

# No Need for High Speed

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U.S. NAVY (JHI SCOTT)

**TWO COs, ONE SHIP** Each LCS mission module comes with its own commander separate from that of the ship, which will surely affect unit cohesion. Here, Command Master Chief Anthony Decker stands bridge watch on board the USS *Freedom* (LCS-1).

## The LCS's missions were not sufficiently studied before construction began, but the design can still be improved.

The U.S. Navy will soon decide which prototype of the new littoral combat ship (LCS) to accept for full production. Problems with this program have ranged from huge cost overruns to new, largely untested systems. But the underlying problem—and the one from which we must learn—is that the LCS design was based primarily on available or future technologies, not a thorough study of the ship's principal projected operational environment and missions.

### How It Came to Be

To resolve the lack of surface combatants specifically designed to operate in the littoral waters, the U.S. Navy announced in November 2001 its intention to build a new class of smaller, reconfigurable surface combatants with high speed, shallow draft, and high maneuverability. They would be able to operate near enemy shores, where larger, deeper-draft ships were severely constrained. The planned force of 55 LCSs is intended to replace 30 FFG-7 *Oliver Hazard Perry*-class frigates and 26 coastal mine hunters (14 MCM-1 *Avenger*- and 12 MHC-51 *Osprey*-class).

General Dynamics and Lockheed Martin were awarded contracts to develop and build competing designs. Lockheed Martin's is a 3,090-ton semi-planing monohull, based on technologies developed by the Italian Fincantieri shipyard for the 1,000-ton *Destrier* commercial vessel. General Dynamics' is a 2,790-ton trimaran, based on a proven Australian passenger/car ferry design. Both prototypes consist of two principal elements: a core sea frame and the mission package. Each frame can perform a set of primary functions, including self-defense; navigation; command, control, communications, computers, and intelligence; and the launch and retrieval of unmanned vehicles.

### Modular Approach

The LCS modular design was adopted from the successful Danish STANFLEX 300 (*Flyvefisken*-class) ship. The Danish concept combines a standard hull with modular systems that can quickly change functions. It consists of fully containerized weapon systems for surveillance and patrol, escort, mine countermeasures, and other duties. The ship can carry a modal plug-and-fight mission package for antisubmarine warfare (ASW), mine countermeasures (MCM), or surface warfare (SUW).<sup>1</sup> Current plans envisage procurement of 64 mission packages (24 SUWs, 24 MCMs, and 16 ASWs). Reportedly, average time for the mission package change-out to full operational capability,

including systems testing, is two and a half days. A module can be swapped within 24 hours.<sup>2</sup>

The LCS's primary missions are to counter the threat of small boats, diesel submarines, and mines in the littorals. Secondary missions include intelligence, surveillance, reconnaissance, maritime intercept operations, homeland defense, support of special operations teams, and logistic support for moving personnel and supplies. Other missions being considered include fire support, carrying Marines, and medical and humanitarian assistance. Unlike other large U.S. surface combatants, the LCS was designed to carry out a single primary mission at any time.

### Warfare Capabilities

In its core configuration, the LCS is armed with one BAE Mk 110 Bofors 57-mm dual-purpose gun (220 rounds per minute) and one 21-round launcher for a 6-mile-range Raytheon RIM-116 rolling airframe missile, plus two .50-caliber machineguns.

It is fitted with a large flight deck and hangar capable of accommodating two MH-60R/S helicopters and several vertical takeoff unmanned aerial vehicles (VTUAVs) or a single CH-53 heavyweight helicopter. It also carries one Spartan unmanned surface vehicle.

Yet the LCS has very limited capabilities to defend itself against enemy aircraft and antiship cruise missiles (ASCMs). The Navy believed that other large surface combatants and aircraft would provide anti-air defense for the ship in a high-threat environment, but it should have a robust point-defense against enemy land-based aircraft or unmanned aerial vehicles.<sup>3</sup> Additionally, it has no effective anti-torpedo defenses.

In this regard, the Navy might be well advised to consider Israeli ideas in reaching its final decision. The Israelis evaluated the LCS for their navy and concluded that its core sea frame was inadequately armed to engage enemy surface combatants and to neutralize the threat of enemy aircraft. They planned a variant of the LCS, but because of its high cost, they instead recently bought two 2,200-ton German-designed MEKO-100 corvettes.<sup>4</sup> The Israeli LCS was to be built by Lockheed Martin. In a single platform, it would have been capable of performing all basic missions (anti-air, -surface, -submarine, and -missile) plus special operations. It was to be fitted with two Mk-41 vertical-launch systems for eight missiles, including the highly effective Barak-8 medium-range anti-missile system; four launchers for enhanced RGM-84 Harpoon or Gabriel ASCMs, single Phalanx Block 1A close-in-weapon systems (CIWS), the Mk 110 57-mm guns, and two Mk-32 surface-vessel torpedo tubes.<sup>5</sup>

The SUW capabilities are very modest given the ship's size. In addition to a single 57-mm gun, this mission package might include only two 30-mm automatic cannons or four Army non-line-of-sight launcher systems dubbed NETFIRE. Each one contains 15 cells and 60 24-mile-range precision-attack missiles. These 117-lb PAMs have modest capability against enemy small craft. The missiles

can receive in-flight updates and can be retargeted. Their warhead is effective against both soft and hard targets.

The LCS also carries three VTUAVs armed with 3.75-in rockets, and one MH-60R helicopter with GAU 16 gun/Hellfire plus the new non-lethal running-gear entanglement system for fighting off pirates.

The Navy's main concern in operating in the littorals is the threat posed by enemy small and fast boats armed with shoulder-mounted or crew-served weapons such as light machine guns.<sup>6</sup> The SUW mission package for LCS is primarily intended for protecting larger U.S. surface combatants transiting chokepoints against swarming small-boat attacks.<sup>7</sup> Yet it is doubtful that the ship would be able to defend itself against such skillfully executed attacks. A large number of small boats armed with missiles or torpedoes launched from various concealed bases could converge almost simultaneously against a single target or even a group of targets, and then rapidly disperse. Such mass attacks could also include conventional and midget submarines.<sup>8</sup> The LCS is too large and insufficiently agile to engage such threats.

Allegedly, the LCS's survivability rating is similar to that of a logistics ship.<sup>9</sup> As presently configured, it cannot engage large surface combatants. The Navy believes that these threats are best neutralized by tactical aircraft or larger surface warships, but this is a shortsighted view.<sup>10</sup> Three-thousand-ton ships such as the LCS should have sufficient firepower to deal with large surface combatants. They should not have to rely on the protection of other forces that might be not available when needed, or might be involved in other missions that stop them from providing effective support to the LCS.

### Severe Limitations

The ASW mission package relies heavily on various systems including distributed offboard sensors and manned or unmanned vehicles.<sup>11</sup> Specifically, it includes ultra light-weight Array, two multi-mission unmanned surface vehicles, two remote multimission vehicles, three VTUAVS, multistatic sonobuoys, torpedo countermeasures, and one MK-60R helicopter carrying airborne low-frequency sonar, sonobuoys, and MK-54 lightweight ASW torpedoes.

The effectiveness of the LCS as an ASW platform in real combat conditions is essentially unknown. Submarine detec-

tion in shallow water is far more difficult than in deep water, because of poor sonar performance near the sea bed, great variations in the water temperature and salinity, and influx of fresh waters. Also, natural and manmade ambient noises greatly complicate the effectiveness of acoustic sensors. An advanced conventional submarine might generate less noise than the surrounding environment—and the sub can use bathymetry, bottom composition, nearby topography, or shipwrecks to hide.<sup>12</sup> Unmanned systems cannot be used too far from the mother ship. Finally, the LCS may not be able to carry out major repairs for components of an ASW module.

The ship carries a full array of organic mine countermeasures (OMCM), which are usually effective in favorable environments. But conditions are marginal to poor in most littoral areas.<sup>13</sup> At best, OMCM provides limited capability to avoid or clear a small number of localized, unsophisticated mines.



**COMPETING DESIGN ALTERNATIVES** General Dynamics' USS *Independence* (LCS-2, above) is a trimaran based on an Australian ferry; Lockheed Martin's *Freedom* (right), here passing under Montreal's Pont Jacques-Cartier en route to the Old Port, is a semi-planing monohull developed from the *Destrier* commercial vessel. Both support mission modules.

The LCS is not designed to sweep or neutralize weapons in an enemy minefield. Instead, it will keep its distance and deploy MCM sensors forward.<sup>14</sup> And, unlike conventional MCM ships, the LCS will be employed individually, not in groups. Finally, the ship does not solve one of the most important problems facing the Navy: neutralizing the threat of mines in very shallow water.

Obviously, the LCS is too large a platform for conducting MCM. A ship of this size should not be used for tasks traditionally conducted by dedicated surface MCM forces. Additionally, the new MCM systems were originally designed for much larger ships, such as aircraft carriers, destroyers, and amphibious ships. These are capable of providing intermediate and depot-level maintenance in case of major breakdown or malfunctioning. In contrast, the LCS does not have such support capabilities.<sup>15</sup>

The LCS core crew will be only 40, compared with more than 200 for the Navy's frigates and 300 or more for cruisers or destroyers. Up to 35 Sailors will operate aircraft and mission modules.<sup>16</sup> This large reduction in crew size was made possible through a very high degree of automation.<sup>17</sup> The small crew raises the question of whether the ship will be able to maintain the high standards of damage-control effectiveness for which the United States is widely known. This ship will have one CO in charge of the ship, and another for the mission package. Swapping modules will surely negatively impact the unit cohesion of the ship as whole.

## Overemphasis on Speed

High speed for a surface combatant generally incurs much higher construction costs, power requirements, fuel consumption, and maintenance; and decreased range, payload, and stealth. Yet the Navy's specifications required the

aluminum has low resistance to heat, and structural collapse would occur much faster than in steel structures.<sup>21</sup>

Because of the speed requirement, the useful space for weapons and sensors is only about 400 tons. After deducting the needs for fuel, ammunition, crew, and stores, some 180 tons of payload remain for the mission packages.

Speed is of critical importance mostly for small surface combatants such as corvettes and fast attack craft, because they lack staying power and must avoid pursuit after launching missiles or torpedoes. The high maximum speed for the LCS was explained as necessary for avoiding or pursuing small boats, conducting ASW or mine-intercept operations, or for insertion/extraction of special operations teams. Yet one cannot seriously envisage a situation in which a 3,000-ton combatant would flee when faced with the threat of small, lightly armed boats.

Another reason for the high speed is to enhance survivability against ASCMs. But 47—50 knots does not improve chances of an LCS surviving an attack by sea-skimming Mach 1 ASCMs and 60- or 70-knot heavyweight anti-ship torpedoes.<sup>22</sup> The value of speed is more important in some types of missions than others: a surface ship searching for enemy submarines can only travel at limited speed because the hull-borne sonar is less effective at more than 25 knots. Similarly, the LCS must operate at moderate speeds when using its distributed off-board ASW sensors.

The need to launch and retrieve helicopters and unmanned vehicles also means that the LCS must spend substantial time moving slowly.<sup>23</sup> And for countering fast submarines, long-range weapons are more effective than speed.<sup>24</sup> MCM missions as well can be conducted only at moderate speeds. Even when employed primarily in a SUW mission, the LCS will not need to use maximum speed often.

An LCS could successfully perform all its missions at a top speed of 32-35 knots. The much smaller—but highly successful—Swedish 620-ton *Visby*-class multipurpose corvette has a maximum speed of 35 knots. The U.S.-designed Israeli 1,275-ton *Eilat*/SAAR 5-class corvette's top speed is about 33 knots. Finally, a 3,000-ton LCS cannot attain maximum speed in shallow waters, in areas with considerable shipping traffic, or in bad weather.

## There Is a Need

The Navy's decision to build smaller surface combatants for littoral waters was long overdue. The service lacks the



LCS to achieve a full speed of 47 to 50 knots. Normally, the high-speed requirement is based on the ship's size, primary missions, and prospective operating environment.

The ship can reportedly sail for about 1,250 nautical miles at its sprint speed.<sup>18</sup> But most likely the range at maximum speed is much shorter than publicly revealed. At a sustained speed of 18 knots, the LCS can sail for some 3,500 nm. According to some reports, the ship has to be refueled every three days when deployed in the operating area.<sup>19</sup> Between 30 and 40 percent of the hull, mechanical, and electrical costs are directly attributable to the high-speed requirement.<sup>20</sup> This necessitates weight reduction, which in turn led to the decision to build using lighter materials.

Lockheed Martin opted for a steel hull with aluminum superstructure, while General Dynamics used an all-aluminum hull and superstructure with steel stiffening added into the hull. This option was apparently chosen because of the need to reduce the ship's top weight and enhance stability, but the

proper number and types of combatants capable of conducting missions on both the open ocean and in the littorals across the range of possible conflicts. Even though the Navy declared its intent to focus on conducting operations in the littorals about 15 years ago, it remains essentially a blue-water force.

The LCS design has several strong features—and some serious shortcomings. Both prototypes have excellent seaworthiness and maneuverability. Their open architecture allows fitting of the new weapons and sensors. But, as discussed previously, perhaps the single greatest design flaw is overemphasis on high speed. This is not surprising, since the LCS originated in the heyday of the most vocal

4. Barbara Opall, "Moving Up to Warships? Israel Shipyards Hopes for Big Step in Technology," *Defense News*, 20 July 2009.
5. "LCS Entering Deep Water: USS Freedom Enters Sea Trials," Defense Update September 2008, International Online Defense Magazine, <http://defense-update.com/features/2008/august08/lcs.html>, 3–4.
6. GAO, *Defense Acquisitions: Plans Need to Allow Enough Time to Demonstrate Capability of First Littoral Combat Ships* (Washington, DC: GAO-05-255 Report, March 2005), 15.
7. Alkire et al., *Littoral Combat Ships*, 13.
8. Fariborz Haghshenass, *Iran's Doctrine of Asymmetric Naval Warfare* (Washington, DC: Institute for Near East Policy, 1179, 21 December 2006), 1–2.
9. "Surface Warfare Still Searches for 21st Century Ideas," U.S. Naval Institute, <http://blog.usni.org/?p=3434>, June 2009, 2.
10. GAO, *Defense Acquisitions*, 16.
11. John R. Benedict, "The Unraveling and Revitalization of U.S. Navy Antisubmarine Warfare," *Naval War College Review* (spring 2005), 114.
12. Naval Doctrine Command, *Littoral Anti-Submarine Warfare Concept*, 1 May 1998, <http://www.fas.org/man/dod-101/sys/ship/docs/aswcnpct.htm>, 15.



**SMALL BOAT THREAT** Swarms of small armed craft could quickly converge, attack, and disperse, but even at high speed, the LCS is too large and insufficiently agile to handle such threats. Here in a training drill, the Singapore police chase "terrorists" in July 2009.

proponents of network-centric warfare and transformation in the U.S. military, when speed was held as the most important capability in conducting warfare, regardless of operating environments or missions.

Whichever prototype the Navy accepts, the LCS should have a maximum speed of 35 knots. Efforts should be made to increase its sustained speed and range. The ship needs balanced and much stronger SUW, ASW, AAW, anti-missile, and anti-torpedo capabilities integrated into its core sea frame. It should not be used for MCM: it is too large and cannot replace dedicated surface forces in either numbers or effectiveness. Instead, the Navy should expand and modernize its dedicated MCM forces.

Finally, a better balance between manned and unmanned systems is badly needed. The human element is the single most critical factor for success in warfare. The LCS should have a single crew instead of two, for unit cohesion and combat training, especially in damage control. ❄

13. Alkire et al., *Littoral Combat Ships*, 14.
14. GAO Report to the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives, *Defense Acquisitions: Overcoming Challenges Key to Capitalizing on Mine-Countermeasures Capabilities* (Washington, DC: GAO-08-13 Report, December 2007), 16.
15. *Ibid.*, 22.
16. Ronald O'Rourke, *Navy Littoral Combat Ship Program: Background, Oversight Issues* (Washington, DC: Congressional Research Service, 5 June 2009), 2.
17. Maryann Lawlor, "Littoral Combat Ship Launches Change," SIGNAL, December 2005, [http://www.afcea.org/signal/articles/templates/SIGNAL\\_Article\\_Template.asp?articleid=1](http://www.afcea.org/signal/articles/templates/SIGNAL_Article_Template.asp?articleid=1), 2.
18. Doug Thomas, "Warship Concepts: Littoral Combat Ship," *Canadian Naval Review* 2, no. 4 (2007), 38.
19. *Ibid.*, 37; Jones, "Aboard the Freedom," Alkire et al., *Littoral Combat Ships*, 99.
20. Phillip Ewing, "Refueling Tops List of LCS Crew Challenges," *Navy Times*, 19 May 2009.
21. James Lyons, "Ship Shopping List," *Washington Times*, 1 February 2009.
22. *Ibid.*
23. "Surface Warfare Still Searches," 35.
24. Anthony Preston, "Designing Surface Ships for the Next Decades," *Armada International*, December-January 1989.

1. Brien Alkire et al., *Littoral Combat Ships* (Santa Monica, CA: RAND, 2007), 99.
2. Matthew Jones, "Aboard the Freedom," *Virginia Pilot*, December 16, 2008.
3. Alkire, *Littoral Combat Ships*, 13.

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