gary Roughead.

It could deliver the first frigate by 2012, if the Navy was able to add \$75 million for long lead procurement items into the fiscal 2009 budget proposal to be sent to Congress next month, Northrop said.

The frigate is about 75 percent compliant with special requirements that apply only to U.S. Navy ships. Northrop said it believed it could qualify for waivers on the remaining 25 percent because similar waivers were granted in the past.<sup>37</sup>

## **Legislative Activity for FY2009**

**Table 4** summarizes congressional action on the Navy’s FY2009 funding request for the LCS program.

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<sup>37</sup> Andrea Shalal-Esa, “Northrop Offers US Navy New Ship For Fixed Price,” *Reuters*, January 17, 2008.

**Table 4. Congressional Action on FY2009 Funding Request**

(millions of dollars; figures rounded to nearest tenth of a million)

Budget account <sup>a</sup>	Request	Authorization			Appropriation		
		HASC	SASC	Comp. <sup>a</sup>	HAC/D <sup>b</sup>	SAC/D <sup>c</sup>	Comp. <sup>a</sup>
RDT&EN	371.0	371.0	371.0	371.0	n/a	n/a	369.3
SCN	920.0	840.0	797.0	920.0	n/a	1090.0	1020.0
APN	55.3	55.3	55.3	55.3	n/a	n/a	50.3
WPN	2.8	2.8	2.8	2.8	n/a	n/a	2.8
OPN	131.2	81.2	131.2	106.2	n/a	n/a	73.9

**Sources:** Prepared by CRS based on FY2009 Navy budget submission, committee reports on FY2009 defense authorization bills, joint explanatory statement and associated funding tables on compromise version of FY2009 defense authorization bill, press releases on the HAC/D and SAC/D markups of the FY2009 defense appropriation bills, and explanatory statement on compromise version of FY2009 defense appropriation bill.

**Notes:** HASC is House Armed Services Committee; SASC is Senate Armed Services Committee, HAC/D is Defense subcommittee of House Appropriations Committee; SAC/D is Defense subcommittee of Senate Appropriations Committee; Comp. is compromise version of bill. n/a = not available.

- In lieu of conference reports on the FY2009 defense authorization and appropriation bills, there were compromise versions of the two bills, each accompanied by an explanatory statement intended to serve the same general function as a conference report.
- A House committee report was not filed. A July 30, 2008, press release from Representative John Murtha, chairman of the Defense subcommittee of the HAC, summarized the subcommittee's markup that day of the FY2009 defense appropriation bill. The press release did not mention the LCS program.
- A Senate committee report was not filed. On September 10, 2008, the Senate Appropriations Committee issued a press release summarizing the markup that day by the committee's Defense subcommittee of the FY2009 defense appropriations bill. The press release stated, in its section on procurement funding for shipbuilding, that the subcommittee "Adds \$170 million for the Littoral Combat Ship (LCS)."

## FY2009 Defense Authorization Bill (H.R. 5658/S. 3001/P.L. 110-417)

### House

Section 123 of H.R. 5658 as reported by the House Armed Services Committee would amend the cost cap on the LCS program, which was previously amended by Section 125 of the FY2008 defense authorization act (H.R. 4986/P.L. 110-181 of January 28, 2008). As described by the committee, Section 123:

would amend section 124 of the National Defense Authorization Act for Fiscal Year 2006 (P.L. 109-163) as amended by section 125 of the John Warner National Defense Authorization Act for Fiscal Year 2007 (P.L. 109-364) by allowing costs associated with economic inflation to exceed the cost cap of \$460.0 million per vessel, provided that the increase for economic inflation does not exceed \$10.0 million per vessel. The provision would also allow costs associated with the introduction of new technology, not fielded on the first two ships of the class, provided that the insertion of new technology would reduce life-cycle cost of the vessel, or the new technology is required to meet an emergent warfighting threat. (Page 141)

Section 123 states:

SEC. 123. LITTORAL COMBAT SHIP (LCS) PROGRAM.

Section 124 of the National Defense Authorization Act for Fiscal Year 2006 (P.L. 109-163; 119 Stat. 3157), as amended by section 125 of the National Defense Authorization Act for Fiscal Year 2008 (P.L. 110-181; 122 Stat. 29), is amended in subsection (d) by adding at the end the following:

‘(3) The amounts of increases or decreases in costs attributable to economic inflation after September 30, 2007. However, in the case of a vessel the procurement of which is funded from amounts appropriated pursuant to an authorization of appropriations or otherwise made available for fiscal year 2008 or 2009, the amount of such an increase for such a vessel may not exceed \$10,000,000.

‘(4) The amounts of increases or decreases in costs of that vessel that are attributable to insertion of new technology into that vessel, as compared to the technology built into the first and second vessels, respectively, of the Littoral Combat Ship (LCS) class of vessels. However, the Secretary of the Navy may make an adjustment under this paragraph only if—

‘(A) the Secretary of the Navy determines, and certifies to the congressional defense committees, that insertion of the new technology would lower the life-cycle cost of the vessel; or

‘(B) (i) the Secretary of the Navy determines, and certifies to the congressional defense committees, that insertion of the new technology is required to meet an emerging threat; and

‘(ii) the Secretary of Defense certifies to those committees that such threat poses grave harm to national security.’

The House Armed Services Committee, in its report (H.Rept. 110-652 of May 16, 2008) on H.R. 5658, approved the Navy’s request for procurement of two LCSs in FY2009 but reduced the Navy’s FY2009 procurement funding request for the LCS program by \$80 million. (Page 79, line 013)<sup>38</sup> The report recommended reducing the Navy’s FY2009 funding request for LCS mission modules by \$50 million. (Page 87, line 029)

The report states that “The committee disagrees with the submitted Future Years Defense Plan and budget request” for several reasons, including “the failure to deliver a coherent strategy for Littoral Combat Ship acquisition.” (Pages 82 and 83) The report also states that “The committee expects the budget submission for fiscal year 2010 to contain” several things, including “a comprehensive decision on the acquisition plan for surface combatants including the plan for the Littoral Combat Ship class.” (Page 83) The report does not discuss the recommended \$80-million reduction in ship procurement funding, but the committee’s summary of its markup states that “reduction of \$80 million [is] due to the availability of material previously procured for construction of ships that were subsequently canceled by the Navy.”<sup>39</sup> The committee’s report does not discuss the recommended \$50-million reduction in procurement funding for LCS mission modules.

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<sup>38</sup> The report’s table on page 79 states that the committee recommended procurement of one LCS rather than two in FY2009, but this appears to be a typo, as the report does not elsewhere mention reducing the procurement request from two ships to one, and the committee’s summary of its markup states that it approved procurement of two LCSs.

<sup>39</sup> House Armed Services Committee summary of H.R. 5658, page 13.

## Senate

The Senate Armed Services Committee, in its report (S.Rept. 110-335 of May 12, 2008) on S. 3001, approved the Navy's request for procurement of two LCSs in FY2009 but reduced the Navy's FY2009 procurement funding request for the LCS program by \$123 million, which the report states would "Fully fund two ships to [the LCS program] cost cap in FY[20]09, reflecting government furnished material (GFM) from cancelled ships." (Page 58, line 013) Regarding funding for ship procurement, the report stated:

The first ship (LCS-1) was scheduled to deliver in late 2006. The Navy is now estimating that the first ship will deliver sometime in late 2008. The LCS-1 contractor team had barely started on their second ship (LCS-3) when the program ran into major cost problems earlier last year. The Navy then issued a stop work order on LCS-3 in order to reduce expenditures and limit further cost exposure on the program while it separately re-evaluated program cost estimates.

The Navy entered into negotiations with the LCS-1 team to sign up to a fixed price contract on the two ships or face outright cancellation on the second ship. The Navy terminated the contract for LCS-3 for the convenience of the government. As a result of that termination, the government will take delivery of some sizeable inventory of equipment and material for the cancelled LCS-3.

The second contractor team had a contract to build two LCS vessels of another design (LCS-2 and LCS-4). The Navy awarded this contract almost a year later, so LCS-2 was roughly 1 year behind the LCS-1. The Navy went ahead with activities leading to the start of construction on LCS-4, despite internal warnings that the second contractor would face similar cost and schedule problems as those faced by the first contractor. Late last year, the same poor performance and fixed priced negotiation scenario also played out on the LCS-2 and LCS-4. This led the Navy to also cancel the LCS-4, again with the result that the government will take delivery of some sizeable inventory of equipment and material for the cancelled LCS-4.

Section 125 of the National Defense Authorization Act for Fiscal Year 2008 (P.L. 110-181) places a cost ceiling on LCS contracts of \$460.0 million per ship, a dollar value provided by the Navy. Congress also authorized and appropriated one LCS in fiscal year 2008.

The Navy has not awarded the one LCS approved in the fiscal year 2008 budget. The Navy's acquisition strategy, which has been extremely fluid, is to award this ship, plus the two ships from the fiscal year 2009 program later this calendar year. The Navy's intent is that the award be a limited competition, with each yard assured of being awarded at least one ship.

The total funding provided in fiscal year 2007 and prior budgets for the six previously authorized Littoral Combat Ships totals \$1,639.0 million. The Navy has determined that \$1,162.0 million of these funds is required for construction, test, trials, outfitting, and post-delivery of LCS-1 and LCS-2. The remaining \$477.0 million funding is allocated against the terminated ships, LCS-3 and LCS-4, including material purchased for those ships prior to termination. Within the remaining funding allocated against the terminated ships, sufficient funding should also be available for LCS class design to ensure that the follow-on ships commence production with "clean," producible drawings and planning products. Presuming the Navy maintains stable design requirements, the availability of clean drawings and planning products should ensure healthy learning curve performance in production. This learning curve performance, in conjunction with material purchased in prior years (from the terminated ships), should more than offset the effects of one year's escalation for ships purchased in 2009.

The fiscal year 2008 budget has resources sufficient to award one LCS within the cost cap to either shipyard, when taking into account the inventory of equipment and material available from that shipyard's cancelled ship. The Navy would provide this equipment and material to the shipyard that wins the fiscal year 2008 ship as government furnished material (GFM). The value of this GFM would count against the cost cap.

Under their plan, the Navy would also award at least one of the two ships in the fiscal year 2009 budget to the other shipyard. The Navy would likewise provide the GFM from that shipyard's cancelled ship to offset the cost of that one ship. Similarly, the value of this GFM would count against the cost cap on this ship as well.

The fiscal year 2009 budget request, however, would fund both ships to the full cost cap and not take the value of this GFM for the second cancelled ship into account. This means that the budget request of \$920.0 million includes more funding than can be placed on contract without violating the cost cap, unless the Navy were to withhold the GFM for the second shipyard.

The committee believes that the Navy should apply the GFM to both contractors' vessels as soon as a second ship is purchased from either yard. Therefore, the committee recommends a reduction of \$123.0 million to take that GFM into account. This will leave sufficient funds in the Navy's hands to award two ships in fiscal year 2009, with both ships fully funded to the congressional cost cap of \$460.0 million. (Pages 77-78)

Regarding LCS mission packages, the report states:

The Navy has embarked on a program to develop modular counter-mine, anti-surface, and anti-submarine warfare systems, referred to as mission packages, to be deployed on the Littoral Combat Ship (LCS). The Navy envisions fielding 60 mission packages, which Navy commanders could interchange across the 55-ship LCS class as operational requirements dictate. This total system capability of the LCS program has been identified by the Chief of Naval Operations as a top priority for operations in the littorals. The committee similarly views the capability provided by a family of LCS mission packages as a key component of the maritime strategy. The committee is, therefore, concerned by the delays to mission package initial operational capability, deployment, and full operational capability caused by delays to the LCS construction program.

The Navy has designed the LCS mission packages with modularity and with open architecture. Having done this, the Navy should be able to deploy this capability on other ship classes. Such an expanded concept of operations would provide opportunities to employ mission packages more rapidly, and against threats and in operational scenarios perhaps not envisioned today.

Therefore, the committee directs the Secretary of the Navy to evaluate alternatives for employing LCS mission packages on other ship classes of the battle force, and to provide a report on his findings to the congressional defense committees with submission of the 2010 budget request. The report shall outline the feasibility, cost, and impacts associated with integrating mine countermeasures and anti-submarine mission packages on other surface combatant and amphibious force ship classes, and provide an assessment of the operational utility afforded by being able to deploy mission packages across the broader battle force. (Page 126)

## **Compromise**

In lieu of a conference report, there was compromise version of S. 3001 that was accompanied by a joint explanatory statement. Section 4 of S. 3001 states that the joint explanatory statement “shall have the same effect with respect to the implementation of this Act as if it were a joint explanatory statement of a committee of conference.”

Section 122 of S. 3001 amends the unit procurement cost cap on LCS sea frames so as to delay the implementation of the cost cap to ships procured in FY2010 and subsequent years. (The cost cap previously was to be applied to ships procured in FY2008 and subsequent years.)

The joint explanatory statement for S. 3001 states:

The agreement would authorize the budget request of \$920.0 million for two LCS vessels. Elsewhere in the agreement, we recommend a provision that would delay implementation of the cost cap for the LCS program until fiscal year 2010. We note that the Navy has taken delivery of the first ship of this class and anticipates taking delivery of the second by the end of the calendar year. While these are significant milestones, we remain concerned that the Navy has not taken sufficient actions to control costs for follow-on vessels. Moreover, in repeated testimony before the Committees on Armed Services of the Senate and the House of Representatives, we have been told that a primary benefit of utilizing mid-tier shipyards is that such yards can easily balance commercial and government workload to ensure that the Navy does not have to pay overhead costs to maintain capability during periods of limited government funding. Nevertheless, the Navy has requested, for the second year in a row, an adjustment to the cost cap in order to preserve industrial capability because the Navy is unable to purchase a ship at or below its budgetary estimate and lacks a coherent acquisition strategy for the program. We strongly encourage the Navy to take steps to procure follow-on vessels with required warfighting capability, while prioritizing the aggressive management of cost and the most efficient utilization of the industrial base. Likewise, we direct the Secretary to develop and submit to the Congress a long-term acquisition strategy for LCS vessels with the submission of the fiscal year 2010 budget request.

The compromise recommended reducing the OPN request for the LCS program to \$106.15 million—a reduction of \$25.091 million from the request.

## **FY2009 Defense Appropriations Bill (H.R. 2638/P.L. 110-329)**

### **House**

A House committee report was not filed. A July 30, 2008, press release from Representative John Murtha, chairman of the Defense subcommittee of the HAC, summarized the subcommittee’s markup that day of the FY2009 defense appropriations bill.<sup>40</sup> The press release did not mention the LCS program.

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<sup>40</sup> September 10, 2008, press release from Senate Appropriations Committee entitled “Senate Defense Appropriations Subcommittee Approves Fiscal Year 2009 Defense Appropriations Bill.”

## **Senate**

A Senate committee report was not filed. On September 10, 2008, the Senate Appropriations Committee issued a press release summarizing the markup that day by the committee's Defense subcommittee of the FY2009 defense appropriations bill. The press release stated, in its section on procurement funding for shipbuilding, that the subcommittee "adds \$170 million for the Littoral Combat Ship (LCS)."<sup>41</sup>

## **Compromise**

In lieu of a conference report, there was compromise version of the FY2009 defense appropriations bill that was incorporated as Division C of H.R. 2638. (H.R. 2638, which was introduced as the FY2008 Department of Homeland Security appropriations bill, was later amended to become an FY2009 consolidated appropriations bill that included, among other things, the FY2009 defense appropriations bill.) The compromise version of H.R. 2638 was accompanied by an explanatory statement. Section 4 of H.R. 2638 states that the explanatory statement "shall have the same effect with respect to the allocation of funds and implementation of this Act as if it were a joint explanatory statement of a committee of conference."

The explanatory statement provides \$1,020 million for procurement of two LCSs in FY2009. Section 8042 of the bill rescinds \$337 million in FY2008 shipbuilding funds for the LCS program, effectively canceling the LCS procured in FY2008. The explanatory statement states:

The bill includes \$1,020,000,000 for [procurement of] two LCS seaframes [in FY2009] and a rescission of \$337,000,000 in fiscal year 2008 LCS [shipbuilding] funding. Additionally, funds and material from fiscal year 2006 can be used to supplement the fiscal year 2009 LCS program. Due to industrial base concerns, the Navy is directed to make contract awards for the two fiscal year 2009 LCS seaframes as soon as practicable.

The explanatory statement provides \$369.3 million in research and development funding for the LCS program—a reduction of \$1.7 million from the request. The net reduction of \$1.7 million consists of a reduction of \$12 million for "Combat System C4I Development," an increase of \$2.0 million for "Autonomous Acoustic Array Advanced Tubular Solid Oxide Fuel Cell," an increase of \$4.5 million for "LCS Common Mission Package Training Environment," and an increase of \$3.8 million for "Alternative Use of Mine Warfare Modules."

The explanatory statement provides \$50.3 million in Aircraft Procurement, Navy (APN) funding for the LCS program—a reduction of \$5 million from the request.

The explanatory statement provides \$73.902 million in Other Procurement, Navy (OPN) funding for the LCS program—a reduction of \$57.339 million from the request. The reduction consists of a reduction of \$9.291 million for "Mission Package Integrator," and a reduction of \$48.048 million for "Delay One Mission Module."

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<sup>41</sup> Source: September 10, 2008, press release from Senate Appropriations Committee entitled "Senate Defense Appropriations Subcommittee Approves Fiscal Year 2009 Defense Appropriations Bill," p. 2.



## **Appendix. March 2009 Navy Testimony on LCS Program**

On March 10, 2009, the Seapower and Expeditionary Forces subcommittee of the House Armed Services Committee held a hearing to review the status of the LCS program. Reprinted below is the full text of the Navy's prepared statement for the hearing.<sup>42</sup>

### **INTRODUCTION / REQUIREMENT**

Mr. Chairman, distinguished members of the Subcommittee, thank you for the opportunity to appear before you today to address the Navy's Littoral Combat Ship (LCS) program. We thank the Committee for its continued support and active interest in Navy shipbuilding programs.

The Navy remains committed to the LCS program. LCS fills warfighting gaps in support of maintaining dominance in the littorals and strategic choke points around the world. The Navy remains committed to procuring 55 LCSs, and is aggressively pursuing cost reduction measures to ensure delivery of future ships on a schedule that affordably paces evolving threats. This will be accomplished by matching required capabilities, to a recurring review of warfighting requirements through applying lessons learned from the construction and test and evaluation periods of seaframes and mission packages.

The LCS program is structured in flights of seaframes and spirals of mission packages. This allows the relatively rapid change in technologies and threats associated with the modular mission packages to be continuously improved through incremental upgrades without major design impacts to seaframes. The result is a program that minimizes the risks of a highly interdependent system of systems by decoupling seaframe procurement from mission package procurement. This allows continuous cost efficient delivery of state-of-the-art capability to the warfighter via new mission package upgrades.

The LCS program capabilities address specific and validated capability gaps in Mine Countermeasures (MCM), Surface Warfare (SUW) and Anti-Submarine Warfare (ASW). The Concept of Operations and design specifications for LCS were developed to meet these gaps with focused mission packages that deploy manned and unmanned vehicles to execute a variety of missions. LCS's inherent characteristics (speed, agility, shallow draft, payload capacity, reconfigurable mission spaces, air/water craft capabilities) combined with its core Command, Control, Communications, Computers and Intelligence (C4I), sensors, and weapons systems, make it an ideal platform for hosting additional Maritime Strategy mission areas, such as Irregular Warfare and Maritime Security Operations.

The Navy, as part of its annual review of its shipbuilding program, expects there will be sufficient force structure with our existing frigates and mine warfare ships until LCS delivers in quantity to meet overarching deployment requirements.

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<sup>42</sup> Statement of RADM Victor Guillory, U.S. Navy Director of Surface Warfare, and RADM William E. Landay, III, Program Executive Officer Ships, and Ms. E. Anne Sandel, Program Executive Officer Littoral and Mine Warfare, before the Subcommittee on Seapower and Expeditionary Forces of the House Armed Services Committee [hearing] on the Current Status of the Littoral Combat Ship Program, March 10, 2009. 11 pp. (including the cover as page 1).

Legacy mine warfare ships and frigates are planned to be phased out gradually. These decommissionings will be balanced with LCS mission package and seaframe deliveries to mitigate warfare risks.

LCS 1, USS FREEDOM, was delivered to the Fleet on September 18, 2008—six years and one day after the program was established. LCS 2, the future USS INDEPENDENCE, was christened in Mobile, AL, on October 4, 2008. Later this year the program will have delivered a second ship of a completely different design.

While the initial cost and schedule objectives for the program were overaggressive, they did provide the tension and urgency for these achievements. Although the concurrent design and construction of LCS revealed challenges for meeting the original cost and schedule objectives, the Navy will apply lessons learned to this program as well as other shipbuilding programs.

At the Subcommittee's request, the Navy is pleased today to discuss an overview of the history of the LCS program, the current status of LCS 1 and LCS 2, and the future acquisition strategy for the LCS program.

## **BACKGROUND**

The LCS acquisition strategy, approved in May 2004, was based on the tenets of modular and open system architecture, Cost-As-an-Independent-Variable design process, a rapid construction cycle and continuous competition at all levels of the program. The Navy awarded contracts for construction of the first four LCS seaframes, with Lockheed Martin (LM) and General Dynamics (GD) awarded two ships each. Fabrication of LCS 1, the first LM ship, began in February 2005 and the ships delivered in September 2008. Fabrication on LCS 2, the first GD ship, began in November 2005 and this ship will deliver this year. LCS 3 and 4 options were exercised in June and December 2006, respectively.

Cost growth on both variants resulted in a detailed assessment of program cost and structure. The Navy sought to restructure the contracts for LCS 3 and 4 to fixed-price incentive terms to more equitably balance cost and risk, but could not come to terms and conditions that were acceptable to both parties. On April 12, 2007, the Navy terminated construction of LCS 3 for convenience under the Termination clause of the contract. On November 1, 2007, the Navy terminated construction of LCS 4 for convenience under the Termination clause of the contract. Based on program restructuring, the Navy requested and received congressional approval to reprogram FY 2007 shipbuilding appropriations to fund cost increases on LCS 1 and 2.

At the direction of Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN(RDA)), the LCS program underwent a thorough independent assessment to review the cause of the cost growth and evaluate the way forward.

The results of that assessment identified a number of factors key to the program's poor performance. The Navy has actively addressed those key findings in the program as it operates today:

— The design for both ships is mature and we are incorporating revisions to specific areas based on the lessons learned from the construction of the initial ships, proposed production improvements, acceptance inspections and the early stages of the post delivery testing period. Those revisions will be in place for the start of construction of the FY 2009 ships.

- The Navy has increased the staff assigned in the program office and at the shipyards to monitor performance. The program office staff has grown from eight to 20 civilian personnel, focusing on critical production, acquisition, and financial management specialties. An additional 12 billets have been assigned as the two lead ships complete delivery and post delivery milestones this year and more ships are placed under contract. Military staff has increased from three to five assigned. Officers with new ship construction experience were assigned to the program manager and production manager positions.
- The Supervisors of Shipbuilding doubled the staff at each LCS shipbuilder. Focusing resources to the waterfront, the program office works closely with the Supervisors to sustain a daily drumbeat in monitoring production progress on these lead ships, identifying and monitoring key metrics that maintain progress to key events.
- To improve technical decision making and reduce the time to resolve technical issues, especially as related to the application of Naval Vessel Rules, the program office and the Naval Sea Systems Command Chief Engineer have placed senior managers and technical authorities on the waterfront.
- New performance baselines were implemented for each contract to help monitor and control cost, with contracting incentive structures to support improved progress. We continue to work closely with the industry teams to improve their performance and Earned Value Management System measurement and reporting capabilities.
- The FY 2009 and FY 2010 contracts will be fixed-price contracts to ensure cost and schedule adherence remain a primary focus of both the industry and the government program teams.

#### **AFFORDABILITY**

The Navy has implemented a comprehensive cost-reduction program for LCS. Taking advantage of lessons from other shipbuilding programs' affordability initiatives such as the DDG 51 value engineering program, the T-AKE "take cost" program and the Virginia-class cost-reduction initiative, this ongoing effort seeks to reduce acquisition cost and total ownership cost through continuous assessment of operational and technical requirements, improvement of production processes, and implementation of acquisition strategies that will lead to stable production and improved purchasing leverage. Examples of areas under review by this program include:

- A joint team of industry, government and independent experts have conducted a "stem-to-stern" inspection of each ship to identify areas of inefficiency or where alternative production methods can improve production efficiencies.
- The Navy implemented a Total Ownership Cost (TOC) reduction review jointly overseen by the ASN(RDA) and Vice Chief Naval Operations to look for improvements in total lifecycle costs.
- The Navy has initiated a second study to look at the Total Ownership Cost return on investment of a common combat system. The initial study conducted in 2007 did not support a payback sufficient to support the upfront integration and additional procurement costs. The Navy's development of its objective architecture for combat systems provided a different set of assumptions to be considered for this new study.

— Finally, infrastructure improvements are either under review or in progress at both yards that will improve production efficiencies and reduce costs.

## **CURRENT STATUS OF LCS 1 AND LCS 2**

### USS FREEDOM (LCS 1)

USS FREEDOM was built by the Lockheed Martin-led team at the Marinette Marine shipyard in Marinette, WI, and was commissioned on November 8, 2008. Due to restrictions on some testing in the Great Lakes, acceptance testing was broken into two phases. Acceptance Trial 1 (AT) evaluated the ship, propulsion, navigation and some communications. Acceptance Trial 2 will evaluate the remaining communications and most of the combat systems. In August 2008, the Navy's Board of Inspection and Survey (INSURV) conducted Acceptance Trial 1 on LCS 1 and found the ship to be "capable, well-built, and inspection-ready," and recommended that the Chief of Naval Operations authorize delivery of the ship following the correction or waiver of cited material deficiencies, a standard practice in Navy shipbuilding.

During inspection, INSURV identified 21 "starred" deficiencies onboard LCS 1. This is a relatively low number and compares favorably to other first-of-class ships. The Navy developed a plan to address these deficiencies in a timely, prioritized sequence – 12 were closed prior to delivery, five more will be closed during the ship's current Industrial Post Delivery Availability, and the final four will be closed during Post Shakedown Availability (PSA) in FY 2010.

After acceptance, the crew conducted a vigorous shakedown of the ship during her transit from the building yard to Norfolk, VA. Encountering adverse weather and numerous instances of challenging ship handling evolutions, the crew reported the ship performed superbly during the 2,400 mile journey. LCS 1 will undergo AT 2 and additional test and trials period intended to complete certifications and mission package integration testing.

### INDEPENDENCE (LCS 2)

INDEPENDENCE is being built by the General Dynamics team at the Austal USA shipyard in Mobile, AL. She was christened on October 4, 2008, and is expected to deliver in 2009, with Initial Builder's Trials and Acceptance Trials to complete prior to ship delivery. Following delivery and commissioning, LCS 2 will transit to Norfolk, VA, and conduct a post delivery test and trials period similar to FREEDOM.

Facing similar lead ship challenges on INDEPENDENCE, Navy leadership directed General Dynamics to take a phased approach to completing the ship. The initial phase prioritized efforts on that scope of work required to safely take INDEPENDENCE to sea, demonstrating propulsion and additional systems and components necessary for communications and safe navigation. Based on performance to this goal, a second phase of work would be authorized focusing on only those core combat systems necessary to demonstrate a basic detect-to-engage capability required during an acceptance trial. The third phase is the remaining systems and components required to demonstrate complete combat systems and communications capabilities of the complete sea frame. At this time, the program manager has authorized phase 1 and 2 work. Phase 3 remains contingent on performance of the first two phases. It is still the program manager's intention to present a complete ship to INSURV at acceptance trial.

The Navy monitors progress through daily assessments, weekly analysis of key metrics on production and test progress, and conducts monthly progress and cost reviews with the contractor to ensure that corrective actions are implemented and effective. As of February

2009, all four of the ship's generators have been started and vital shipboard electrical systems have completed initial testing, aligning with current schedule projections for ship delivery. The program expects to achieve main propulsion engines light-off in April and May, with a goal of Builder's Trials in late June. The program is prudently managing resources to be able to address any potential challenges.

#### Status of Mission Package Procurement

The modular open system architecture used for the LCS design allows independent development of seaframes and mission packages that integrate across a controlled interface specification to ensure complete interoperability. This allows the relatively rapid change in technologies associated with the modular mission packages (MPs) to be continuously improved through incremental upgrades without major design impacts to seaframes. The result is a program that minimizes the risks of a highly interdependent system of systems by decoupling seaframe procurement from mission package procurement, and allows continuous cost efficient delivery of state-of-the-art capability to the warfighter via new mission package upgrades.

The underlying strength of the LCS lies in its innovative design approach, applying modularity for operational flexibility. Fundamental to this approach is the capability to rapidly install interchangeable mission packages into the seaframe. The ability to modify the LCS physical configuration with different MPs in less than a 96-hour period gives the operational commander a uniquely flexible response to changing theater warfighting requirements. This also allows the LCS warfighting capability to quickly adapt to evolving threats, using improved technology. To achieve this flexibility, the Navy is developing and procuring specific numbers of MPs to meet the Fleet's warfighting requirements. A mission package consists of mission systems which are integrated to form mission modules, Sailors organized into mission module and aviation crew detachments and supporting aircraft. Each mission package provides warfighting capability for one of three focused mission areas:

- Mine Countermeasures (MCM)
- Surface Warfare (SUW)
- Anti-Submarine Warfare (ASW)

The first SUW and ASW mission packages were rolled out in FY 2008 and joined the first MCM mission package, which was delivered in FY 2007. Land-based and at-sea testing of mission package components began in FY 2008 and continues in FY 2009. Through an Integrated Test and Evaluation framework, the LCS Mission Modules program office is working very closely with the responsible mission systems program offices in Naval Sea Systems Command, Naval Air Systems Command and the Army to ensure that all Mission System Program of Record, as well as LCS shipboard testing events, demonstrates required warfighting effectiveness and suitability. Formal LCS sea frame testing of mission packages commences in FY 2009 and continues through FY 2012.

The LCS Mission Modules program office has adopted an open business model that leverages Participating Acquisition Resource Managers' (PARMs) developmental efforts for both program-of-record and non-program-of-record systems and components. This process minimizes LCS Mission Modules program investments of research and development dollars required to mature unique technologies. In addition, the process allows for package procurement flexibility by limiting integration of immature technologies/systems. This is done by continuous evaluation of system maturity through a disciplined system engineering framework. Through this open business model, the LCS Mission Modules program procures

mature mission systems from PARMs and then engages an industry partner for Package Production and Assembly (PP&A) of mission packages.

## **FUTURE ACQUISITION STRATEGY FOR THE LCS PROGRAM**

### LCS Acquisition Strategy

In October 2008, the Undersecretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) approved a revised acquisition strategy for LCS to cover procurement of the FY 2009 and FY 2010 ships. The updated acquisition strategy combines the FY 2009 procurement and FY 2010 options in order to maximize competitive pressure on pricing as a key element of cost control. Increasing the quantity solicited by adding the FY 2010 ships to the FY 2009 solicitation as options will also enable industry to better establish longer term supplier relationships and offer the potential for discounting to the prime contractors and subcontractors. FY 2010 ship options will be a competition for quantity.

Acquisition strategies for FY 2011 and outyear ships are under development. The Navy's strategy will be guided by cost and performance of the respective designs, as well as options for sustaining competition throughout the life of the program. Evaluations of combat systems and hull, mechanical and electrical (HM&E) performance will be conducted throughout those tests and trial periods and, as was mentioned earlier, we are already looking for opportunities to reduce total ownership costs through commonality, reductions or consolidations based on return-on-investment analysis.

### FY 2009 and FY 2010 Contract Awards

As a result of congressional direction contained in the FY 2009 Defense Appropriations Act, the Navy amended the LCS seaframe construction solicitation to delete the FY 2008 ship. This amended solicitation continues the competition between the two incumbent industry teams. The Navy may award one ship to each industry team in FY 2009 and intends to hold a competition for the FY 2010 option ships soon after award of the FY 2009 contracts. Affordability remains a key tenet of the LCS program as the Navy works with industry to provide this capability for the lowest cost.

The FY 2009 and FY 2010 awards will be fixed-price incentive contracts, with the Navy anticipating that each LCS prime contractor receives one ship in FY 2009. The Navy remains committed to effective cost control and has modified contracting strategies and management practices to provide program stability. The FY 2009 and FY 2010 ships will be designated as Flight 0+ and will include only existing approved engineering changes along with improvements to construction or fabrication procedures. The Navy will incorporate further lessons learned from LCS 1 and 2 sea trials into the FY 2009 and FY 2010 ships prior to production. Any such changes will be limited to those essential for safety, operability or affordability. Furthermore, the RFP requests that the proposals for the FY 2010 option ships include alternative prices for both a full-up ship and separately priced contract line item numbers (CLINs) for a core seaframe (only systems for safe operation at sea), core combat system and individual combat systems and equipments (such as the gun or radar). This allows us the opportunity to manage the integration of the combat systems separately if that proved to be more affordable.

In the interim prior to FY 2009 contract awards, both industry teams were authorized and funded to pursue limited design and construction efforts while source selection proceeded. The scope of these efforts was carefully coordinated with prime contractors with an eye on preserving critical shipbuilding skills or to improve production process engineering. Once the FY 2009 ships are awarded, these sustaining efforts will be subsumed in the shipbuilding contracts.

### Mission Modules Acquisition Strategy

At the time of its inception in FY 2004, the Mission Modules program office decided to utilize government labs to build the first two of each type of mission package. The Navy Labs (Naval Surface Warfare Center Panama City (NSWC PC), Naval Undersea Warfare Center Newport (NUWC NPT), SPAWAR Systems Center San Diego (SSC SD) and Naval Surface Warfare Center Dahlgren (NSWC DD)) are developing, integrating, testing and delivering the first six mission packages. This approach was implemented to ensure responsiveness to refined requirements and reduce the financial risk to the Navy associated with cost-type contracts for this unique concept. This strategy has been very advantageous to the Mission Modules program. Once these initial mission packages are completed by the warfare centers, the package production and assembly will transition to Northrop Grumman.

Following a competitive solicitation, Northrop Grumman was awarded a contract in January 2006 to provide a range of package production and assembly functions specified by the Navy. The contract contains Award Fee/Award Term provisions covering a term of up to ten years, with contract options exercised annually. Awarding the options is contingent on continued excellent contractor performance in preceding years, and is assessed annually.

As Northrop Grumman steps into a production and assembly role, the Navy labs will transition into the Technical Direction Agent and In-Service Engineering Agent role. This transition began in 2008 with the transfer of the Technical Data Packages from the Navy labs to Northrop Grumman in 2008 and continues in 2009.

### Rights in Technical Data and Computer Software

It is the Navy's legal and contractual position that the Navy has Government Purpose Rights (GPR) to the seaframe designs of both LCS variants and, as such, can solicit full and open competition for either seaframe design after an adequate design package for such a competition is developed.

For clarity, those rights are as follows:

— Seaframe – The government has GPR to the design of both seaframes. We did not seek the rights to the individual equipments in the seaframe (for example we do not have GPR to the Rolls Royce engine that we could provide to another engine manufacturer to produce for the government). Another shipbuilder or the government would have to contract with the individual equipment manufacturers for fabrication and delivery of the equipment for shipboard installation or, alternatively, negotiate a license with the individual equipment manufacturers based on the equipment, specifications and interfaces detailed in the seaframe design.

— Combat Systems – We have GPR to the technical data pertaining to the LM combat systems, architecture and interfaces. It currently resides in our shared repository. The GD Integrated Combat Management Systems (ICMS) is based on the Thales TACTICOS system for which Northrop Grumman is the sole U.S. licensee. Another shipbuilder or the government would have to either enter into a contract with Northrop Grumman for production and delivery of the ICMS or, alternatively, obtain a license for that system from Northrop Grumman. As with the seaframe, we do not possess GPR to the specific equipments for either system such as the gun, electronic warfare system or radar.

Any third parties seeking to compete on LCS would need to either contract directly with the equipment manufacturers for fabrication and delivery of the required equipment and

associated software or, alternatively, negotiate licensing agreements for the equipment and software with the respective vendors. This is similar to the current approach in place with the LM and GD teams. An alternative approach would be for the government to contract directly with the equipment manufacturers and provide the equipment and software to the shipbuilder as Government Furnished Equipment/Government Furnished Information.

#### LCS “Build-to-Print” Design Concept

To implement a competitive “build-to-print” seaframe acquisition, there remains a significant effort to finalize those revisions to the design that have resulted during construction, as well as lessons learned from LCS Flight 0 production improvement initiatives, developmental/operational testing and at-sea testing. There is a considerable amount of work necessary to convert a design package developed by a specific shipyard based on its own particular production capabilities and processes to one that can be provided to another qualified shipbuilder as a government furnished design.

The amount of effort necessary to prepare the LCS data packages to support a full and open competition derives from the structure of the initial LCS acquisition strategy. The foundation of the LCS procurement is not a traditional detailed drawing package but the Navy-established requirements detailed in the Capabilities Development Document (CDD). Each industry team developed from the CDD a Specified Performance Document (SPD) that describes the required performance to meet the CDD requirements, then a build specification detailing how to build a ship to meet that performance. From these three documents, drawings and specifications detailing exactly what to construct were then developed. The contractual technical baseline is defined by the CDD, SPD and the build specifications, not the drawings. Configuration management is accomplished at the build specification level.

At present in the LCS acquisition, industry has developed drawing packages for LCS 1 and LCS 2. These include digital product models, extracted drawings and drawing liens, representing multiple changes accomplished to the drawings during production. Thus, while appropriate for use in construction by the existing industry teams, these packages were not envisioned to be used as the foundation documents for a build to print solicitation. It would not be prudent to pursue a build-to-print contract for the current design package until it fully reflects those changes.

The Navy’s FY 2009 budget request did request funds to begin refinement of the Flight 0+ baseline design drawings and associated documentation into detailed production drawings and documents. These drawings will also incorporate production, assembly and fabrication lessons learned from the previous seaframes as well as operator feedback from the seaframe and mission package crews obtained during the testing and trials period. Additional time and resources will be necessary to complete a build-to-print package.

The build to print package requires the development of a neutral-format computer-aided design model (both 2-D and 3-D and STEP compliant) for the total ship, clearing all interferences for the model, and review and update of all additional required documentation to ensure that requirements are sufficiently detailed and “generic” to enable providers other than the incumbent to bid (e.g., the design can’t reflect six-inch bent pipe if only the incumbent has facilities sufficient to accomplish this). The timing for completion of such a drawing package is dependent on completion of testing for the LCS lead ships. LCS 1 must complete Acceptance Trials 2 in Spring 2009 as well as seaframe developmental testing/operational testing or integration testing with mission packages. LCS 2 has not been delivered and must complete a similar test and trials period. The Navy is developing an estimate for LCS class design services needed to support this maturation.



Furthermore, to implement a full-and-open acquisition targeted at gaining increased access to additional shipyards, an approach must also be developed for the acquisition of the combat systems/networks/control systems/C4I equipment. To mitigate this risk for combat systems efforts under a build-to-print acquisition, the Navy would either need to direct the shipyards to contract with the current primes as subcontractors, or assume the role of providing the combat systems/networks/control systems/C4I equipment as GFE and develop the infrastructure necessary to serve as the integrator for the program.

## **LESSONS LEARNED**

The Navy has incorporated many of the lessons learned from the initial LCS ships into overall acquisition policy and in specific shipbuilding programs.

On February 26, 2008, the Navy issued SECNAVNOTE 5000, which instituted an Acquisition Governance Improvement Six-Gate reporting, reviewing and oversight process that provides specific criteria for areas such as requirements, funding, and technical performance including a Probability of Program Success (PoPS) tool. This new process ensures that the various stakeholders from the resources, requirements and acquisition communities address and revisit at defined intervals, issues associated with technical maturity, affordability and program health.

Guidance emphasizing the use of independent engineering technical review boards and responsibility for Configuration Steering Boards to monitor requirements changes has been promulgated.

Initiatives to expand the size of the acquisition workforce and to evaluate the composition and experience of program offices are underway. Similar initiatives are underway in the technical and SUPSHIPS areas.

A rigorous production readiness review (PRR) prior to the start of fabrication is in place for shipbuilding programs. It was utilized for the start of fabrication for the DDG 1000, and will be used in the Joint High Speed Vessel (JHSV) program as well as the FY 2009 LCS ships.

A critical aspect of the PRR is design maturity. DDG 1000 requirements were that the design was at least 85% complete prior to start fabrication, including all units scheduled to start construction in the first six months. Similar criteria will govern the start of fabrication for JHSV and subsequent new ship designs.

## **SUMMARY**

In summary, the Navy remains committed to the LCS program. LCS remains a critical warfighting requirement for our Navy to maintain dominance in the littorals and strategic choke points around the world.

The Navy continues to address the problems encountered in the early stages of the program and to implement improvements across the entire shipbuilding portfolio. We appreciate your strong support and the opportunity to testify before the Subcommittee. We will be pleased to answer any questions you may have.

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